

# Western Instruments

Established 1965

26509 TWP RD 543

Sturgeon County, ALBERTA  
T8T 1M1

Phone: (780) 459-6720

Fax: (780) 459-7837

E-mail: [westinst@telusplanet.net](mailto:westinst@telusplanet.net)

Web: [www.westerninstruments.com](http://www.westerninstruments.com)

## Operational Description of DSAW Inspection Systems.

### Mechanical

#### **Probe Assemblies**

Western Instruments utilizes a unique Contact Weld Testing Probe Assembly which uses a unique DSAW Transducer/Shoe assembly, where the specialized transducer is mounted in the Shoe Housing, and compensates for OD pipe sizes. The Probe Assembly, with integral coupling and cooling system introduces the couplant, to the probe/pipe interface, in a manner that optimizes coupling and cooling. These Transducers (Longitudinal and Transverse) are manufactured with an appropriate angle, and frequency, based on the wall thickness range and the number of probes selected to cover the testing operation.

The Lamination Probe Assemblies (Edge and Body) use the common shoe, but are fitted with a dual element transducer of an appropriate size, and again based on the wall thickness range and the number of probes selected to cover the testing operation. The dual element transducer is used, rather than a single element, to provide greater sensitivity to small laminar defects.

Western Instruments Probe Assemblies are specifically designed and manufactured for Spiral DSAW Pipe Testing, and are not adapted from standard manual inspection transducers. These Probe Assemblies provide superior performance and longevity, as each unit is equipped with Ceramic Anti-Wear points, integral couplant supply manifolds, Couplant inlets, and BNC connectors.

This same Probe Assembly can also be used Straight Seam DSAW Pipe (U & O and Pyramid Roll Formed), however most end users utilize our Standard Longitudinal Weld and Lamination Testing Probes.

#### **Probe Suspensions.**

The Probe Assemblies for Spiral Weld Testing are mounted in a holder ring, which permits the probe to be rotated to maximize the ultrasonic signal on the reference notches (Weld Inspection), and to compensate for weld helix angle (Weld and Edge Lamination Inspection). The probe holder ring is held in place by the Probe Yoke, which in turn is mounted to the Series 5000 Barrels that permit vernier adjustment of the probe perpendicular to the pipe centerline (transverse adjustment). The barrel is mounted to a probe suspension that is equipped with vernier adjustment of the probe parallel to the pipe centerline (longitudinal adjustment), and provides a preset hold-down pressure and probe liftoff via a spring loaded single acting pneumatic cylinder. The transverse and

longitudinal vernier adjustments ensure precise and reproducible positioning of the probe to artificial defects in the calibration standard.

### **Weld Inspection Test Head.**

The probe suspensions are attached to Carrier arm located on each side to the weld centerline, and permit positioning of the probes on each side of the weld. The number and type of testing probes is dependent on the customer's needs, with respect to Production Specifications, pipe wall thickness range, and other factors.



### **Spiral DSAW Test Head**

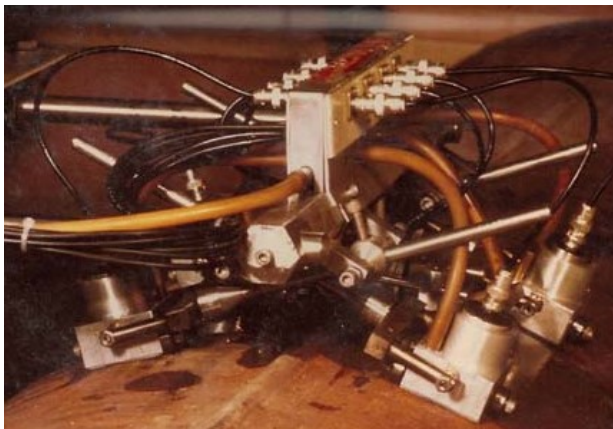
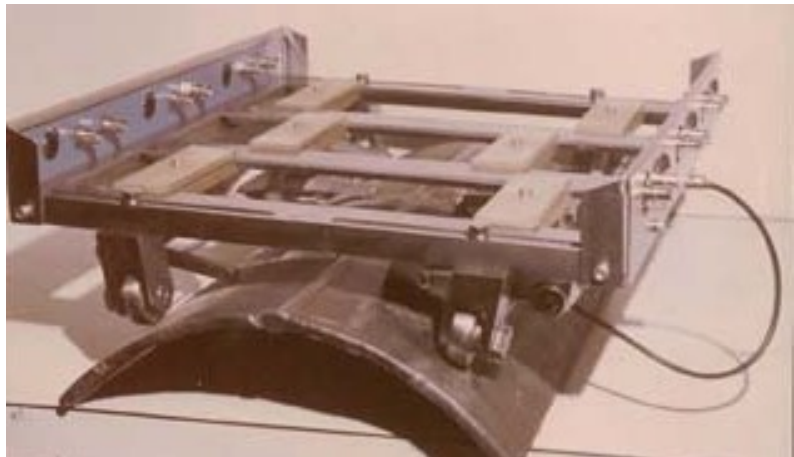
(Note Detail of Probe Assembly)

- 6 Channels for Longitudinal Weld Inspection
- 2 Channels (4 Probes) for Transverse Weld Inspection ("X" Pattern for Coupling).
- 2 Channel Edge Lamination Testing.

### **Straight Seam DSAW Test Head.**

(Note Standard Weld Testing Probes)

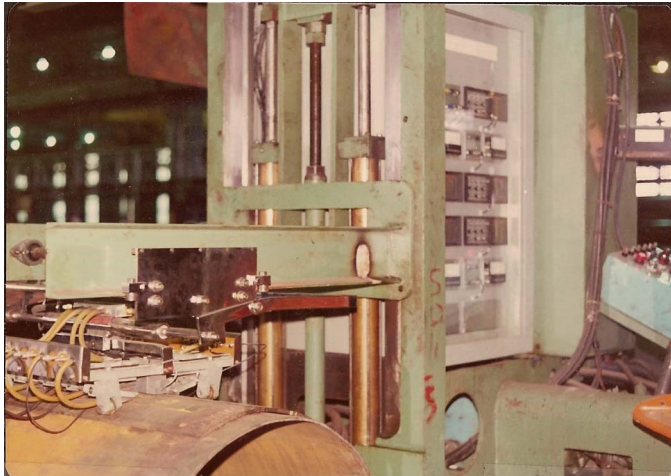
- 4 Channels Longitudinal
- 1 Channel (2 Probes) for Transverse Weld Inspection ("K" Pattern for Coupling Monitoring)



### **Dual Weld Test Head**

This Test Head, manufactured for a Mobil Inspection Company, was designed to test both Spiral and Longitudinally Welded DSAW Pipe. Note the DSAW Probe Assemblies which can be rotated for Spiral or Straight Seam Testing.

The carrier arms are mounted on adjustable Bed Plates that provide further vertical adjustment to compensate for pipe diameter, and in turn the bed plates are mounted to the Test Head Frame. The optional motorized drives are designed to adjust the Test Head about the Centroid of the pipe. This ensures probe positioning remains constant when fine adjustments are made to the position of the Test Head to center the probes on the weld. A Laser pointer and CCTV Camera are mounted to the Ring Gear to aid the operator in centering the testing probes on the calibration standard and weld centerline.



## 7 Channel DSAW Testing System

- 4 Channels for Longitudinal Defects
- 1 Channel (2 Probes) for Transverse Weld Inspection (“K” Pattern for Coupling Monitoring).
- 2 Edge Lamination Testing Channels.
- Automatic Weld Seam Follower.

### Support Structure.

The testing systems mechanical assembly is mounted to the mill floor on a sub-base which is designed by Western Instruments and fabricated and installed by the customer. This sub-base allows the support column to be adjusted laterally to and from the pipe center line during installation. The cantilever support structure is mounted to the support column and contains longitudinal travel adjustment, for positioning the test head up and down stream, and manual vertical adjustment for compensating for pipe diameter. The movement of the test head (and probes) to follow the weld centerline is performed by the Test Head and the Longitudinal and Transverse Adjustment Mechanisms, which are tied into the systems Controls and Automatic Weld Seam follower.

The Optional “On-Line Chasing” system for Spiral Weld Systems, allows an indication (defect) to be proven up immediately after detection, and to provide convenient calibration on a ‘Segmented’ calibration standard. This calibration standard is simply set onto the pipe in the mill or conveyer, and using the ‘Pneumatic Vertical Liftoff’ lifts the test head to the correct elevation to compensate for the Segmented Calibration Standard. Optionally a ‘Calibration Saddle Stand’ can be added, which rigidly holds a Segmented Calibration Standard ‘Off-Line’, and parallel to the mill line to permit calibration while the mill is still running.



**5 Channel Straight Seam DSAW Testing System.**

**Weld Seam Follower.**

The non-contact weld seam follower sensor is mounted to the test head, and senses the thickest and narrowest part of the weld reinforcement, with its instrumentation located in the main cabinet. When the sensor detects a thinning of the weld it provides; a servo signal to the Controls to automatically center the test head on the weld. An alarm alerts the operator if the follower mechanism is out of range so he may re-center the test head on the weld using the mechanical adjustments. This centering ensure the probes remain in calibration to the weld centerline.

The Non-Contact Weld Seam Follower is located on the upstream side of the weld test head, and is equipped with a proximity safety sensor which identifies injurious mechanical conditions. When potentially damaging condition are detected, all sensors (Probes, etc.) are automatically lifted clear too avoid mechanical damage.

**Instrumentation.**

**Main Cabinet.**

The computer based ultrasonic instrumentation is located in the main cabinet and is installed at a convenient location and out of harms way. Depending on customer requirements and the wall thickness range, it consists of 4 or more ultrasonic channels for Longitudinal Weld Inspection and, 1 or 2 channels for Transverse Weld Inspection. Optionally, the unit may be fitted with Lamination (Edge and/or Body) testing channels. The main cabinet is equipped with a large access door, Connector Plate for interconnection cables, and a cooling system which slightly pressurizes it and prevents ingress of contaminated air. The main cabinet also houses the systems Processor based controls, and other auxiliary electronics.

**Operator Control Pendant**

The Operator Control Pendant is positioned in a convenient position for operator access and monitoring, with the control cable run from the systems Instrumentation and Processor Controls. The Control Pendant consists of a Computer Monitor (displaying the A-Scans and Event Envelop), Membrane Keyboard, Operator Manipulation Controls, CCTV Monitor (optional), a large Emergency Stop button, and Power Switch.

The Alarm Annunciator is located adjacent to the 'Event Envelop' on the systems computer monitor and includes status indicators for each channel that is; coupling alarm; flaw warning alarm; and flaw reject alarm. The layout of the Annunciator area is in an easy to understand format. Reset of the indicators is in two modes; automatic, where the indication remains on for a preset number of seconds or manual which requires the operator to reset the indicators.

### **Ultrasonic Instrumentation.**

The ultrasonic instrumentation is specifically designed for DSAW Pipe (Spiral or Straight Seam), and is equipped with specific features to ensure sensitivity to defects. Some of the highlights to this instrumentation are; the display of up to 10 channels, on a single monitor, of corresponding A-Scans and Event Envelops (Digital Chart Recorder), simultaneously; Storage of operational (calibration) parameters; and is equipped with an extensive Gating System that is outlined below;

1. Individual Flaw Gates for Reject and Warning, where the Reject gate level is set to meet the specification the pipe is being manufactured to, and the Warning Gate is set to in-house specifications for detecting low level indications. The Warning Gate is an 'Early Warning' alarm for deteriorating weld conditions.
2. Coupling Monitoring Gate is used for all testing probes, and sends an alarm signal when the coupling signal drops below the preset level.
  - a) Longitudinal weld testing probes operate in pairs and are positioned with one on either side of the weld, each pulse from a probe is received by the opposing, and monitored automatically.
  - b) Transverse weld testing probes are positioned in the "K" or "X" pattern for monitoring coupling, and again each pulse is monitored automatically by a corresponding probe.
  - c) The Lamination Testing Probes are monitored for coupling by positioning the coupling monitor gate below the back wall echoes. Coupling is monitored on each pulse produced and is monitored automatically.
3. The exclusive "Toe Signal Follower Gate"® is positioned over the signal which is produced by the toe of the weld on longitudinal weld testing probe/channels. This signal is constantly changing Position and Amplitude due to longitudinal pipe movement and the dynamic changes in; edge alignment; and weld shape. This gate tracks this signal automatically, setting the position of the Flaw Gates just forward of the Toe Signal, and permits reliable ultrasonic testing results without 'false indications' due to the limitations of fixed gates. If the Toe Signal drops below the gate threshold, the processor automatically positions the Flaw Gates to a preset 'Safe Position'.

When the systems instrumentation monitor is in the Operational Mode, the event envelop displays the overall length of the pipe under test (or for mill line installations, from the point of testing to the cutoff). Indications above a selectable threshold level (the Warning Gate) are shown and plotted on the event envelop. Warning and/or Reject conditions are outputted to the Alarm Lights, Horn, or Paint Spray Defect Marker, to alert the operator of defective or deteriorating weld conditions.

The instrumentation Controls and Monitor, installed on Operators Control Pendant, allows the operator to select any individual channel for inputting set up parameters or to display all A-Scans. Further, it allows the operator to switch between operating and set-up mode, even while the equipment is operating, without interruption to testing. When the system is in calibration mode (selected at the Operators Control Panel), alarms are deactivated and indications are not stored in the delayed marking controller, which activates the paint spray markers, audio and visual alarms. When the system is switched back to operational mode, all alarms are activated.

### **Data Storage and Reporting.**

As the instrumentation is computer base, a full range of data is available for storage, and printing. All calibration set-up configurations, by diameter and wall thickness, can be stored and recalled at a later date. These calibrations can also be printed or stored digitally and provided to the end user. For on-line applications, the operator can print out and/or store reports on the testing results on a time and length basis. For off-line applications, the operator can print out and/or store reports on each individual pipe tested. Full Body Lamination test reports can be displayed as a "Map or C-Scan",

### **Delayed Marking Controller**

The Delayed Marking Controller is the overall systems alarm output storage. Each instrument channel has several alarm outputs. Specifically the weld testing channels have defect warning and defect reject, and coupling monitor alarm outputs. All alarm outputs are sent to the systems Processor Controls for immediate alarm activation, and are also fed to the delayed marking controller for activation downstream of the test head. Input for delayed activation is provided by the customers mill speed encoder.

The equipment includes Aerosol Paint Spray Defect Marking, Large Alarm Lights, and Audio Alarms. A single Aerosol Sprayer supplied for each type of testing (Weld, Edge, and Body Lamination). As many as 6 different alarm lights can be 'stacked', to alert operators to different types of defects, or equipment status conditions. Typically, only a single audio alarm is supplied to announce any type of defect. Furthermore, these alarm outputs can be connected for immediate activation, and/or imputed to the Delayed Marking Controller, delayed activation downstream of the point of testing.

### **Change Over and Calibration**

One of the many benefits of Western's equipment is its capability to perform calibration, and verifications in a minimum amount of time. When a new calibration is to be done, the operator simply enters the new Diameter, and Weld Angle into the Processor Based Controls, and the Automatic Weld Seam Follower, handles any fine adjustment, up to +/- 50 mm. For most large diameters, there is no need to replace the probes, which means when a new calibration is to be done, probes are simply repositioned using the longitudinal and transverse adjustments for each individual probe.

### **Calibration Verification**

When the operator wants to check the units calibration, he simply presses the 'Calibration' indicator on the operator controls, and all alarms are deactivated. He then places the test head in the off-line position, and places the calibration standard on the

pipe that he is currently testing. The operator then lowers the test head, and the probes onto the standard. Using the operator controls he is then able to have the test head travel upstream or downstream along the weld, verifying each individual channel's calibration indication on the reference standard. This "Weld Chasing" feature, removes the guess work out of calibrations, and allows the operator to check his calibration in minutes. The test head is able to follow the weld, using the longitudinal travel and ring gear motors, which follow the weld angle, and diameter of the pipe as entered by the operator. Furthermore, the Automatic Weld Seam Follower is activated, to make corrections during calibration, and/or operation.

### **Dynamic Calibration**

When Western's systems are installed on the mill-line, the automatic weld following capability outlined above can be used for testing the unit's sensitivity, at testing speeds (dynamic calibration) up to 20 m/min. When installed on a conveyer line the operator must use a full pipe, with machined reference indications, at the end user's request, otherwise, the Weld Chasing feature can be used.

### **Body Lamination Test Head.**

The bed plates for the body lamination probes are mounted to the body lamination test head oscillator which moves the probes along the longitudinal axis of the pipe. Scanning coverage is increased with the 4 probes by utilizing the test head oscillating mechanism, which has an adjustable stroke, to again compensate for strip width. This test head moves at approximately 500 mm/second, and can transverse a 1450 mm stroke, on 1500 mm wide strip, in approximately 4 seconds. This oscillation is continuous, and automatic but can be interrupted by the operator, to allow him to reverse the conveyer and re-examine (prove-up) a defective area. The Total Petroleum supplementary specification is fulfilled for inspection coverage, requiring a minimum of 20% of the body inspected for laminations, however this equipment is capable to 30% coverage which also satisfies the Shell (@30%) and Saudi Aramco (@25%) supplementary specifications.

In conveyer applications, the test head is fitted with a sensor that detects the end of the pipe, as it approaches, and automatically lowers the probes individually to ensure as much of the body as possible is tested for lamination. Furthermore, each individual probe is automatically lifted just before meeting the end of the pipe, again to ensure as much of the pipe as possible is tested for lamination.