

Tube Analysis Report

Customer: Your Company
Address: Your Street
City/State: Your City & State

Manufacturer: York
Model Number: YTH3J3E2
Serial Number: 123456 #2

Inspected: February 20, 2008
Analyst: Rick Rives Level III

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Abbreviations

OD _____ Outside Diameter

ML _____ Metal Loss

WAS _____ Wear at Support

ID _____ Internal Diameter

ID Defect _____ ID Defect or Flaw

LD _____ Longitudinal Defect or Flaw

NWT _____ Nominal Wall Thickness +/- .005

S _____ Support

B _____ Bay

IE _____ Internally Enhanced

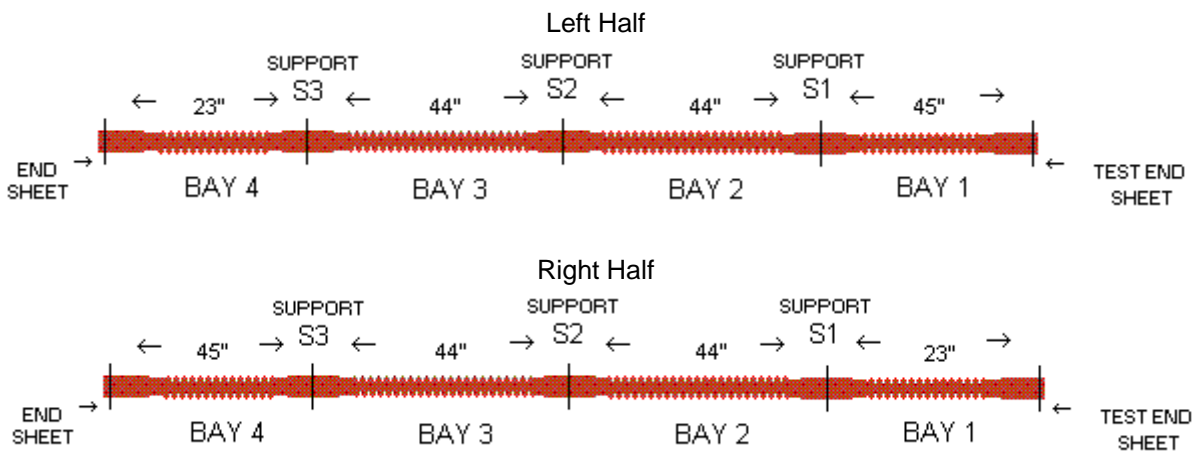
FBH _____ Flat Bottom Hole

Vessel Information

Condenser:

Number of Tubes:	436
Test End:	Left Facing Control Panel
Outside Diameter:	.750
NWT Under Fins:	.031
NWT at Bell End:	.051
Tube Length +/-2":	156"
Tube Type:	Skip Finned IE
Tube Composition:	Copper
Number & Type of Support:	3, Steel
Rows Numbered:	Left to Right
Tubes Numbered:	Top to Bottom

Support Location

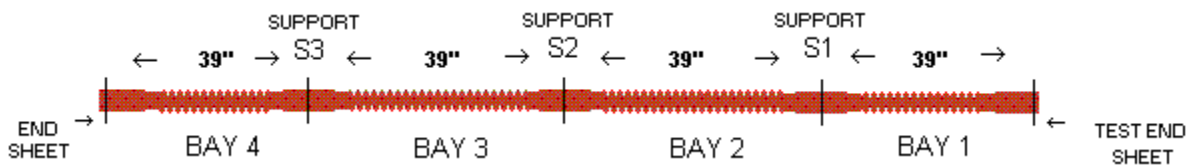


Vessel Information

Evaporator:

Number of Tubes:	377
Test End:	Right Facing Control Panel
Outside Diameter:	.750
NWT Under Fins:	.028
NWT at Bell End:	.051
Tube Length +/-2":	156"
Tube Type:	Skip Finned IE
Tube Composition:	Copper
Number & Type of Support:	3, Steel
Tubes Numbered:	Left to Right
Rows Numbered:	Top to Bottom

Support Location



Recommendations

Accept and reject criteria used are based on established standards for normal wear related defects. The contractor and end user should determine the actual repairs. We suggest the cause of any wear patterns be investigated and corrected or neutralized when possible. If the noted defects require tube replacement, sample tubes should be removed and inspected to confirm our findings. When tube plugging is the repair action, machine efficiency and capacity should be considered.

Condenser:

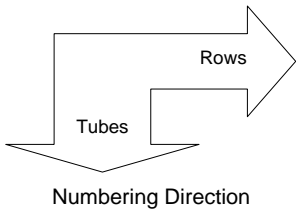
The ID Defects noted are considered acceptable requiring no tube related repair.

Evaporator:

No measurable defects were noted during this inspection.

Inspection Due:

We suggest this machine be inspected again in 3 years.



CONDENSER

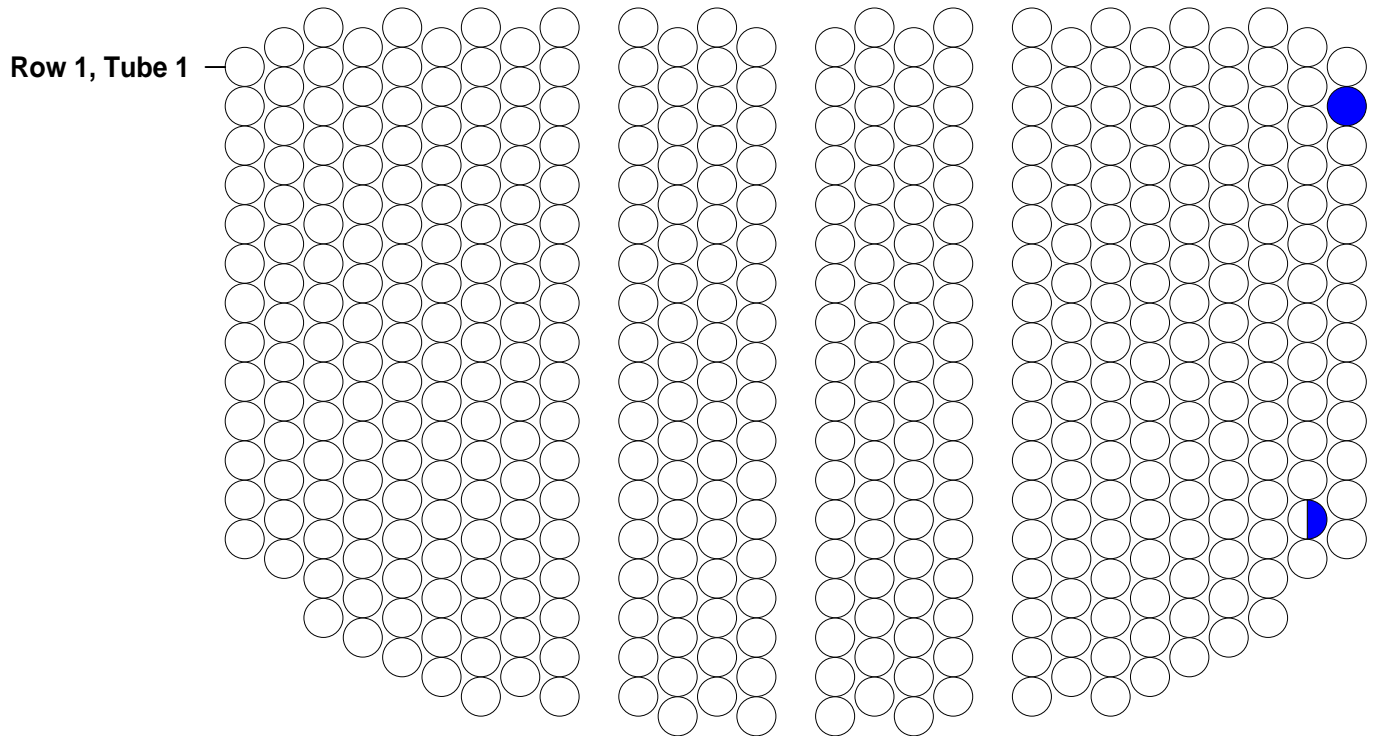
Your Company



Top of Vessel

S/N 123456 #2
Left Facing Control Panel

NO REJECTED TUBES



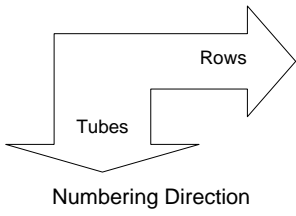
Total Accepted Tubes: 436, 100.00%

Accepted Non-Defective Tubes: 434, 99.54%

Rejected Tubes: 0, 0.00%

Accepted Defective Tubes: 2, 0.46%

- Accept, 434 tube(s), 99.54%, Accept
- ◐ ID Defect < 20%, 1 tube(s), 0.23%, Accept
- ID Defect < 40%, 1 tube(s), 0.23%, Accept



CONDENSER

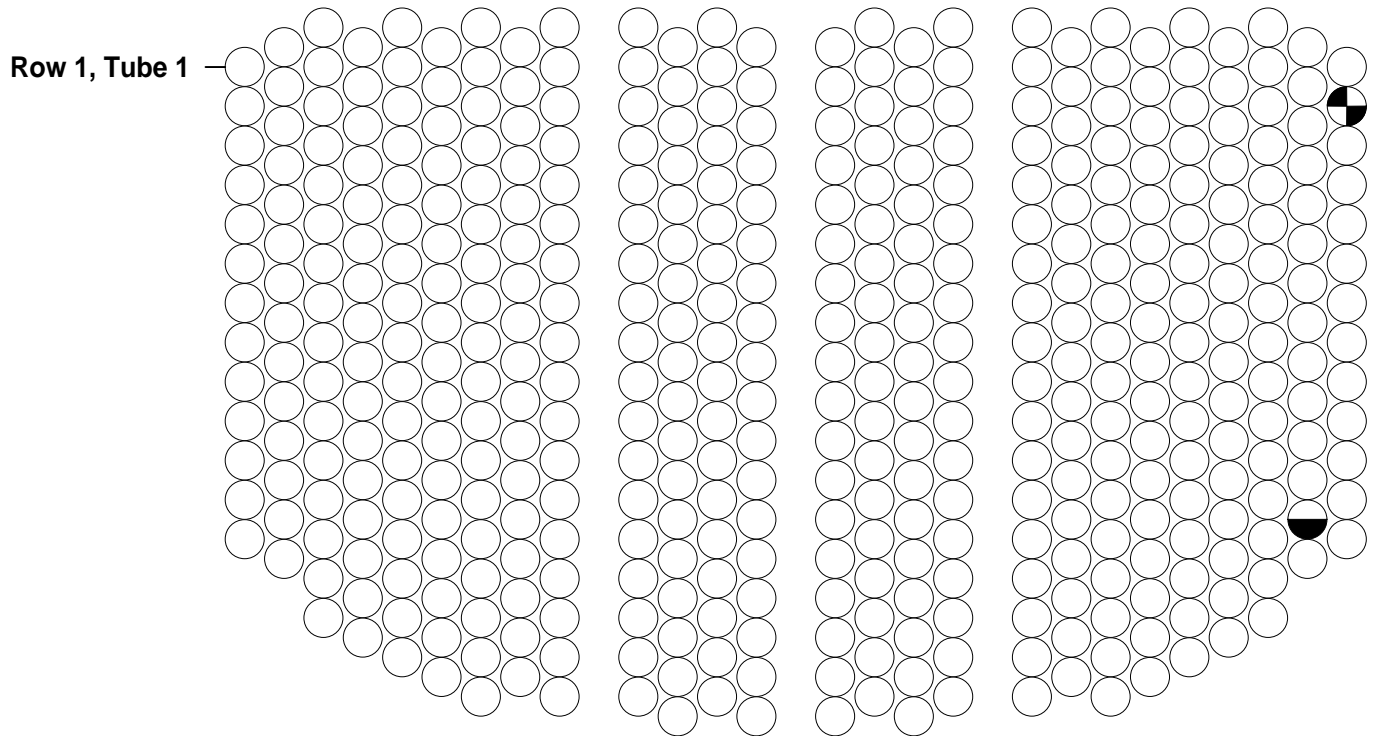
Your Company



Top of Vessel

S/N 123456 #2
Left Facing Control Panel

NO REJECTED TUBES



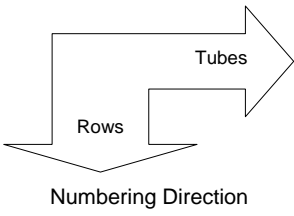
Total Accepted Tubes: 436, 100.00%

Accepted Non-Defective Tubes: 434, 99.54%

Rejected Tubes: 0, 0.00%

Accepted Defective Tubes: 2, 0.46%

- Accept, 434 tube(s), 99.54%, Accept
- ◐ ID Defect < 20%, 1 tube(s), 0.23%, Accept
- ◑ ID Defect < 40%, 1 tube(s), 0.23%, Accept



EVAPORATOR

Your Company

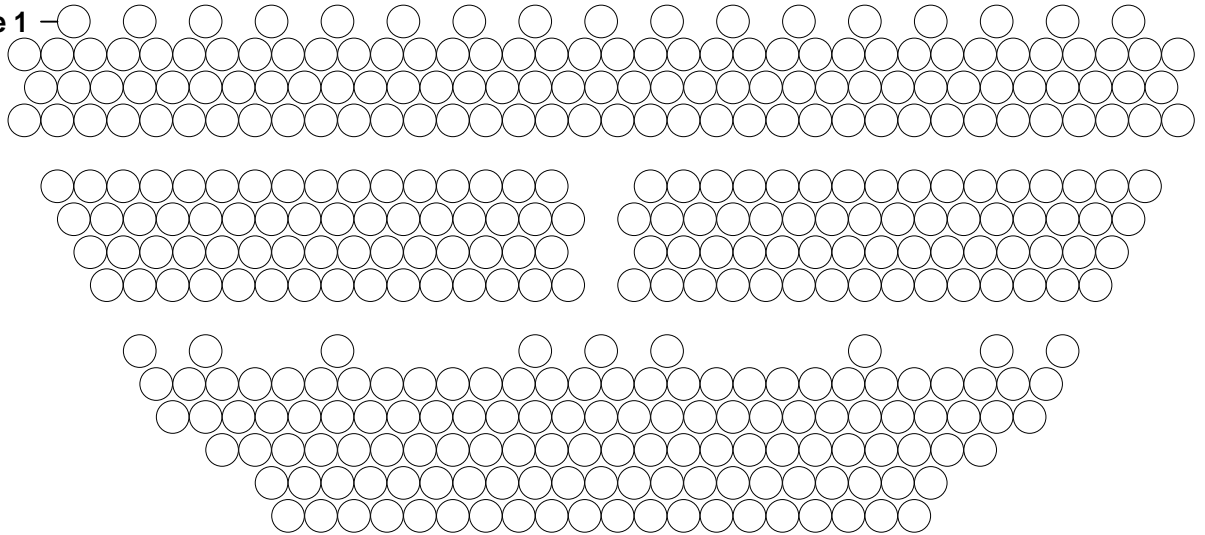


Top of Vessel

S/N 123456 #2
Right Facing Control Panel

NO REJECTED TUBES

Row 1, Tube 1



Total Accepted Tubes: 377, 100.00%

Rejected Tubes: 0, 0.00%

Accepted Non-Defective Tubes: 377, 100.00%

Accepted Defective Tubes: 0, 0.00%

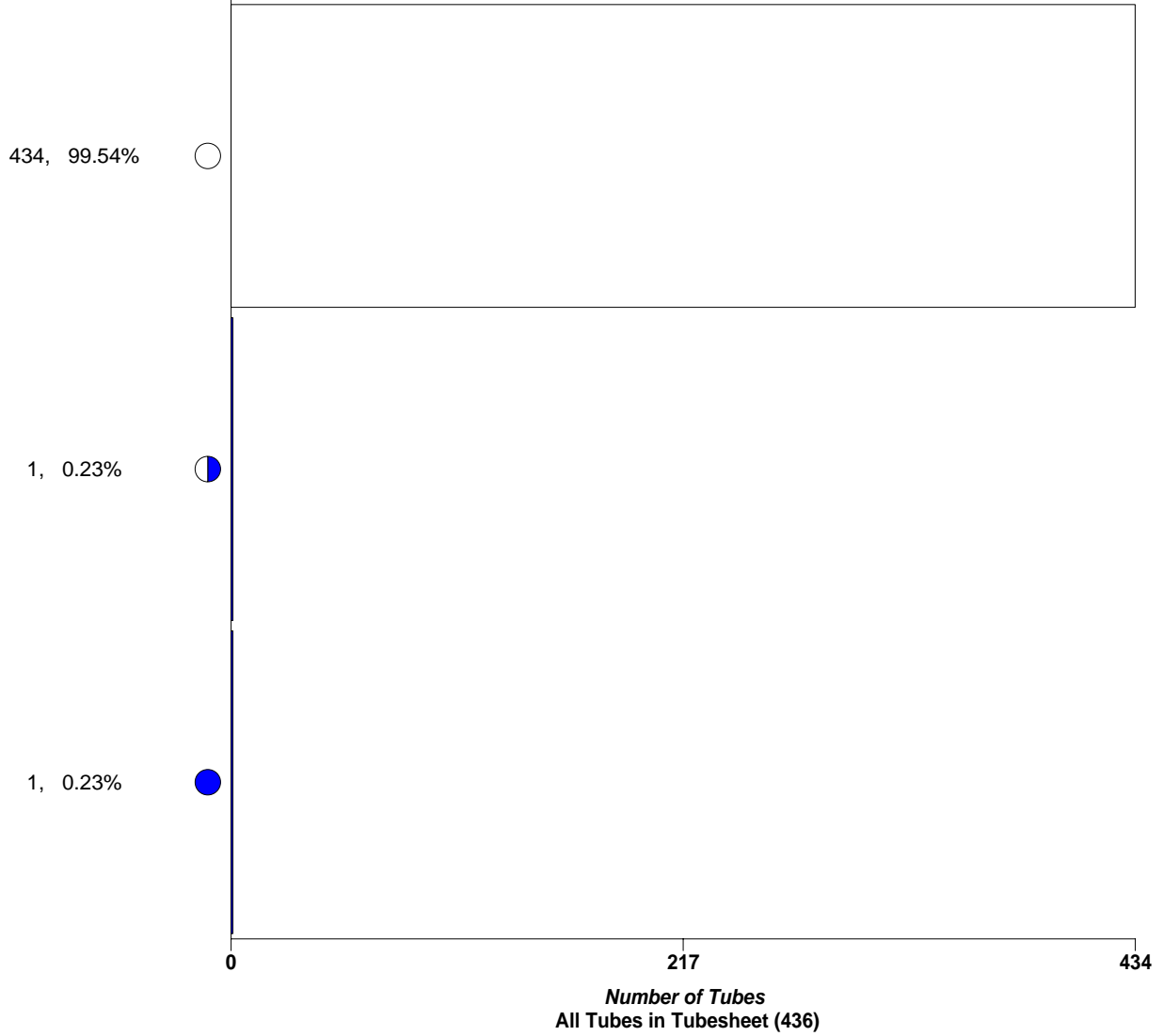
Accept, 377 tube(s), 100.00%, Accept

CONDENSER

Defect Summary

S/N 123456 #2

Qty, Percent



Condenser
February 20, 2008
Tubes Tested: 436

Total Accepted Tubes: 436, 100.00%

Rejected Tubes: 0, 0.00%

Accepted Non-Defective Tubes: 434, 99.54%

Accepted Defective Tubes: 2, 0.46%

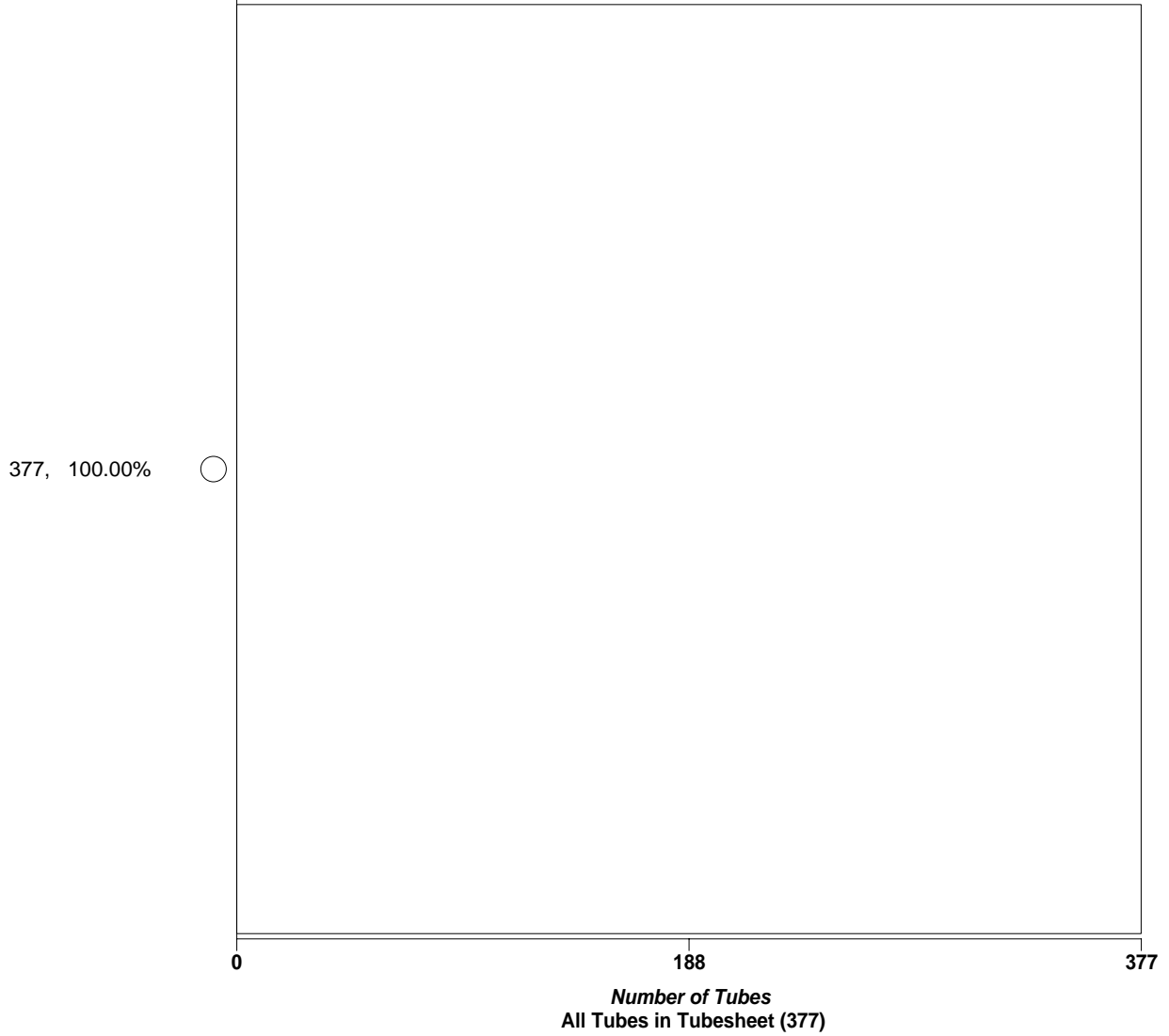
- Accept, Accept
- ◐ ID Defect < 20%, Accept
- ID Defect < 40%, Accept

EVAPORATOR

Defect Summary

S/N 123456 #2

Qty, Percent



Evaporator
February 20, 2008
Tubes Tested: 377

Total Accepted Tubes: 377, 100.00%

Rejected Tubes: 0, 0.00%

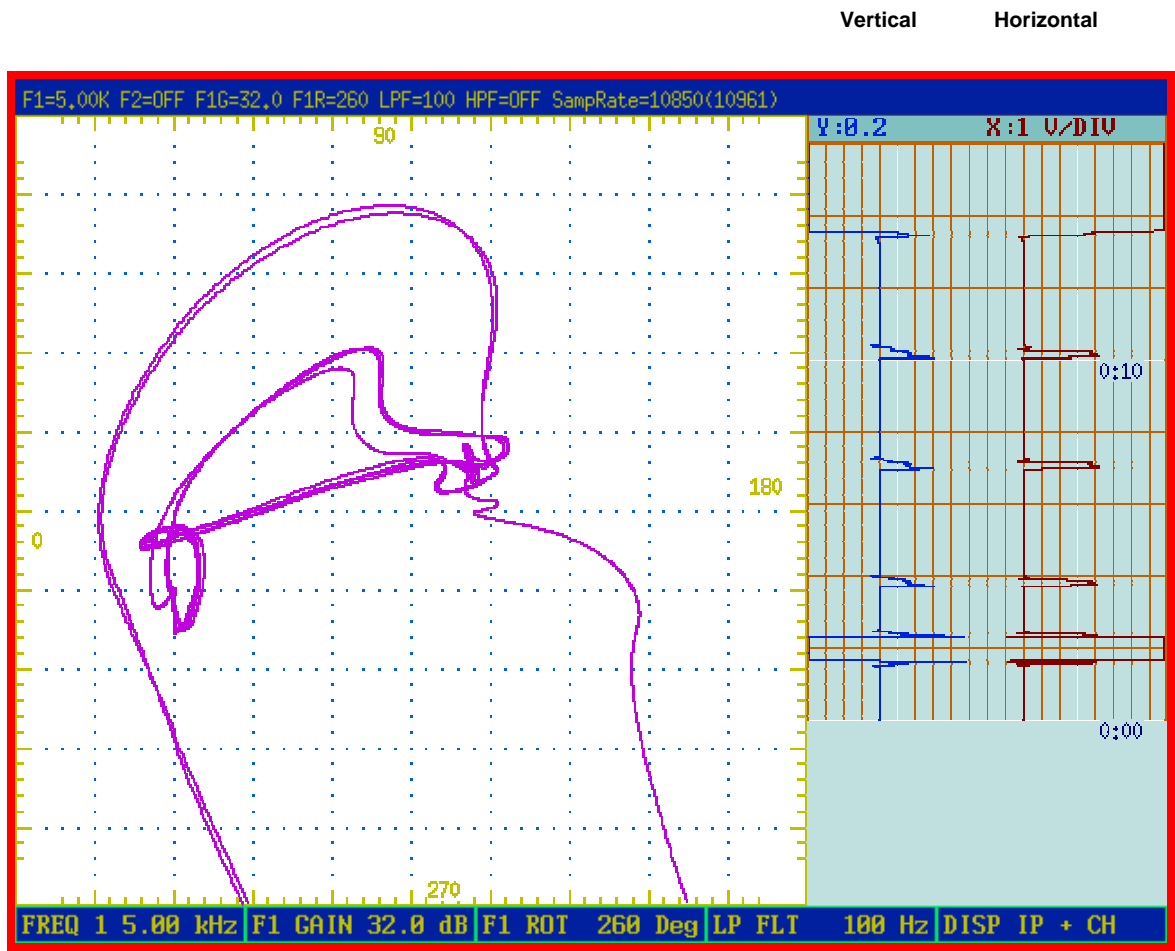
Accepted Non-Defective Tubes: 377, 100.00%

Accepted Defective Tubes: 0, 0.00%

○ Accept, Accept

Tube Data

Condenser Cross Axis:

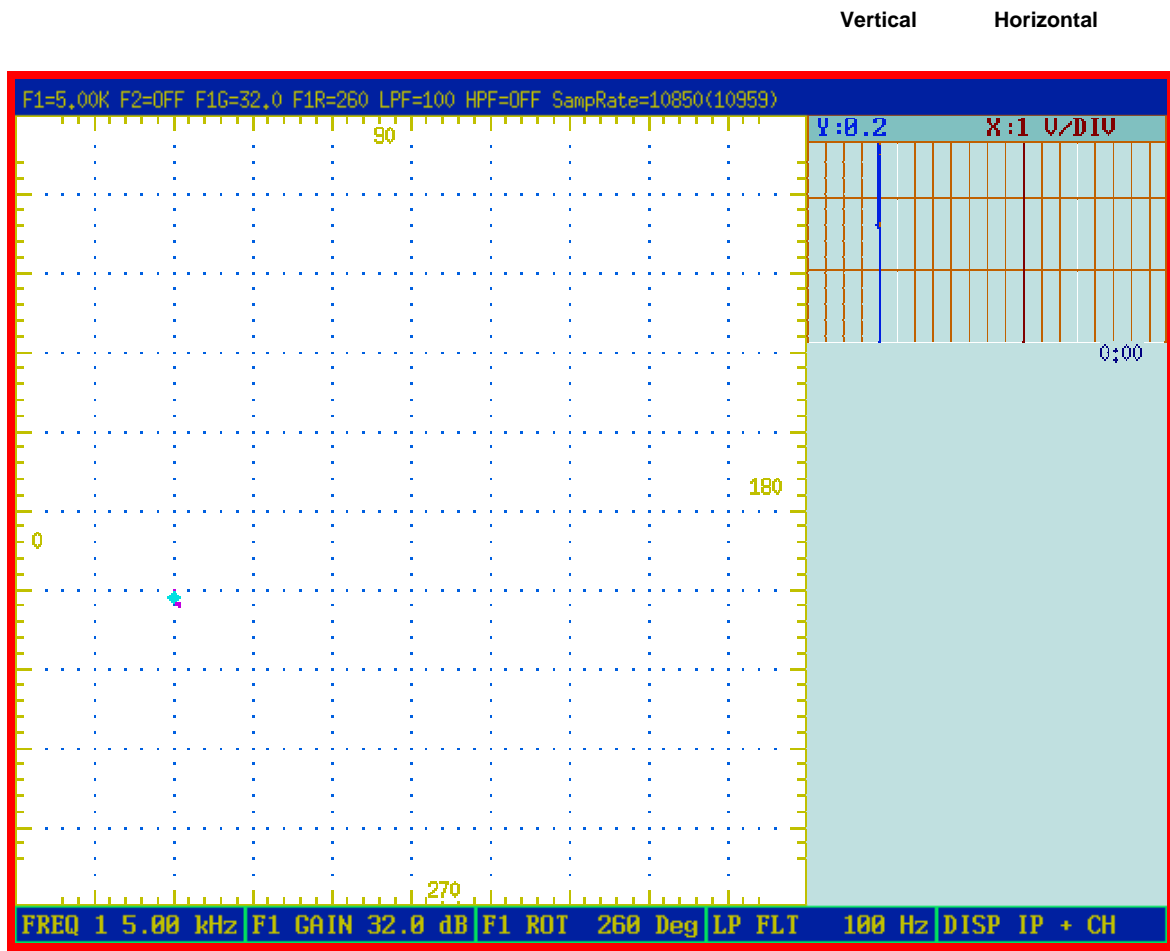


Row 1, Tube 1

Typical Tube

Tube Data

Condenser Cross Axis:

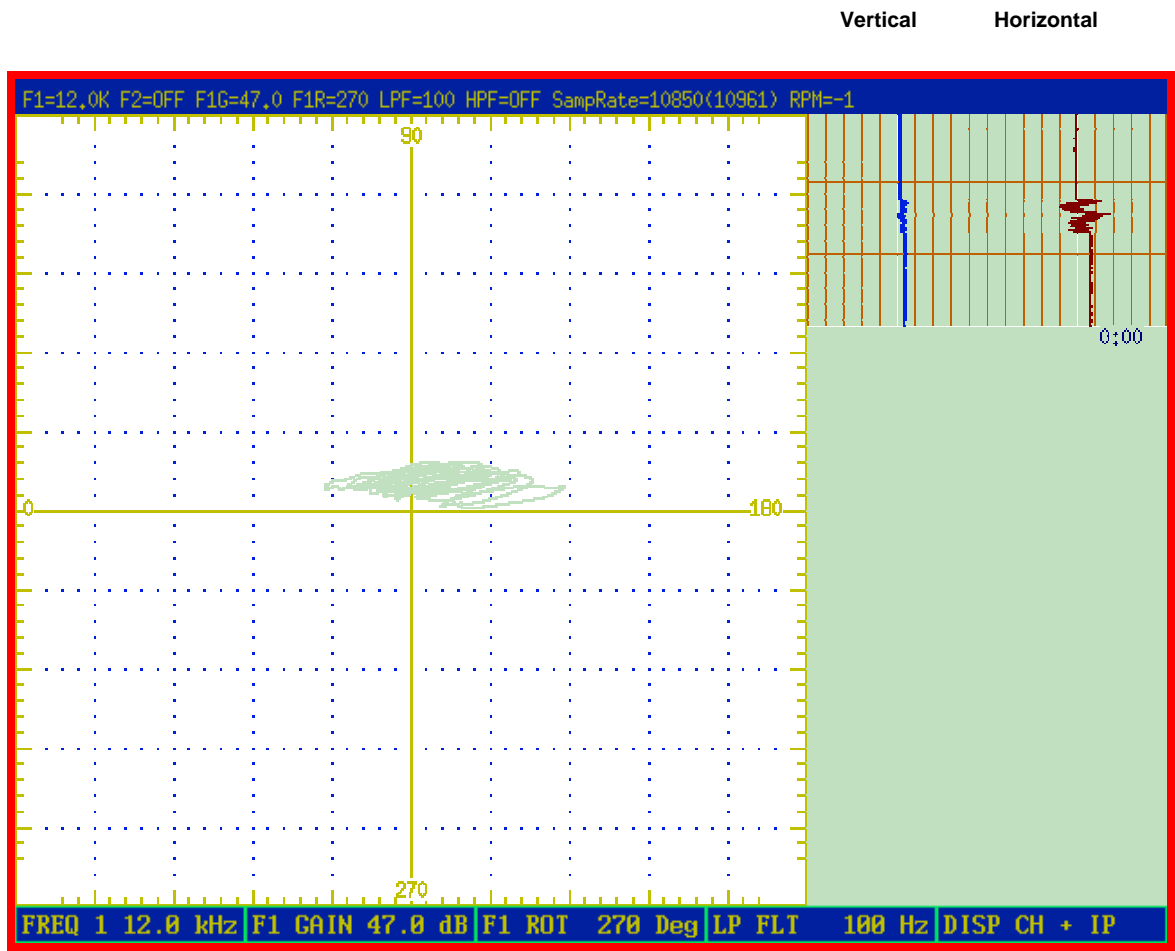


Row 25, Tube 13

ID Defect in Bay 4

Tube Data

Condenser Differential:

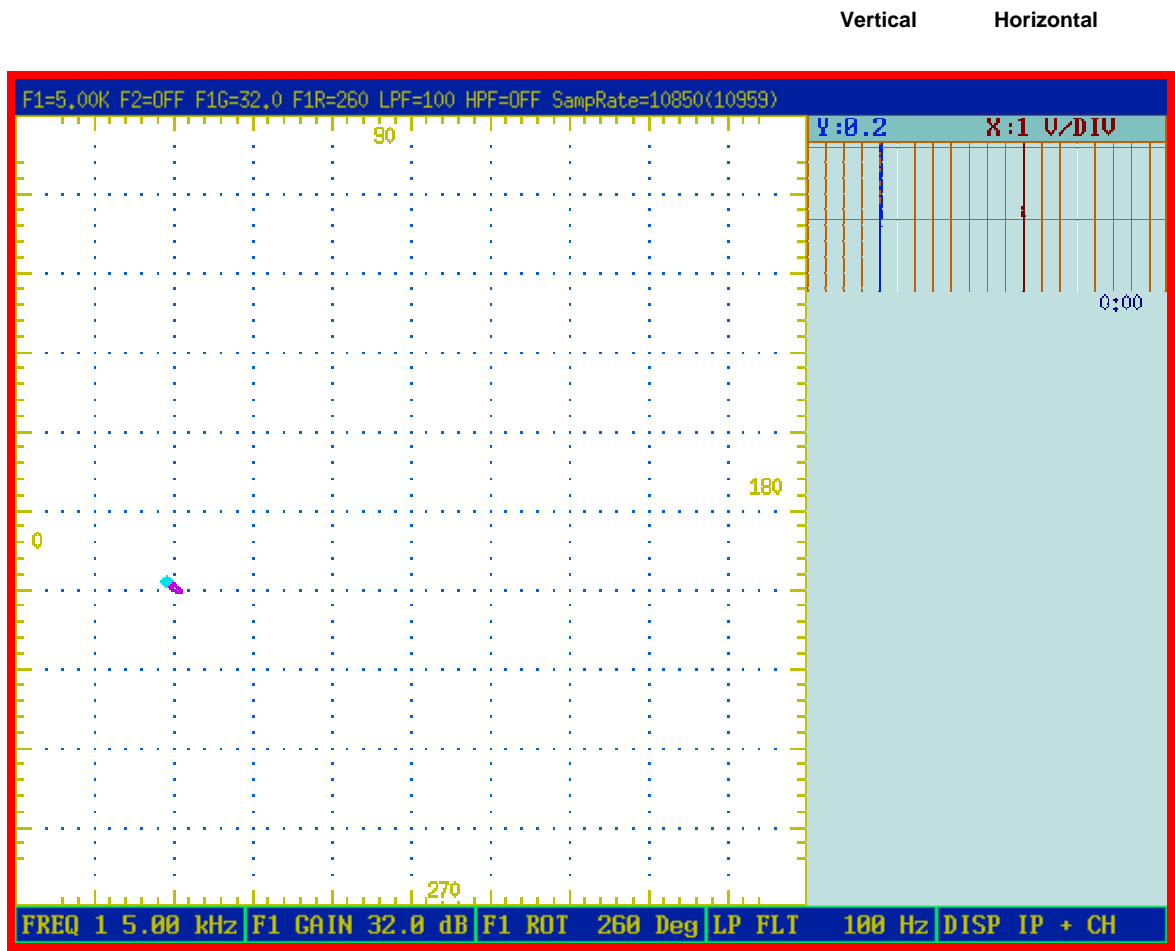


Row 25, Tube 13

ID Defect in Bay 4

Tube Data

Condenser Cross Axis:

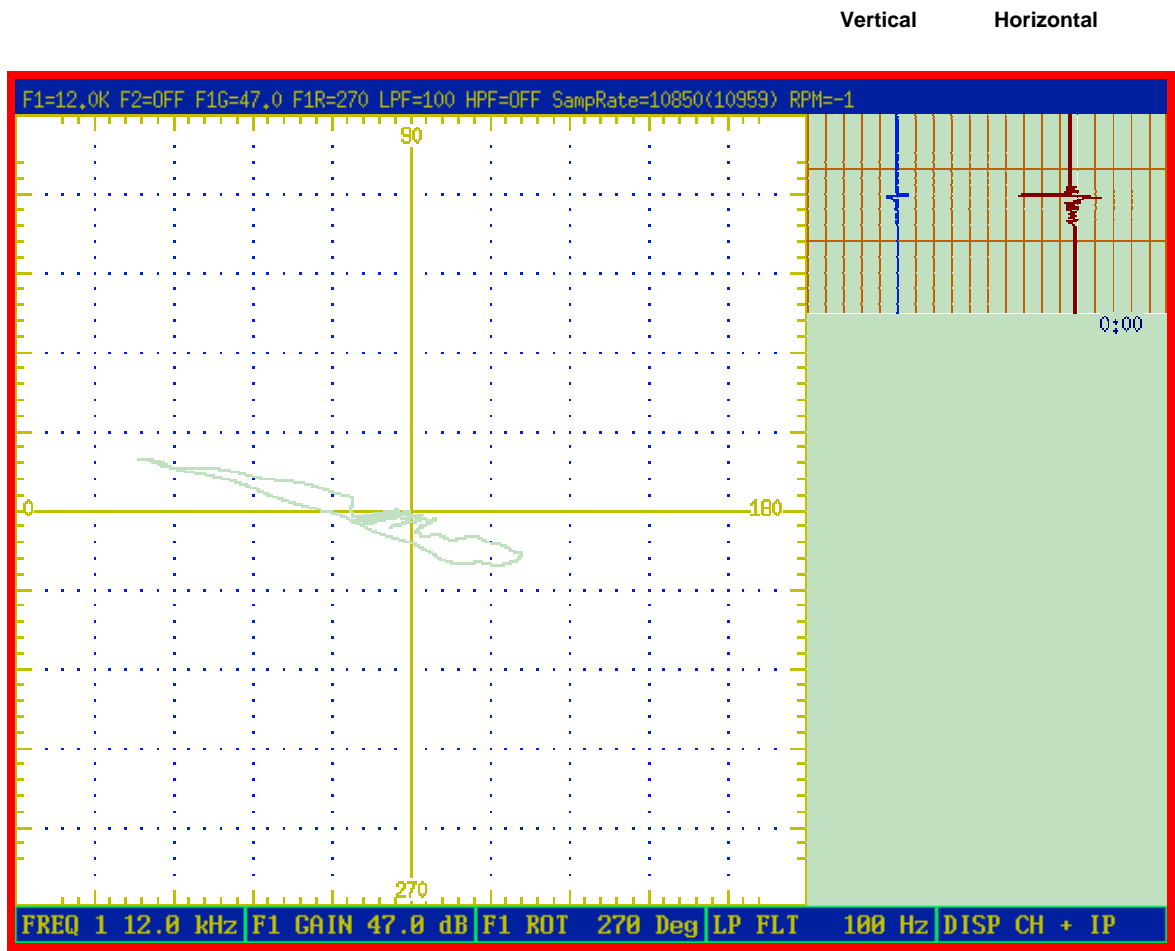


Row 26, Tube 2

ID Defect 9" from S3 in Bay 3

Tube Data

Condenser Differential:

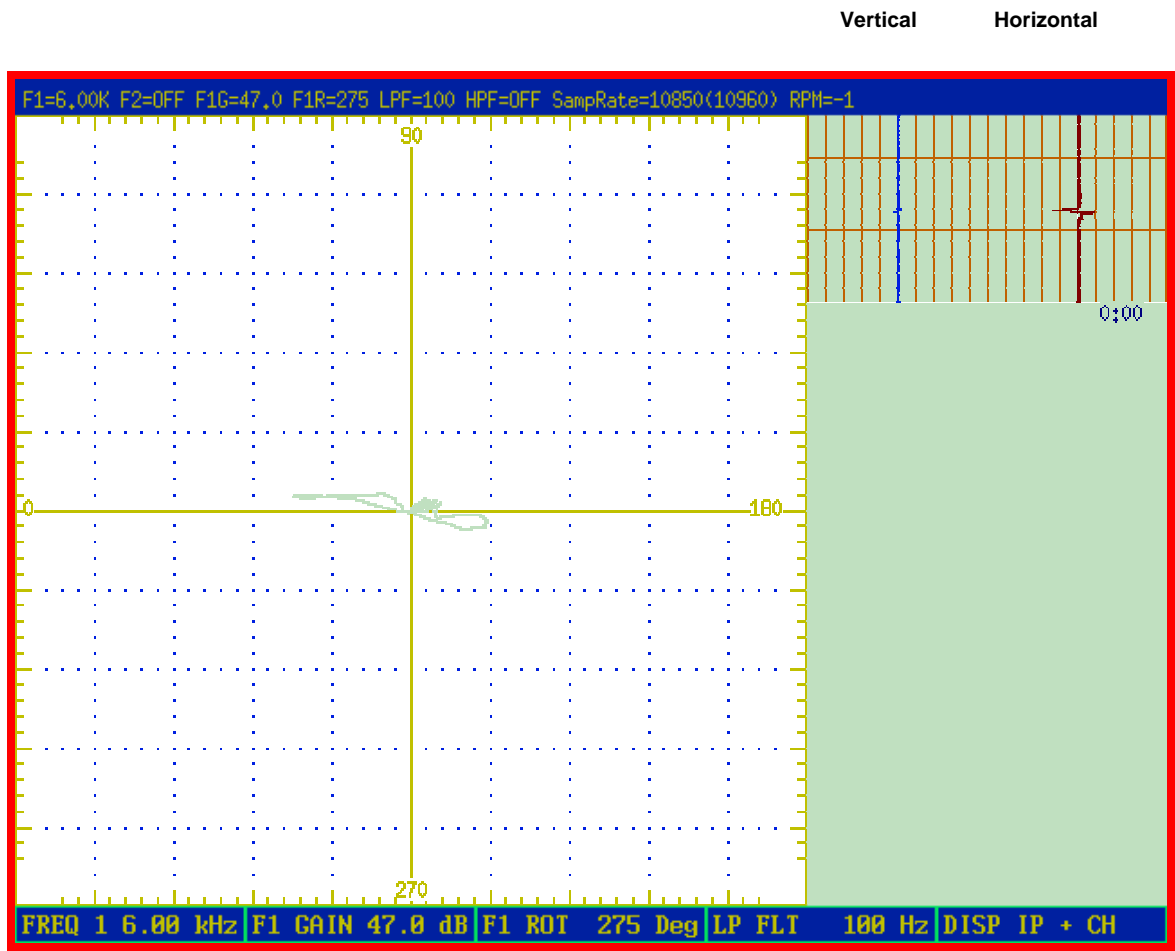


Row 26, Tube 2

ID Defect 9" from S3 in Bay 3

Tube Data

Condenser Differential:

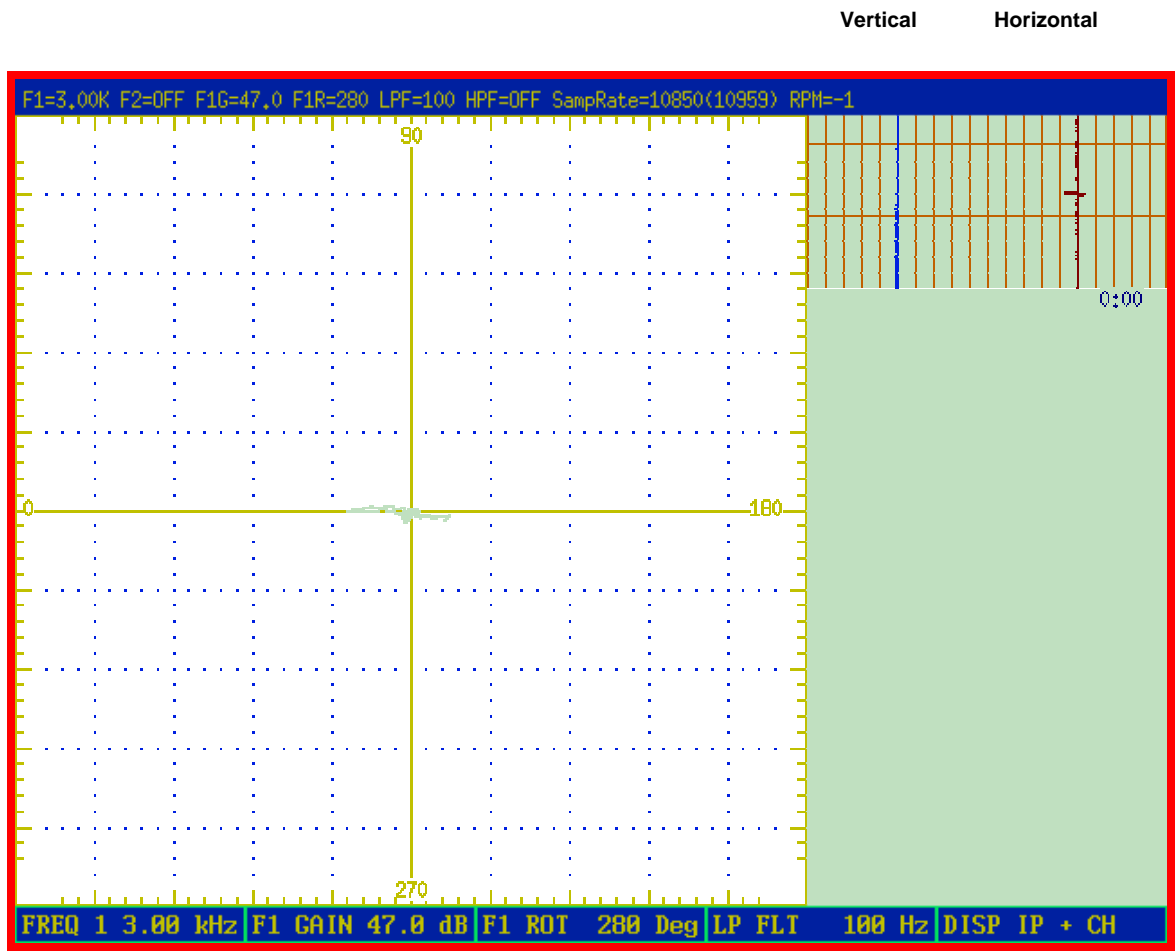


Row 26, Tube 2

ID Defect 9" from S3 in Bay 3

Tube Data

Condenser Differential:

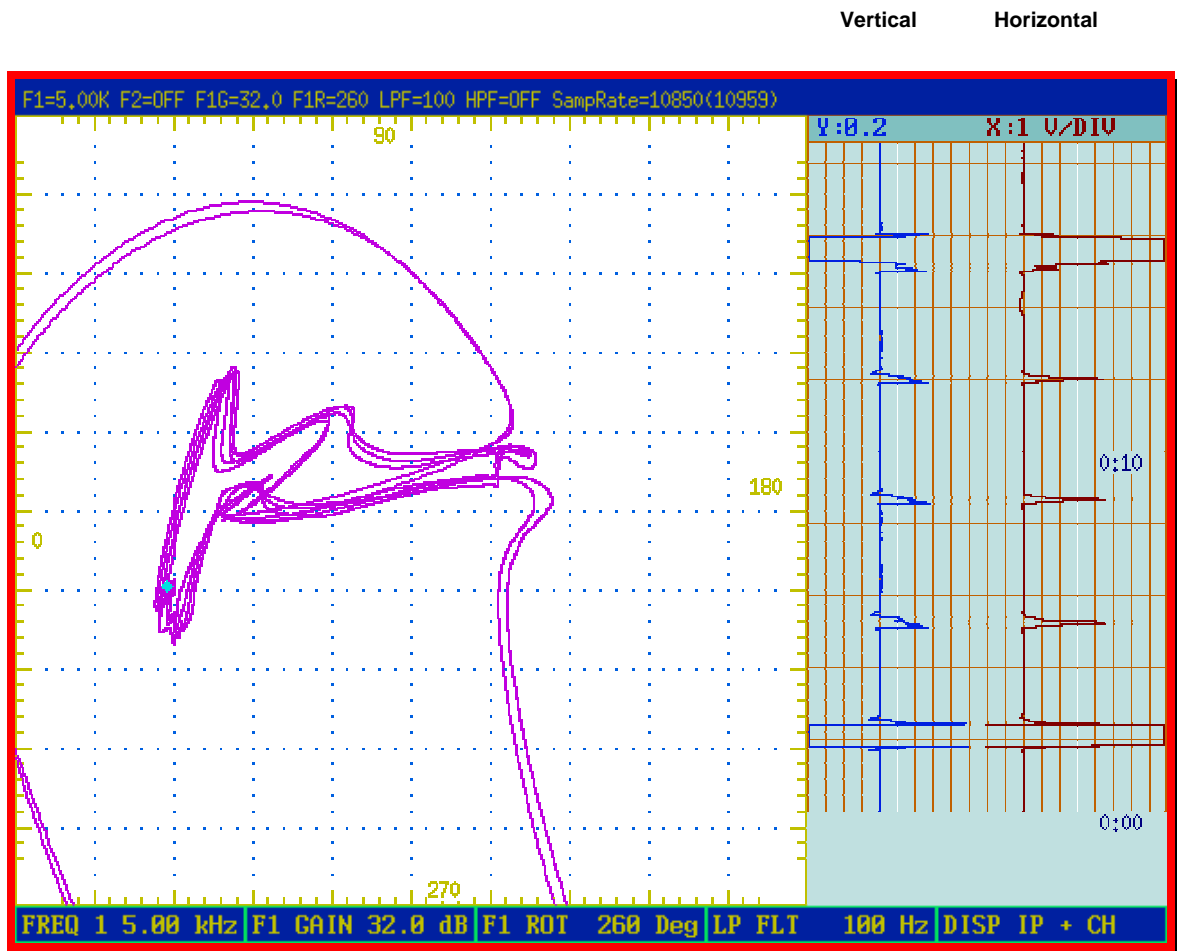


Row 26, Tube 2

ID Defect 9" from S3 in Bay 3

Tube Data

Evaporator Cross Axis:

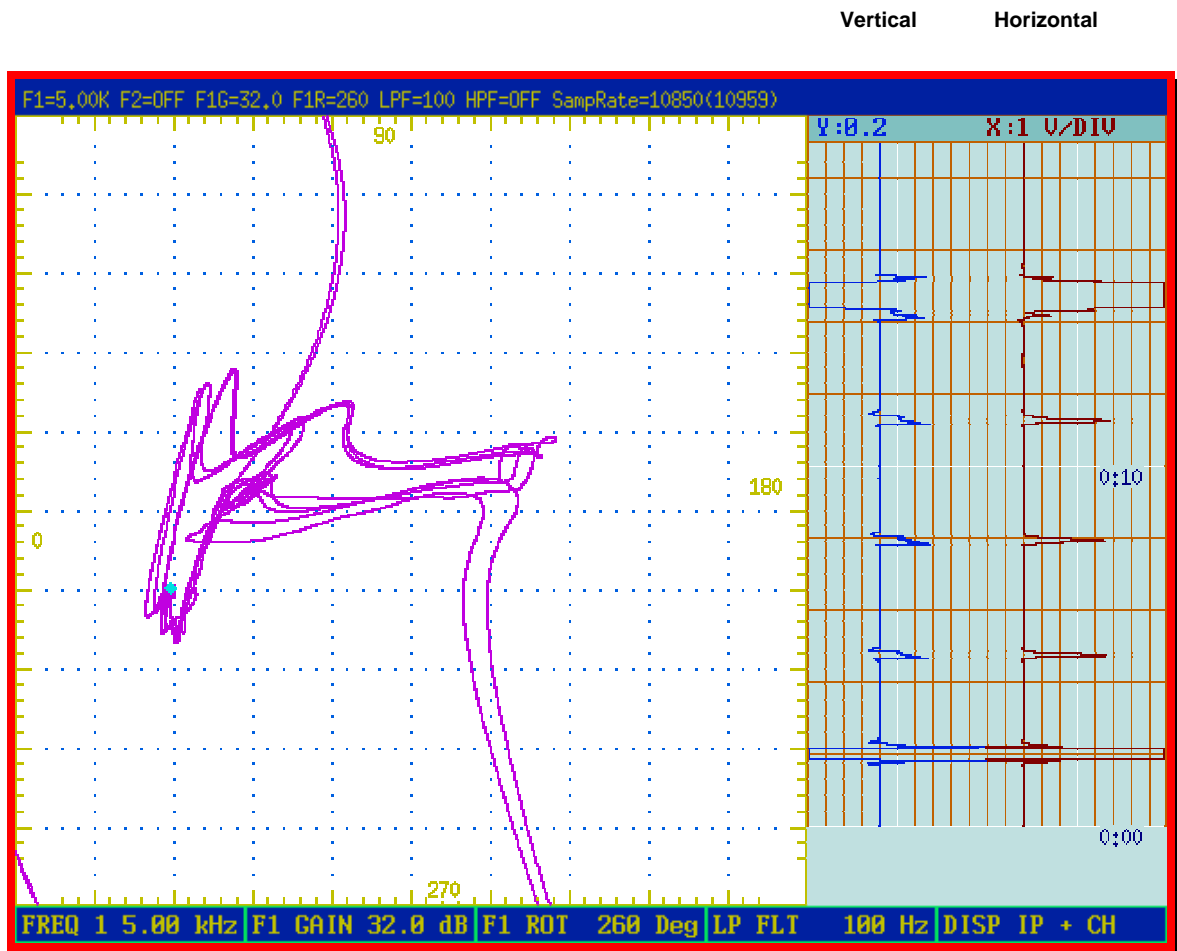


Row 1, Tube 1

Typical Tube

Tube Data

Evaporator Cross Axis:

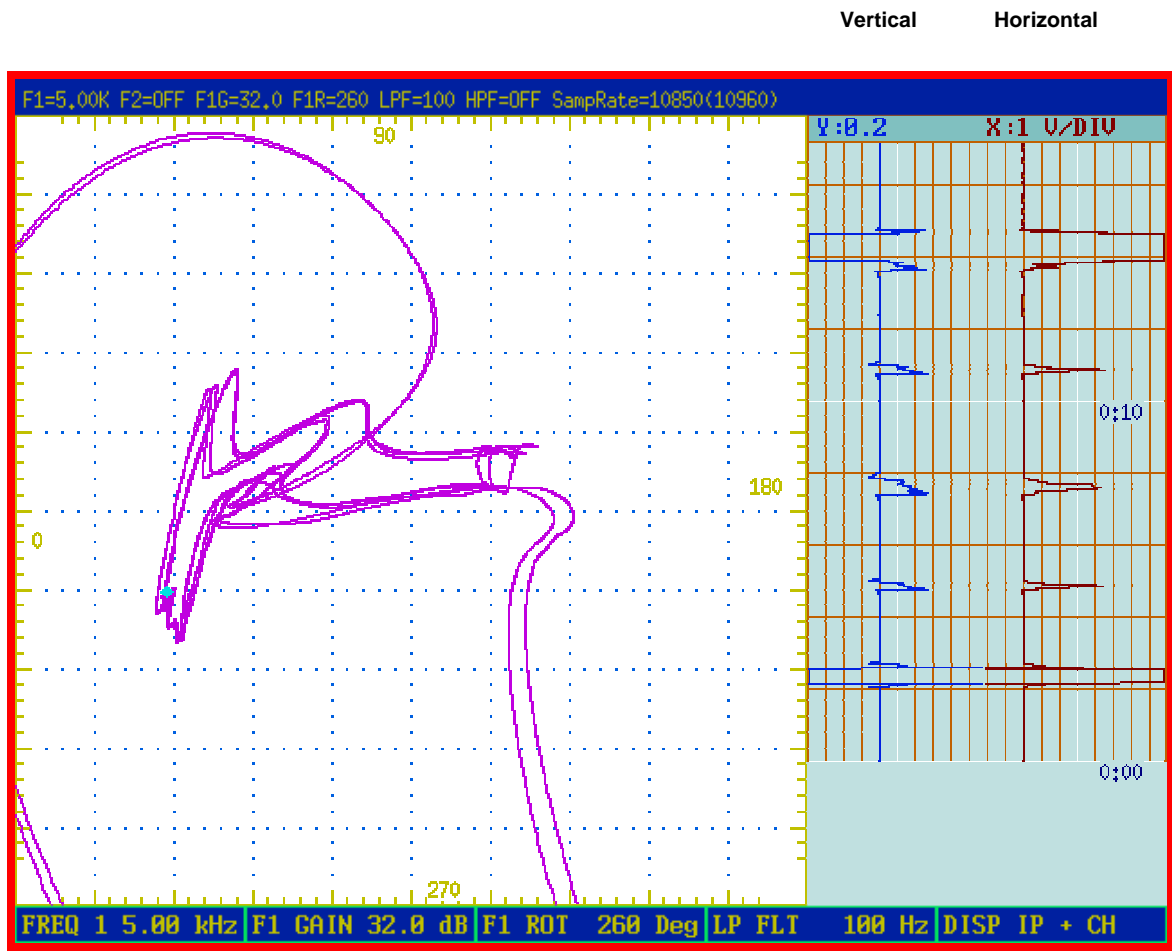


Row 4, Tube 8

Typical Tube

Tube Data

Evaporator Cross Axis:

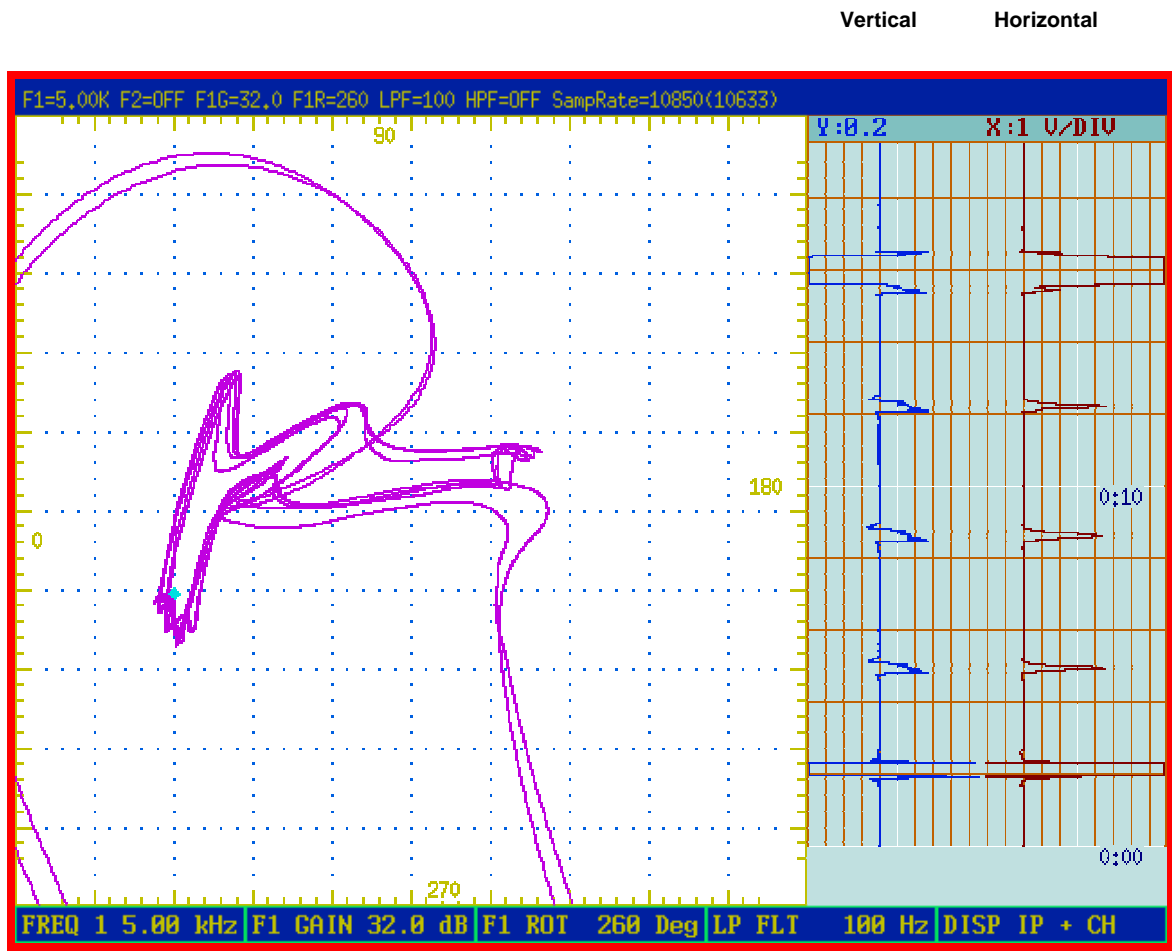


Row 6, Tube 14

Typical Tube

Tube Data

Evaporator Cross Axis:

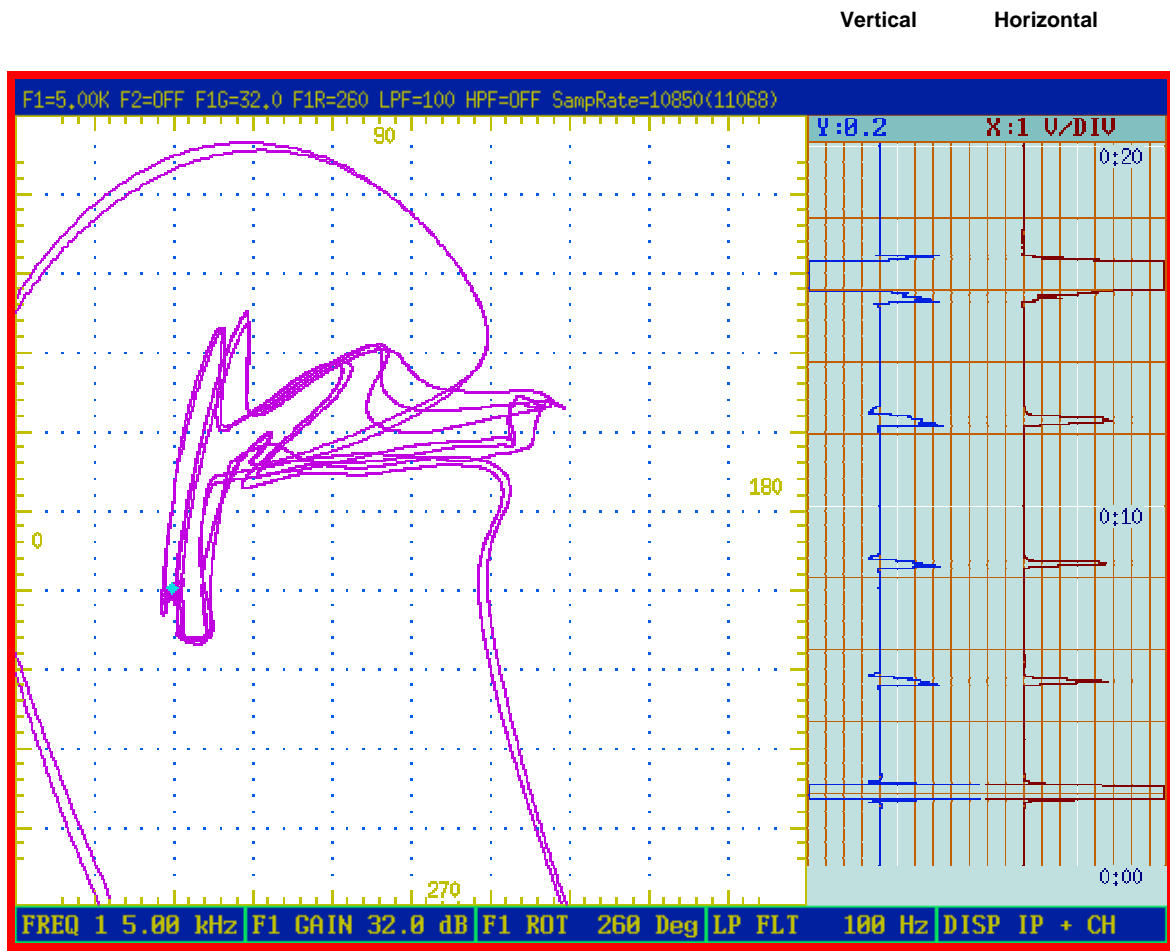


Row 7, Tube 18

Typical Tube

Tube Data

Evaporator Cross Axis:

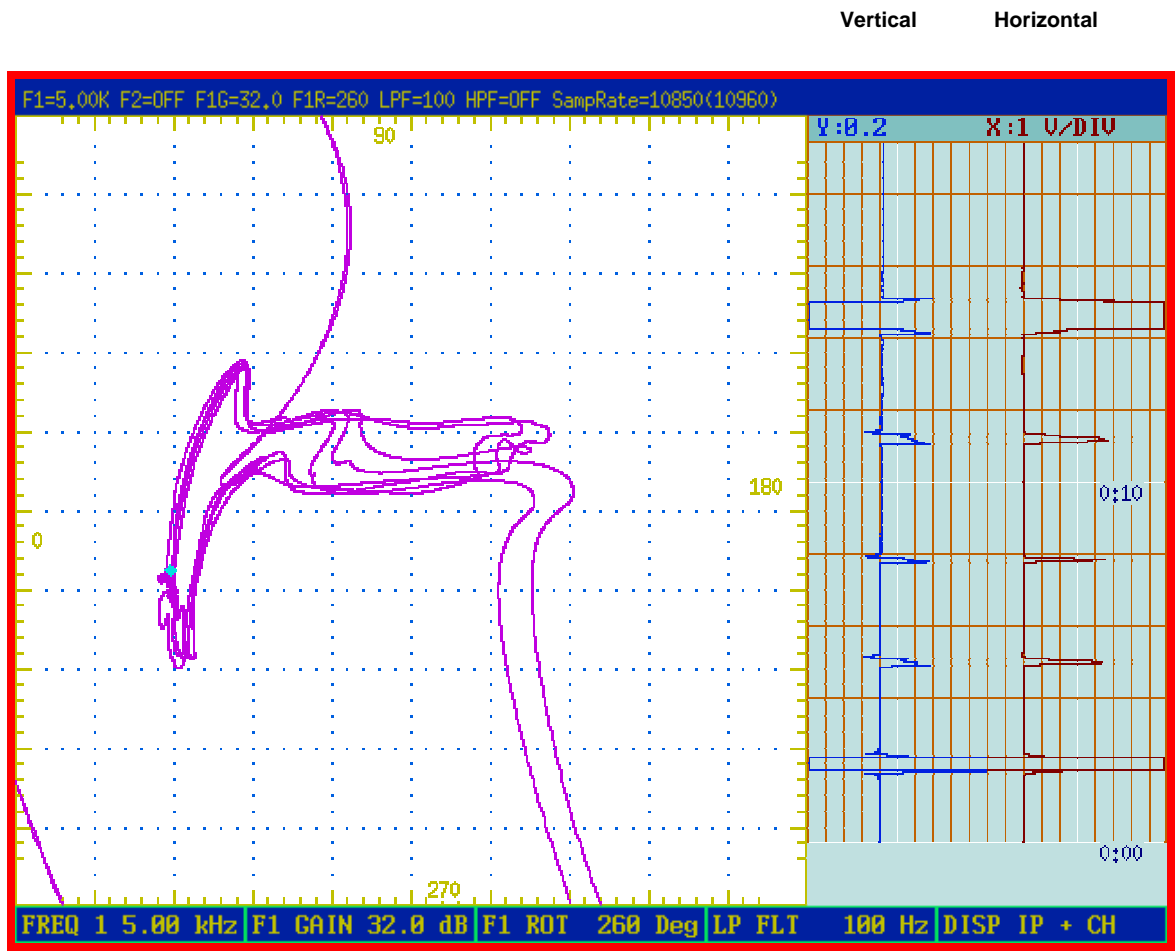


Row 11, Tube 22

Typical Tube

Tube Data

Evaporator Cross Axis:

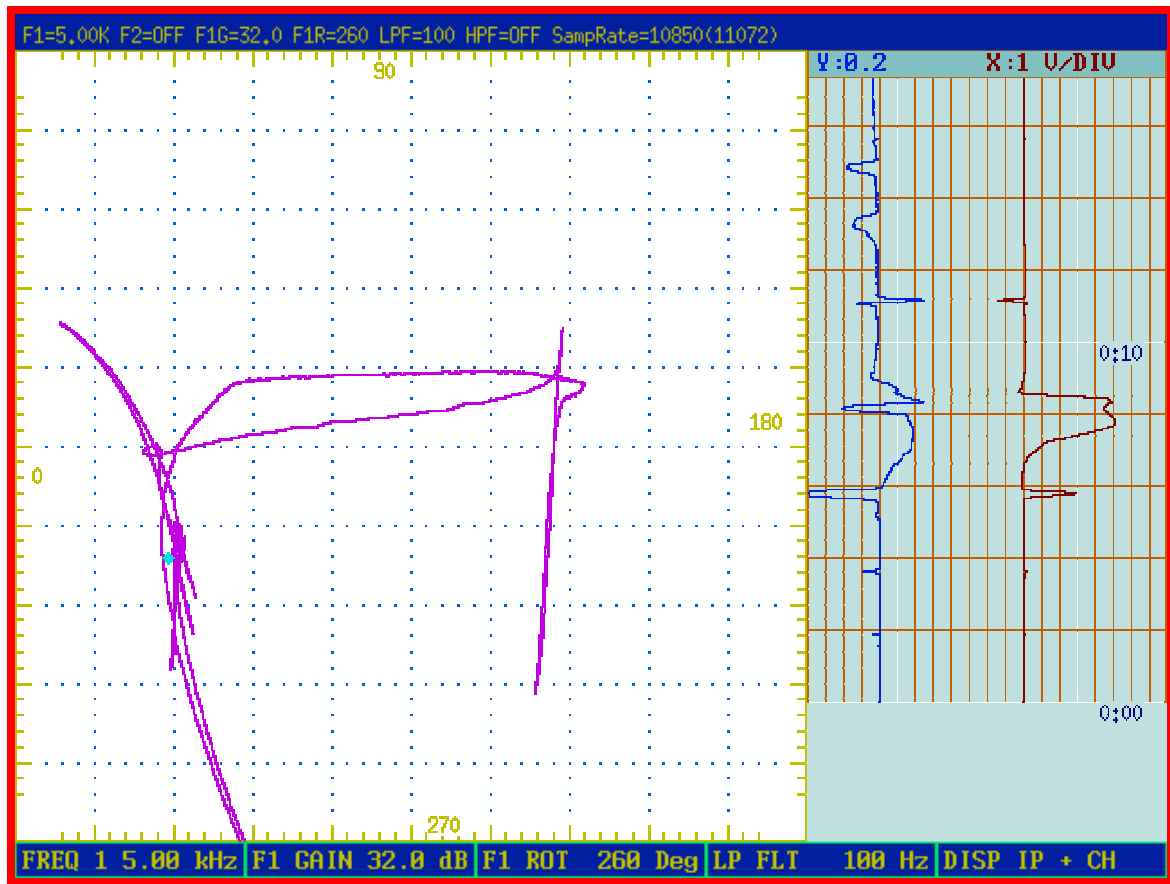


Row 14, Tube 20

Typical Tube

Calibration Data Cross Axis

Condenser:



Test Instrument:

Frequency: 5kHz

Gain: 32db

Rotation: 260°

X/VD: 1

Y/VD: .2

Standard Data #21:

.062 Diameter: 100% Through Wall

.093 Diameter: 100% Through Wall

Longitudinal Crack: 100% Through Wall

.020 OD Notch: 180° .5" Wide Land

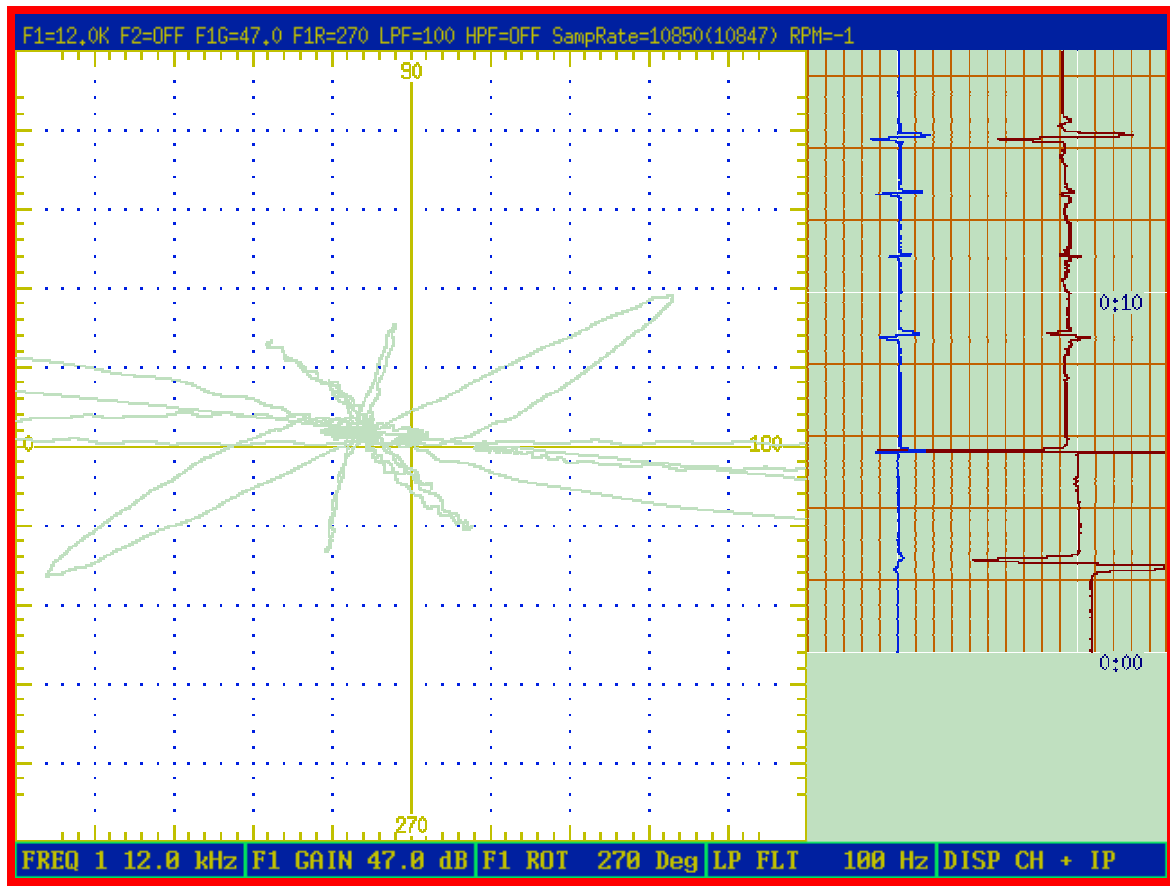
Radial Crack: 100% Through Wall

.010 OD Groove: 360° .5" Wide Fin

.025 OD Notch: 180° .5 Wide Fin

Calibration Data Differential

Condenser:



Test Instrument:

Frequency: 12kHz

Gain: 47db

Rotation: 270°

X/VD: .2

Y/VD: .2

Standard Data #21CU05:

20% ID Anomaly

40% ID Anomaly

.062 Diameter 100% Through Wall

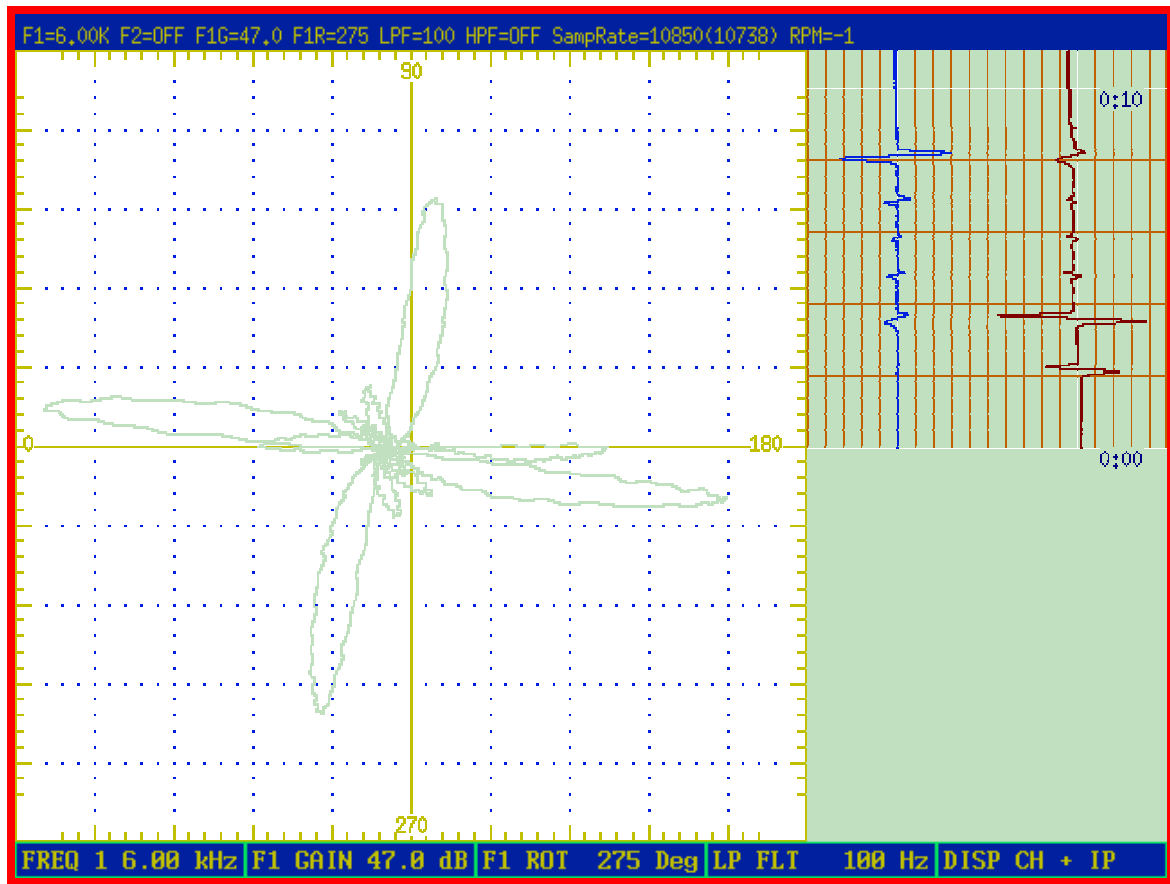
.046 Diameter 100% Through Wall

40% OD .093 Diameter FBH

20% OD Groove .250 Wide 180°

Calibration Data Differential

Condenser:



Test Instrument:

Frequency: 6kHz

Gain: 47db

Rotation: 275°

X/VD: .2

Y/VD: .2

Standard Data #21CU05VF2:

20% ID Anomaly

40% ID Anomaly

.062 Diameter 100% Through Wall

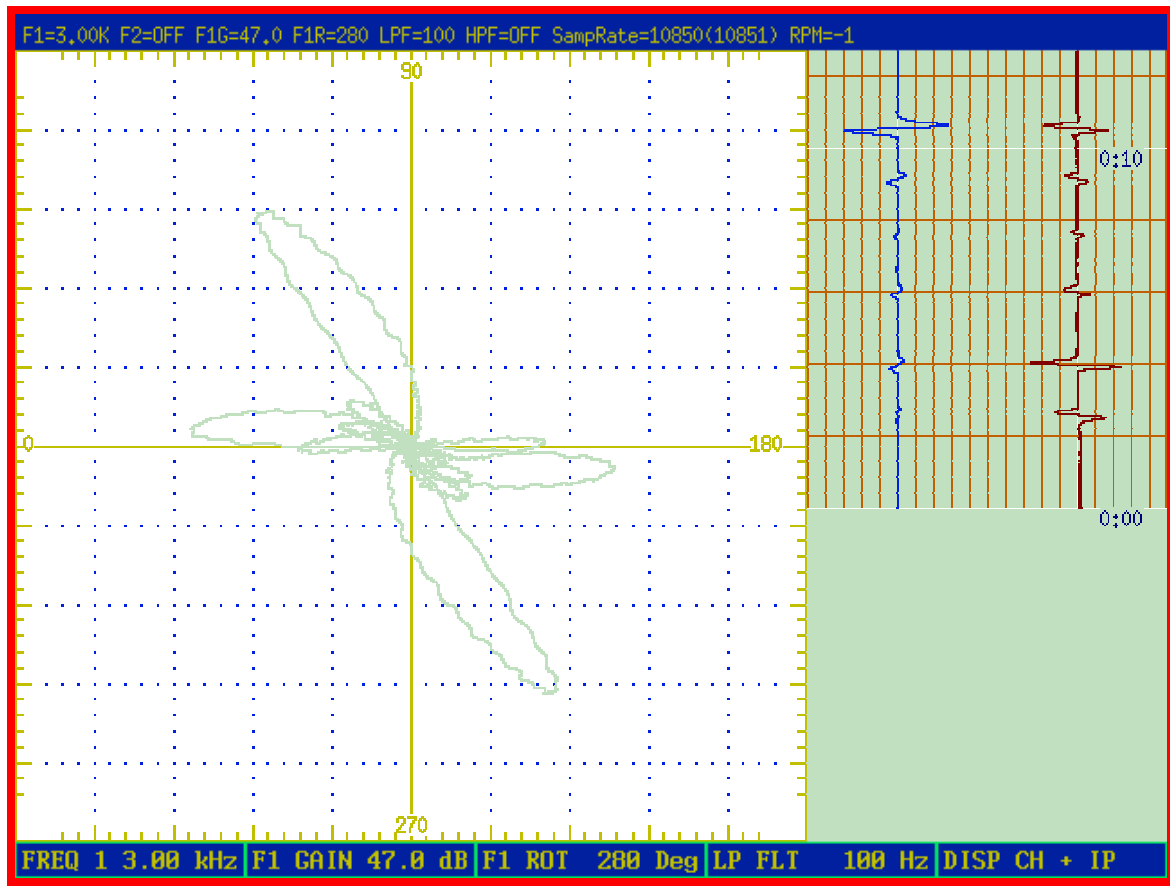
.046 Diameter 100% Through Wall

40% OD .093 Diameter FBH

20% OD Groove .250 Wide 180°

Calibration Data Differential

Condenser:



Test Instrument:

Frequency: 3kHz

Gain: 47db

Rotation: 280°

X/VD: .2

Y/VD: .2

Standard Data #21CU05VF3:

20% ID Anomaly

40% ID Anomaly

.062 Diameter 100% Through Wall

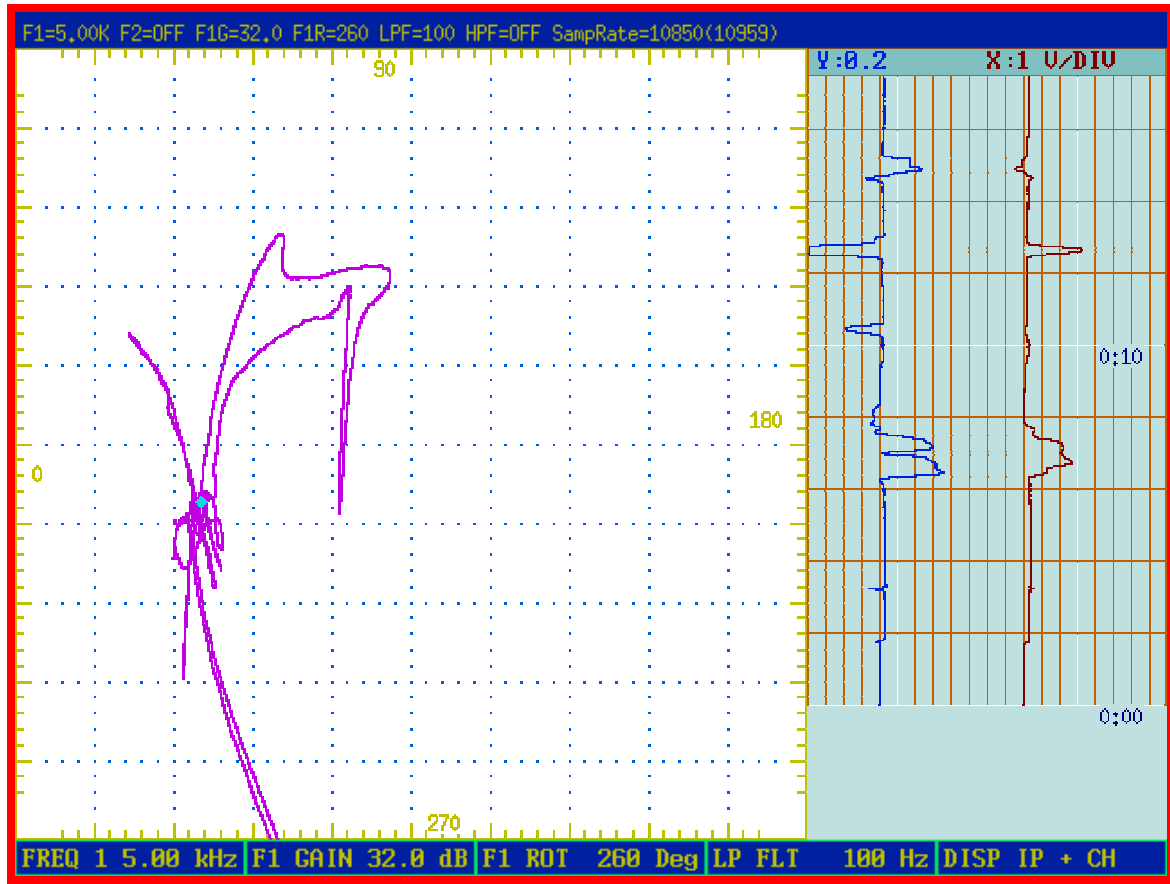
.046 Diameter 100% Through Wall

40% OD .093 Diameter FBH

20% OD Groove .250 Wide 180°

Calibration Data Cross Axis

Evaporator:



Test Instrument:

Frequency: 5kHz

Gain: 32db

Rotation: 260°

X/VD: 1

Y/VD: .2

Standard Data #6:

.062 Diameter: 100% Through Wall

.093 Diameter: 100% Through Wall

.020 OD Notch: 180° .25" Wide Land

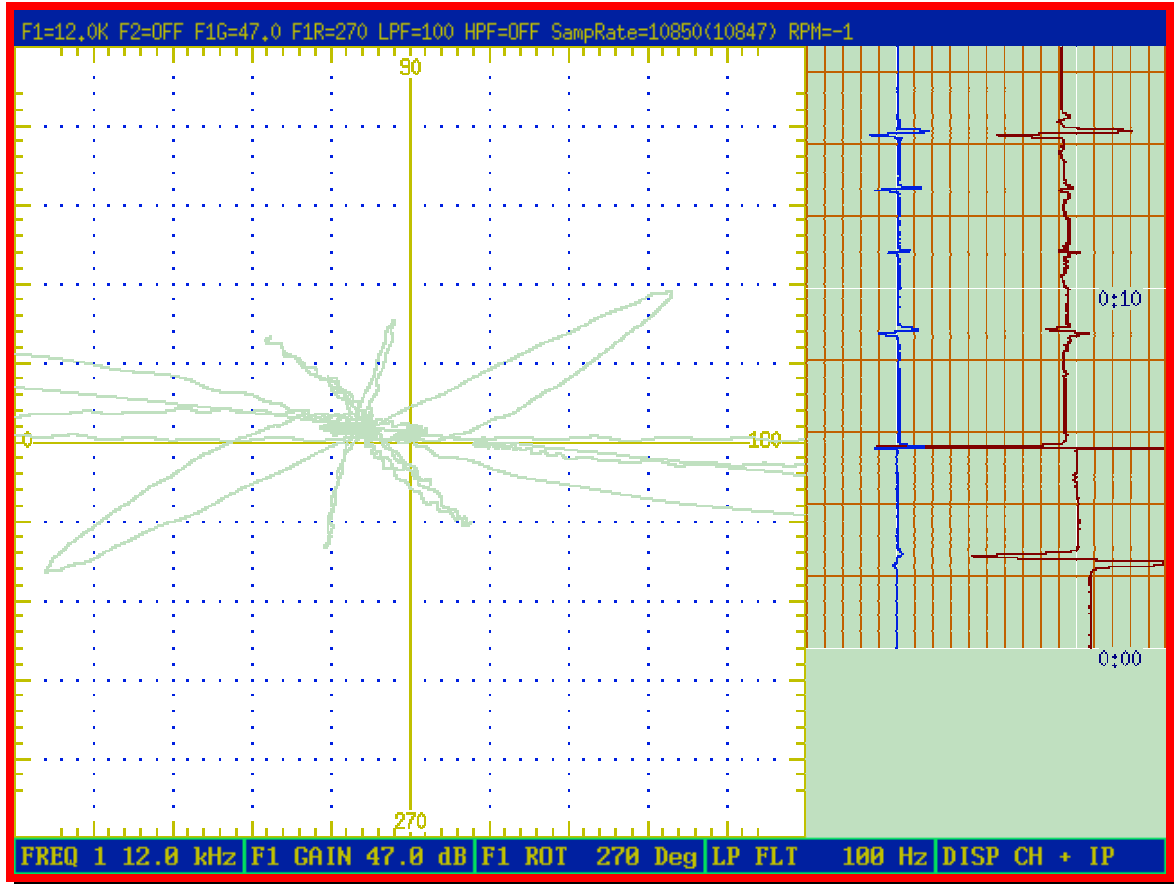
.010 OD Groove: 360° .25" Wide Fin

Longitudinal Crack 100% Through Wall

Radial Crack: 100% Through Wall

Calibration Data Differential

Evaporator:



Test Instrument:

Frequency: 12kHz

Gain: 47db

Rotation: 270°

X/VD: .2

Y/VD: .2

Standard Data #6CU05:

20% ID Anomaly

40% ID Anomaly

.062 Diameter 100% Through Wall

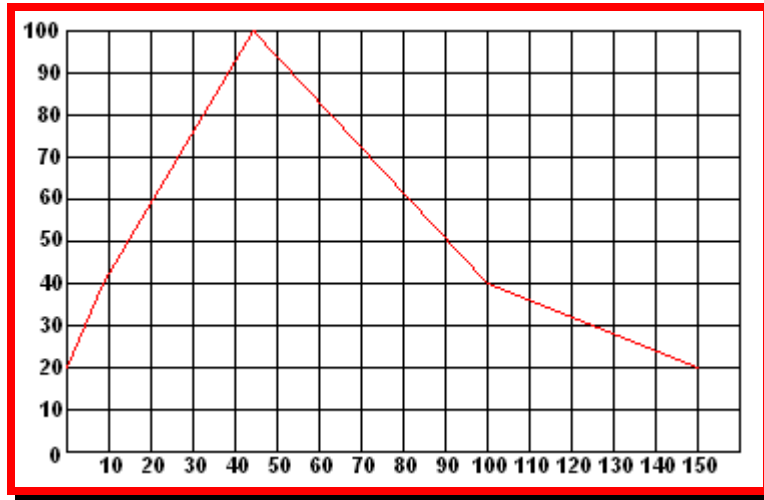
.046 Diameter 100% Through Wall

40% OD .093 Diameter FBH

20% OD Groove .250 Wide 180°

Calibration Curve

Condenser:



Standard #21CU05 12 kHz

Percent Through Wall

Phase Angle Degrees

20 ID

0

40 ID

8

100

45

40 OD

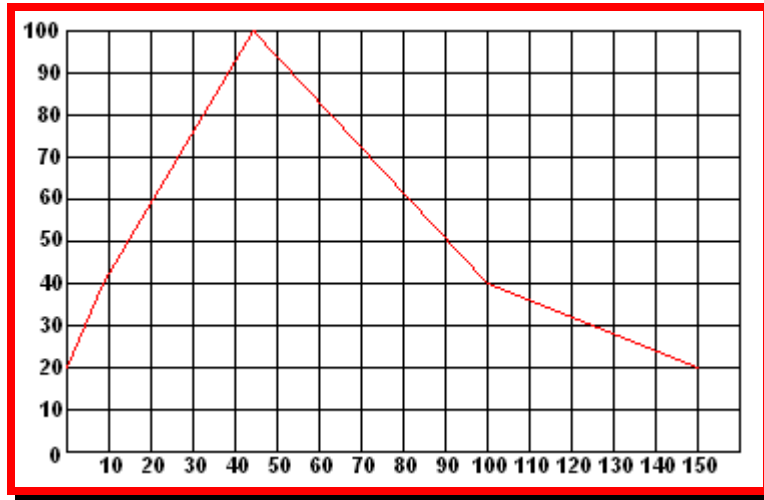
100

20 OD

150

Calibration Curve

Evaporator:



Standard #6CU05 12 kHz

Percent Through Wall

Phase Angle Degrees

20 ID

0

40 ID

8

100

45

40 OD

100

20 OD

150

Record of Inspection

CUSTOMER: Your Company
SECTION: Condenser
TEST DATE/TIME: 02/20/08 17:39:21
NOTES: Total Tubes Tested = 436
Rejected Tubes = 0 (0.00%)
Total Accepted Tubes = 436 (100.00%)
Accepted Non-Defective Tubes = 434 (99.54%)
Accepted Defective Tubes = 2 (0.46%)

ROW	TUBE	ACC	REJ	DEFECT DESCRIPTION
25	13	X		ID Defect < 20%
26	2	X		ID Defect < 40%

Record of Inspection

CUSTOMER: Your Company
SECTION: Evaporator
TEST DATE/TIME: 02/20/08 17:39:39
NOTES: Total Tubes Tested = 377
Rejected Tubes = 0 (0.00%)
Total Accepted Tubes = 377 (100.00%)
Accepted Non-Defective Tubes = 377 (100.00%)
Accepted Defective Tubes = 0 (0.00%)

ROW	TUBE	ACC	REJ	DEFECT DESCRIPTION
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Test Equipment

Condenser:

Test Instrument:

Manufacturer: UniWest
Model: US-454 Eddy View
Serial Number Differential: 371C
Serial Number Cross Axis: 645C

Probe:

Manufacturer: ECT
Model: XADS
Diameter: .560
Serial Number: 11792
Cable Number: 21037/45'

Evaporator:

Test Instrument:

Manufacturer: UniWest
Model: US-454 Eddy View
Serial Number Differential: 371C
Serial Number Cross Axis: 645C

Probe:

Manufacturer: ECT
Model: XADS
Diameter: .560
Serial Number: 11792
Cable Number: 21037/45'

Tube Bundle

Condenser Test End



Control Panel ►

Evaporator Test End



◀ Control Panel

Test Procedures

Our test procedures for eddy current inspections of nonferrous tubing are in compliance with ASTM E 690. The test is designed to detect wear patterns normally found in industrial air conditioning. Eddy current testing is a nondestructive method of locating discontinuities in tubing made of materials that conduct electricity. Signals can be produced by discontinuities located either on the inner or outer surfaces of the tube, or by discontinuities totally contained within the tube wall. This eddy current inspection was performed to the highest possible degree of accuracy. Conditions can exist that require specialized testing with different probes and frequencies.

The test instrument is calibrated in accordance with our Recommended Practice Document 5.4. A machined calibration standard is used for this procedure. Calibration is checked once an hour during operation. The calibration standard has artificial defects that relate to defects normally encountered. Calibration is performed if any of the following change, probe, frequency, gain, phase, tube size or material. Calibration standard data is included in the report.

A test probe is inserted the length of the tube. The probe is energized with alternating currents at the appropriate frequencies. The electrical impedance of the probe is modified by the proximity of the tube, the tube dimensions, electrical conductivity, magnetic permeability and metallurgical or mechanical discontinuities in the tube. The probe is withdrawn through the tube; changes in electromagnetic response caused by variables in the tube produce signals for analysis. The probes ideal fill factor is 85% or more.

All tubes in the bundle are tested. Defects are recorded on the tube bundle map. Data is provided for a typical tube or sample defects noted in a bundle. All defects are compared to machined calibration standards. Defect shape and depth will vary. Not all defects are of a sufficient size to disrupt current flow enough to be detectable. This is particularly true were irrelevant signals caused by metallurgical or mechanical variations generated during manufacturing occur. These irrelevant indications can mask lesser relevant discontinuities. Discontinuities adjacent to tube ends may not produce signals capable of detection due to end effect. If a leak is suspected, we recommend leak testing prior to system start up. Defects are reported in amplitude and classified accept or reject in accordance with our Recommended Practice Document 4.1.