CARRIER COMMERCIAL SERVICE
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Suite 8
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(704)525-2644

Report of Eddy Current Inspection

Manufacturer: Carrier

Model: 23XRV4042

Serial: 3607Q74631 #2

Location: UNIVERSITY OF SOUTH CAROLINA
HEALTH ED CENTER
SPARTANBURG, SC 29301

Inspected: January 2, 2019

Inspected By: LARRY B. WARNOCK, LEVEL III
TAI Services, Inc.

Reviewed By: _____
TECHNICAL MANAGER, LEVEL III

Table of Contents

Vessel Information

Manufacturer	Model	Style	Serial Number	Type
Carrier	23XRV4042	Hermetic	3607Q74631 #2	Screw

Condenser	
TestEnd	Opposite Inlet/Outlet
Tube Count	464
Tube Type	Skip Fin IE
Tube Material	Copper
OD	.750
*NWT/Under Fins	.028
*NWT/Bell/Land	.049
#/Type Support	3 Mild Steel
Tube Numbering	Top to Bottom
Row Numbering	Left to Right
Tube Length +- 2	148 Inches

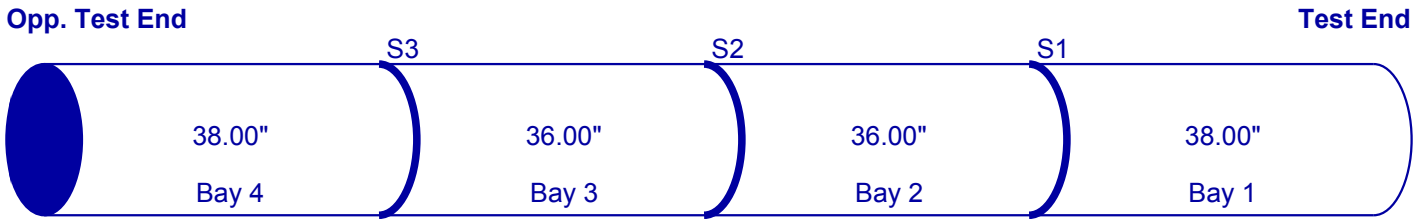
Evaporator	
TestEnd	Opposite Inlet/Outlet
Tube Count	324
Tube Type	Cont. Fin IE w/Land
Tube Material	Copper
OD	.750
*NWT/Under Fins	.028
*NWT/Bell/Land	.049
#/Type Support	3 Mild Steel
Tube Numbering	Top to Bottom
Row Numbering	Left to Right
Tube Length +- 2	148 Inches

Analyst: LARRY B. WARNOCK, LEVEL III

* Nominal Wall Thickness

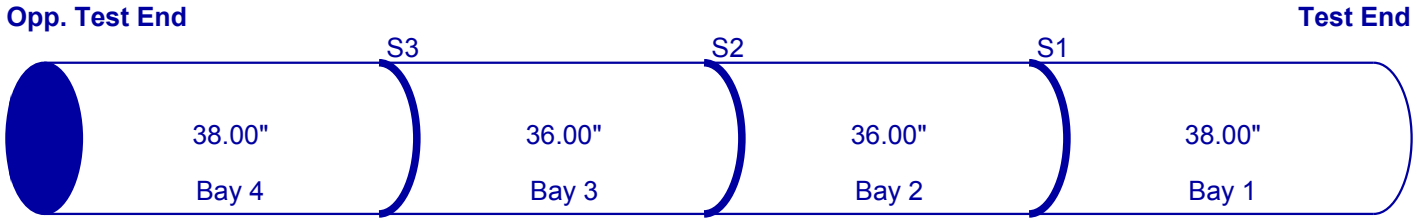
Vessel Bay Length Information

Condenser (Length = 148 inches)
S = Intermediate Support



Bay 4	38.00"
Bay 3	36.00"
Bay 2	36.00"
Bay 1	38.00"

Evaporator (Length = 148 inches)
S = Intermediate Support

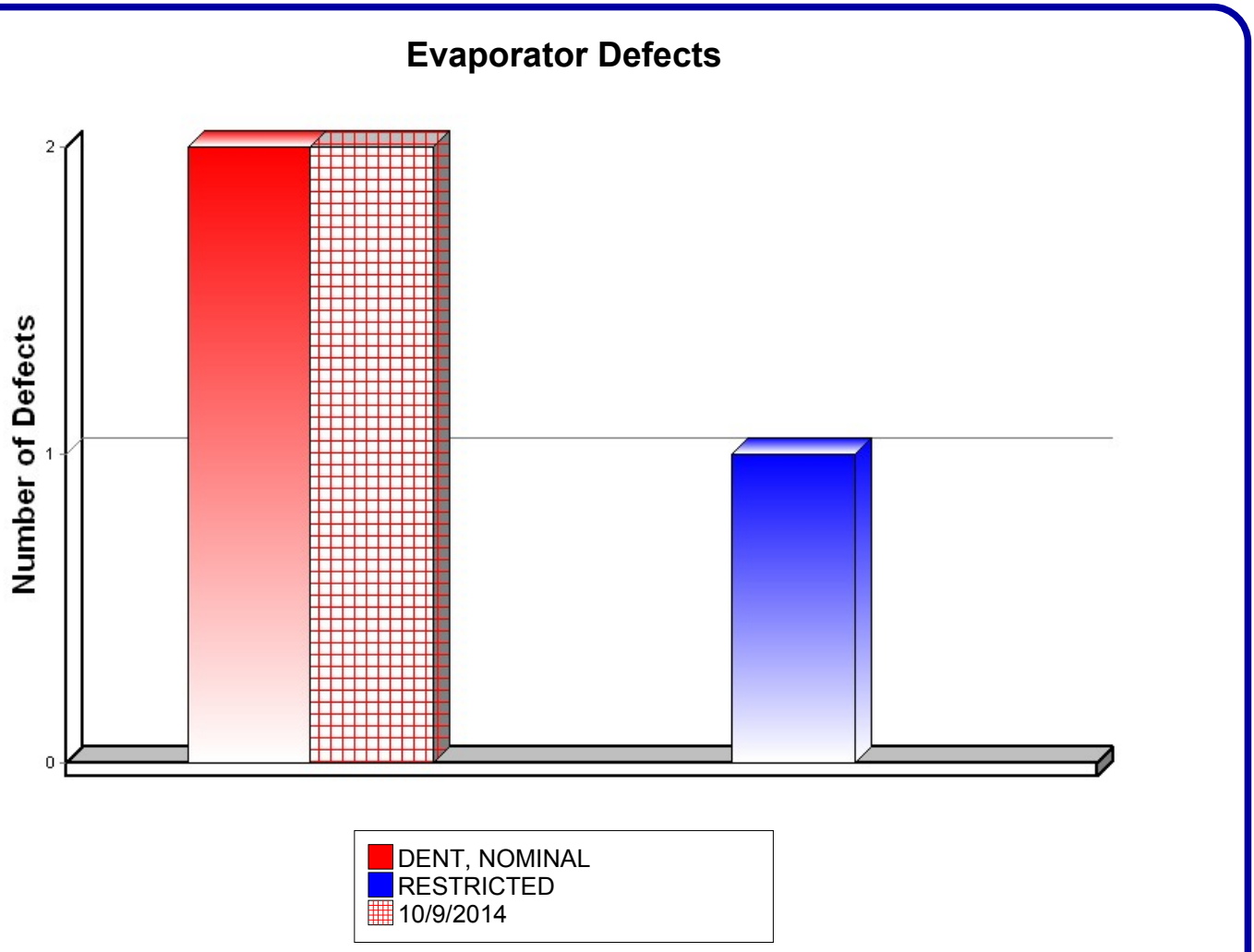


Bay 4	38.00"
Bay 3	36.00"
Bay 2	36.00"
Bay 1	38.00"

Defect Summary/Comparison

Comparison of Tests Performed

1/2/2019 10/9/2014



Location	Model	Serial Number
UNIVERSITY OF SOUTH CAROLINA	23XRV4042	3607Q74631 #2

Note: A graph indicating the number of tubes marked for each category will be generated when tubes are marked. Indications from previous inspections will be displayed as cross hatch bars.

Summary of Inspection

An eddy current tube inspection was performed as part of a preventive maintenance program with the following results.

Condenser: 464 Tubes		
Tubes Tested: 464 Tubes		
Significant/Measurable Indications	Tubes Marked	Percent of Bundle
NO MEASURABLE DEFECTS		
Totals	**0**	**.00**

Evaporator: 324 Tubes		
Tubes Tested: 324 Tubes		
Significant/Measurable Indications	Tubes Marked	Percent of Bundle
DENT, NOMINAL	2	.62
RESTRICTED	1	.31
Totals	**3**	**.93**

Recommendations

An eddy current inspection was performed on the tubes in this machine. This test was performed using accepted eddy current test methods for the inspection of in-service tubing. It should be noted that Eddy Current is not a leak detection method. The possibility does exist that tubes could contain defects and/or leaks which are not detectable. If leaks are suspected, we recommend a pressure test be used to identify the leaking tubes.

The following suggested repair actions are based on accepted industry standards. After removing sample tubes to confirm the inspection results, a determination of corrective action should be made by the repair agency and end user. Only these parties have knowledge of the critical applications and long-term use of the equipment. If plugging is selected over replacement, both efficiency and capacity should be considered.

CONDENSER:

There were no measurable defects noted during this inspection.

EVAPORATOR:

Tubes indicated as "Dent, Nominal" require no corrective action at this time.

Tubes marked as Restricted contained defects, or foreign material which prevented the inspection probe from passing. The condition of these tubes at and beyond the obstruction remains unknown.

RE-INSPECTION RECOMMENDATIONS:

We recommend that a follow-up inspection be performed on these vessels as follows:

Condenser: 02 January 2022

Evaporator: 02 January 2022

A copy of this report should be retained in your files to be used for comparison at that time.

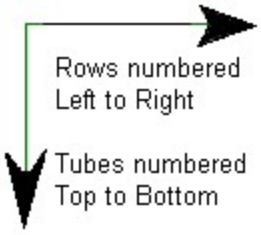
If you should have any questions concerning this report, or if we may be of further assistance, please feel free to call upon us.

Data Sheet

Location	Model	Serial Number	Date
UNIVERSITY OF SOUTH CAROLINA	23XRV4042	3607Q74631 #2	January 2, 2019
SPARTANBURG, SC 29301			

Row	Tube	Description	Area	Action Req.
		SET UP CALIBRATE & STARTED		
		CONDENSER 1/2/2019 10:50 am		
		NO MEASURABLE DEFECTS		
		CALIBRATION CHECK & COMPLETED		
		CONDENSER 1/2/2019 12:32 pm		
		SET UP CALIBRATE & STARTED		
		EVAPORATOR 1/2/2019 12:33 pm		
23	3	DENT, NOMINAL	B04	
23	12	RESTRICTED	B04	
26	2	DENT, NOMINAL	B04	
		CALIBRATION CHECK & COMPLETED		
		EVAPORATOR 1/2/2019 01:44 pm		

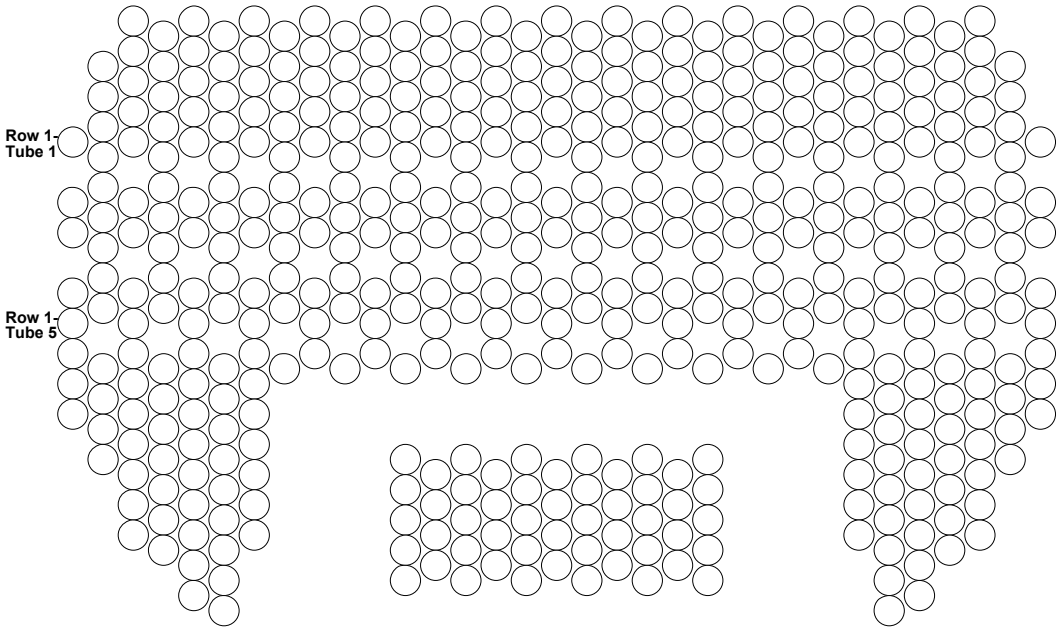
Condenser Section



Top of Vessel

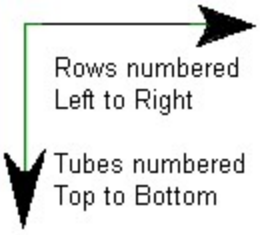
S/N 3607Q74631 #2

Opposite Inlet/Outlet



No Significant defects were found.

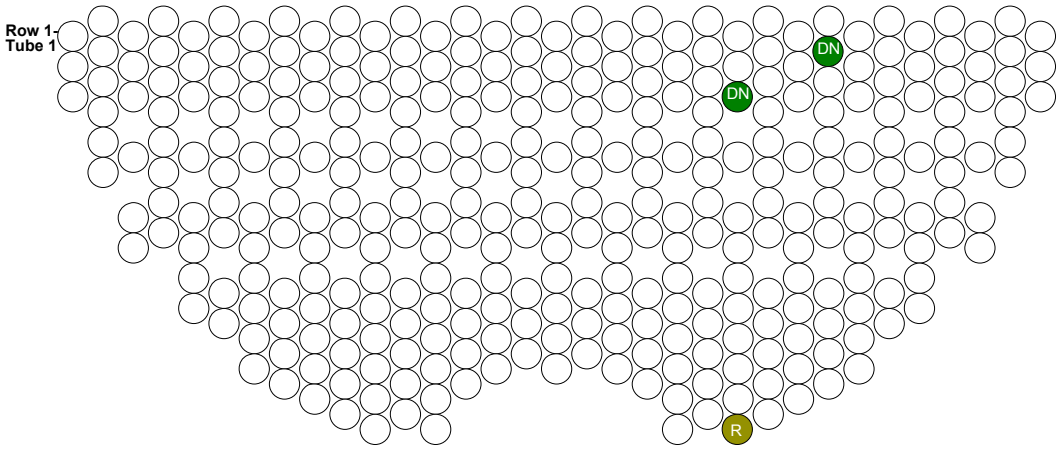
Evaporator Section



Top of Vessel

S/N 3607Q74631 #2

Opposite Inlet/Outlet



DN = DENT, NOMINAL

R = RESTRICTED

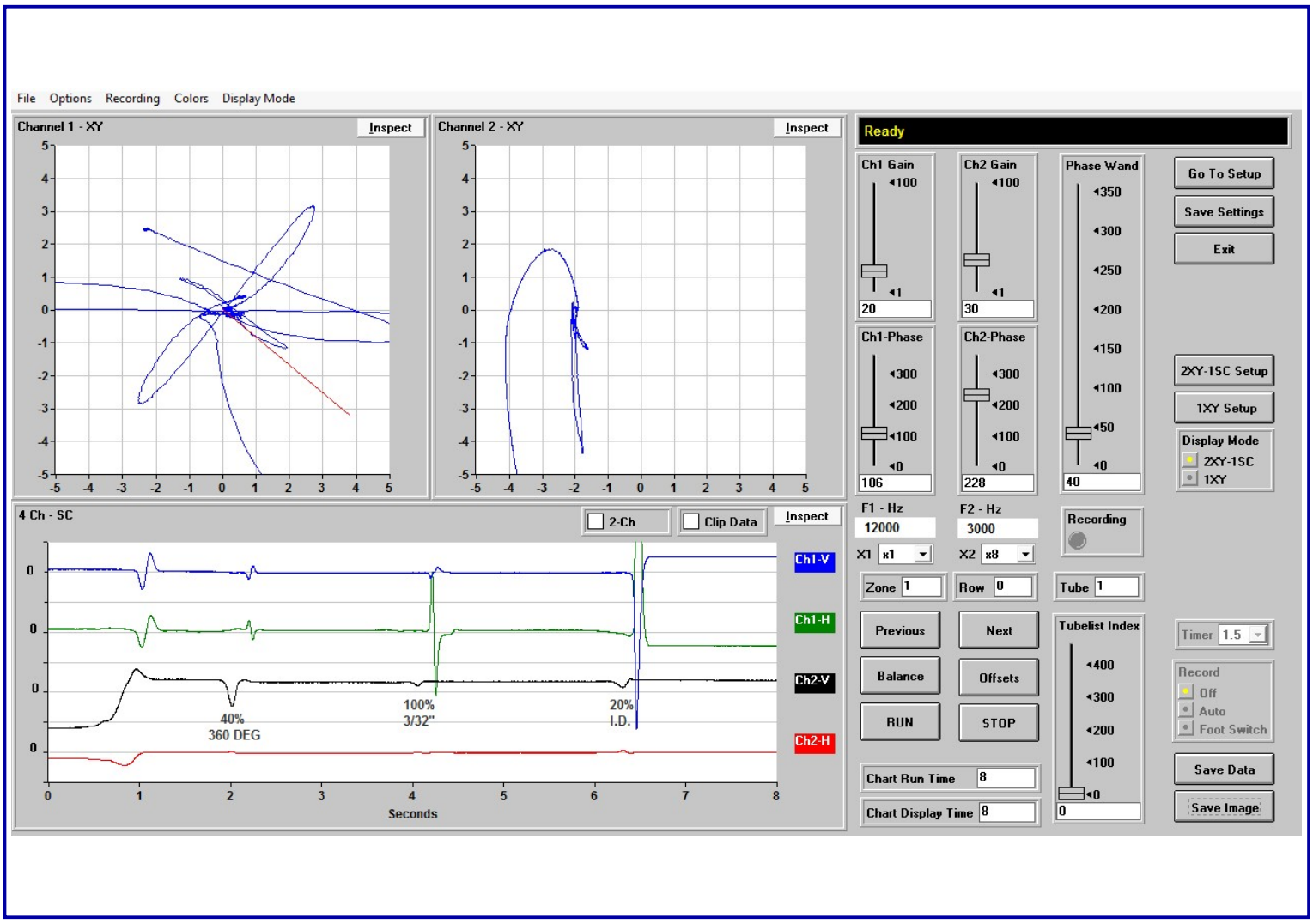
Test Instrument Used
Highline Automation, EC14

S/N 3607Q74631 #2

Calibration Page

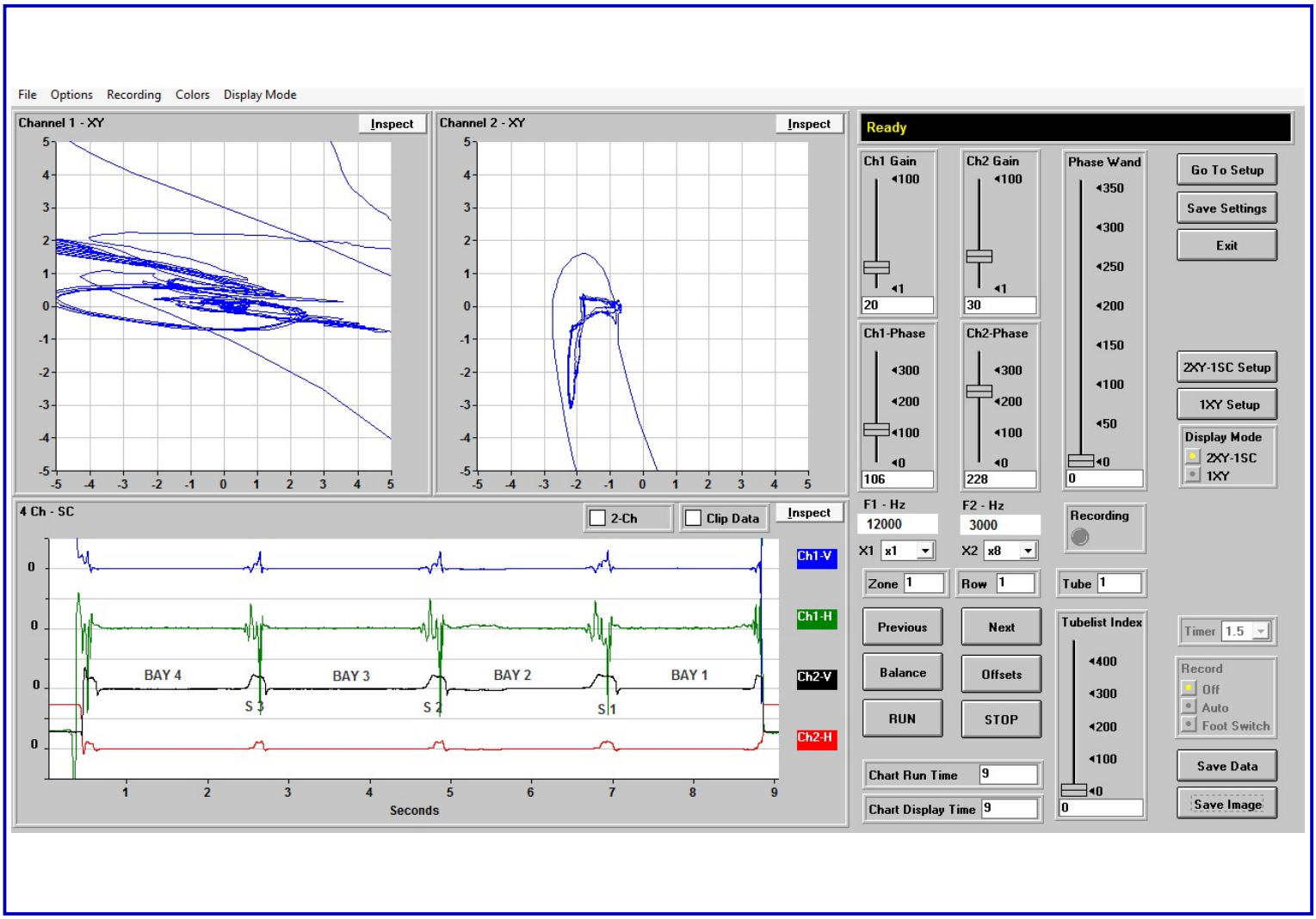
Tube Type	Material	Nom Wall Thick	End Wall Thick	OD	Test Type	Probe Diameter
Skip Fin IE	Copper	.028	.049	.750	Cross/Diff	.5625

Evaporator	Condenser



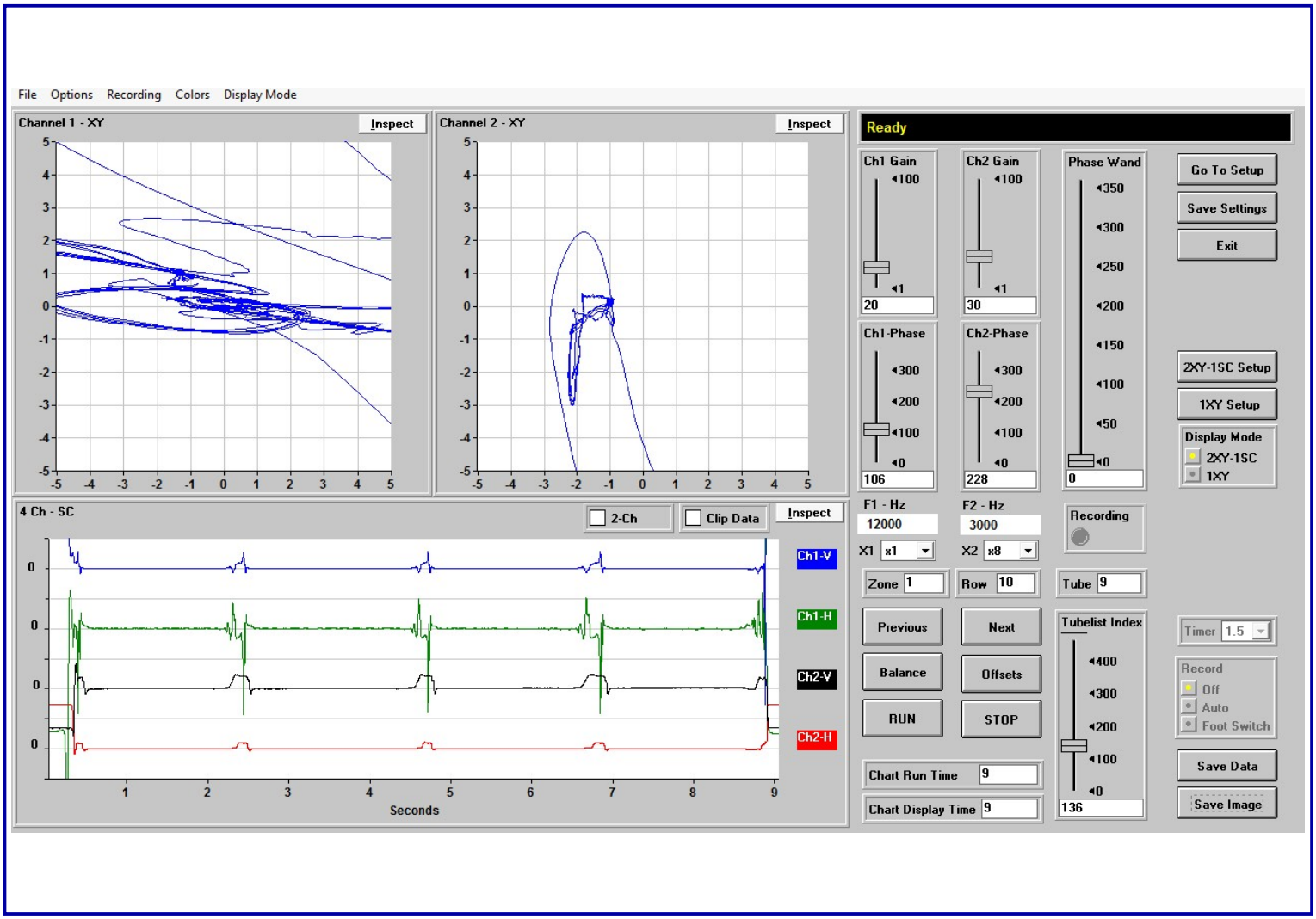
Note: Defects are compared to machined standards.
Actual Defect Geometry may differ.

Condenser Section



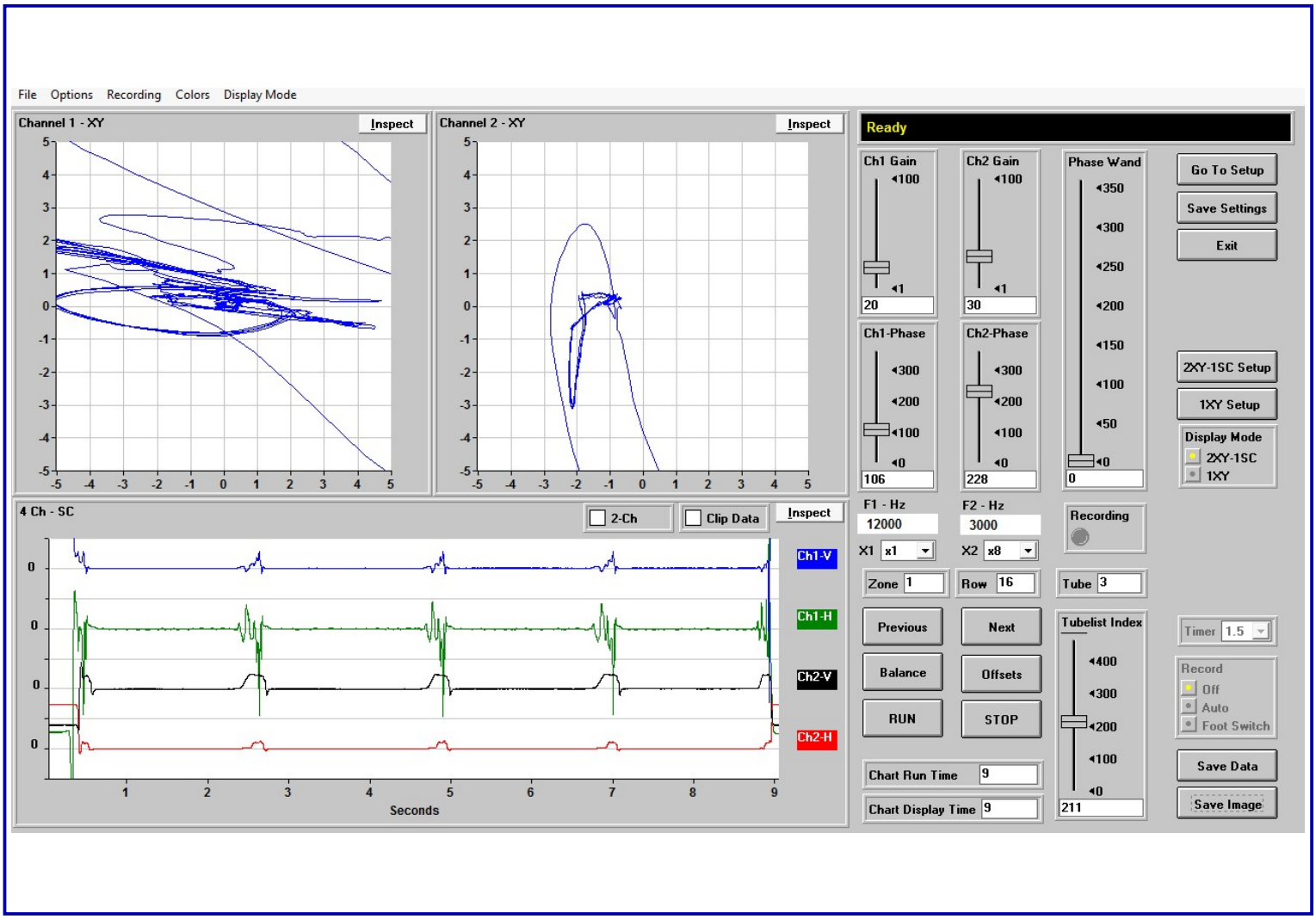
TYPICAL GOOD TUBE (Row 1 Tube 1)

Condenser Section



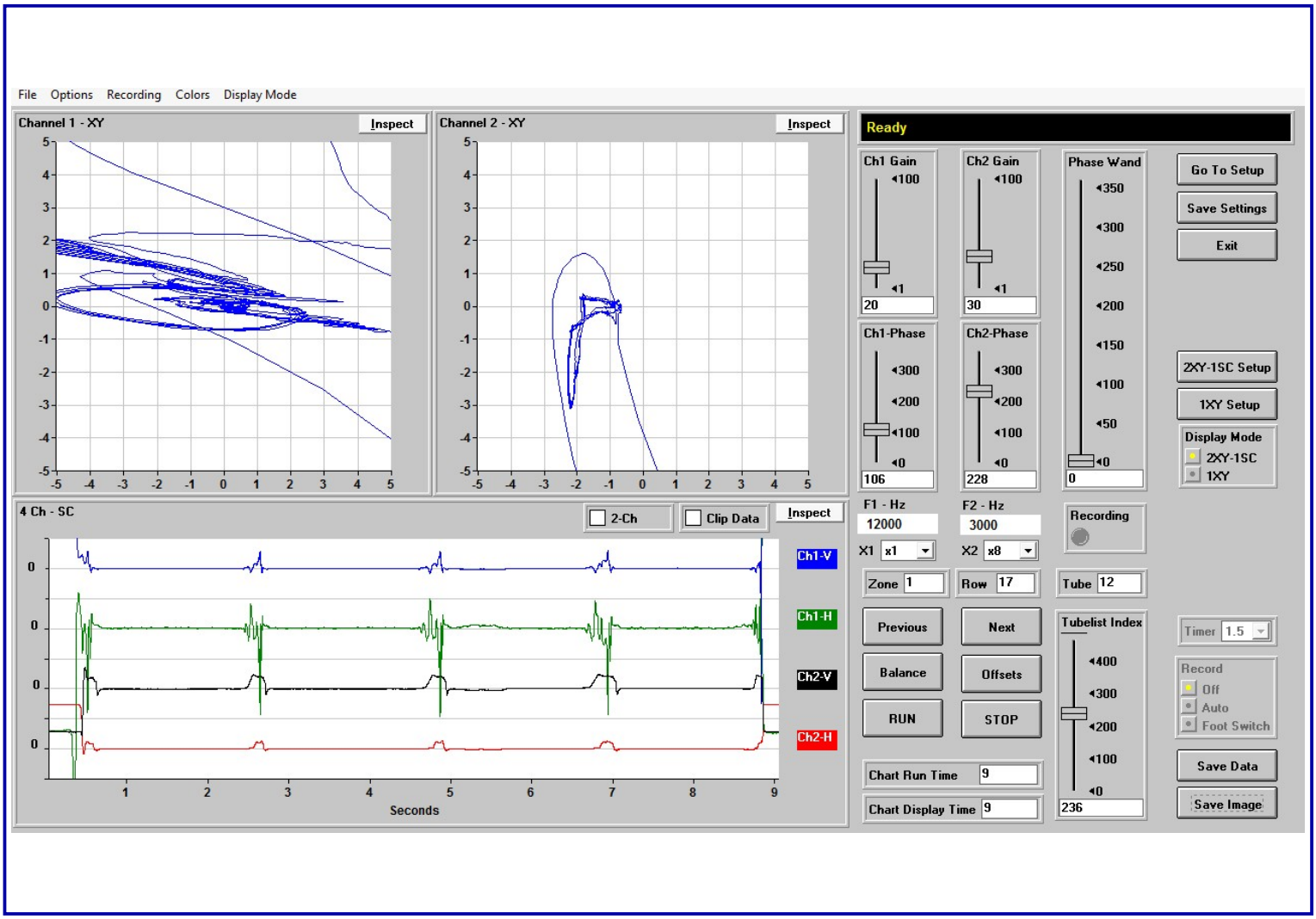
NO SIGNIFICANT DEFECTS (Row 10 Tube 9)

Condenser Section



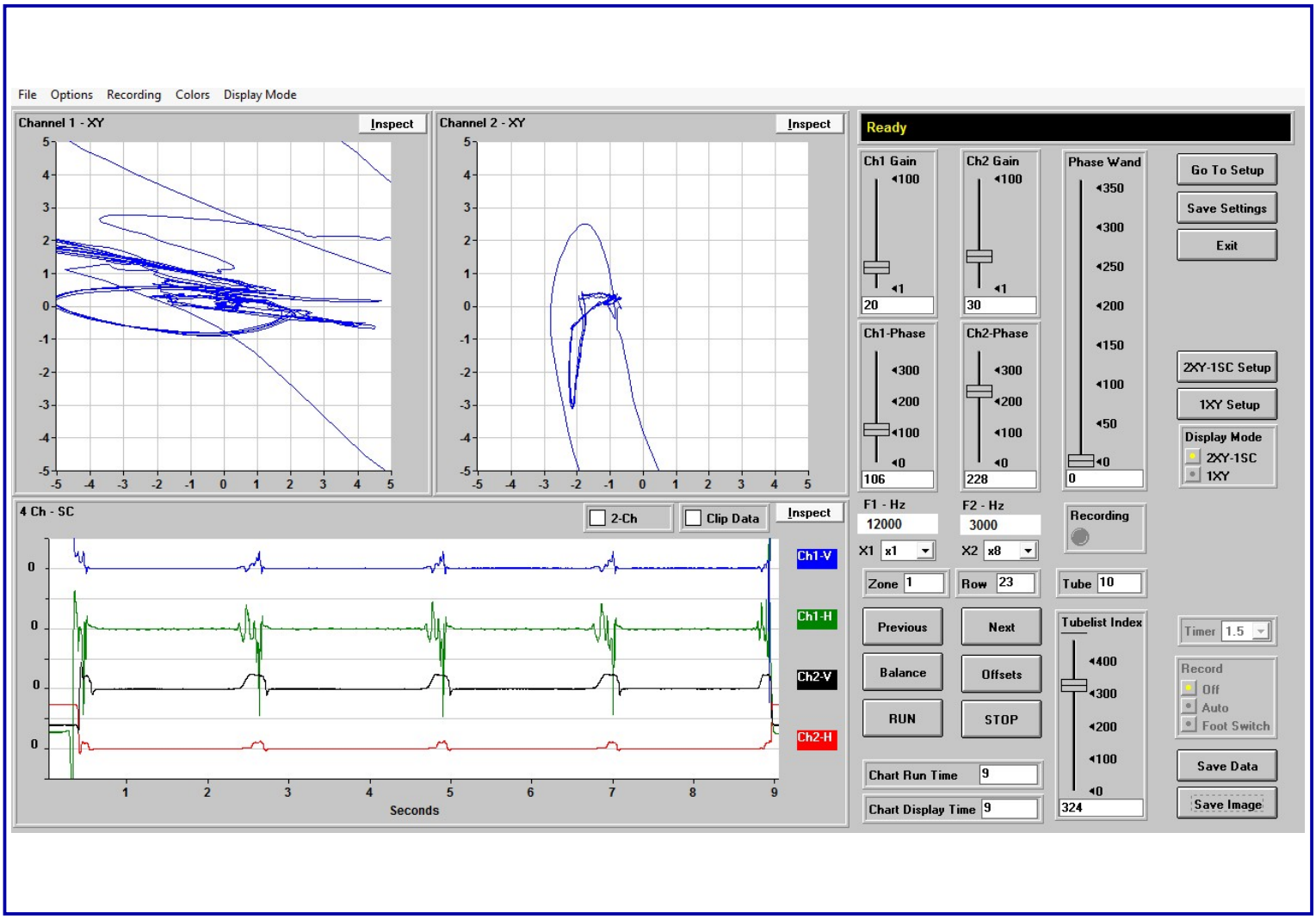
NO SIGNIFICANT DEFECTS (Row 16 Tube 3)

Condenser Section



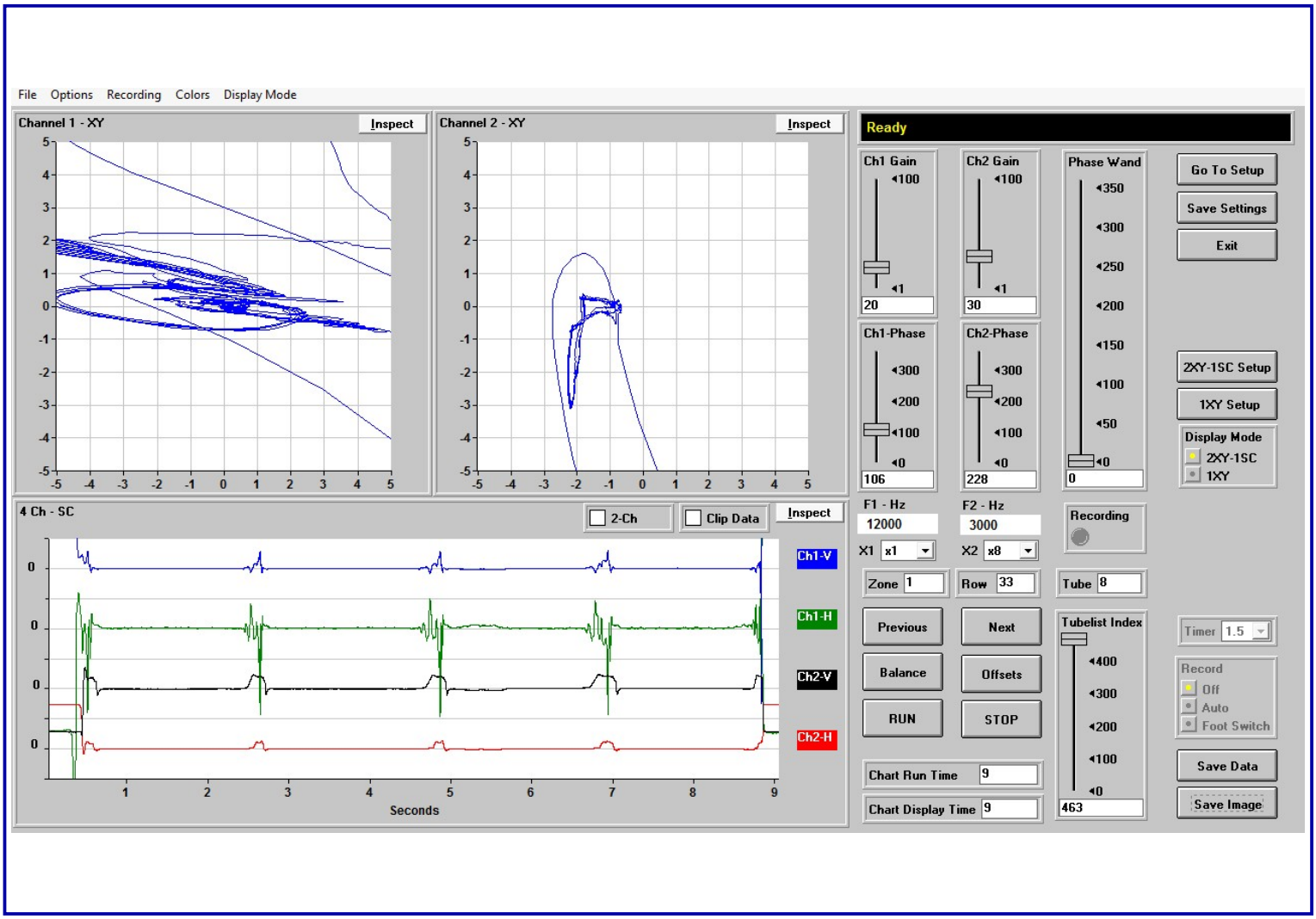
NO SIGNIFICANT DEFECTS (Row 17 Tube 12)

Condenser Section



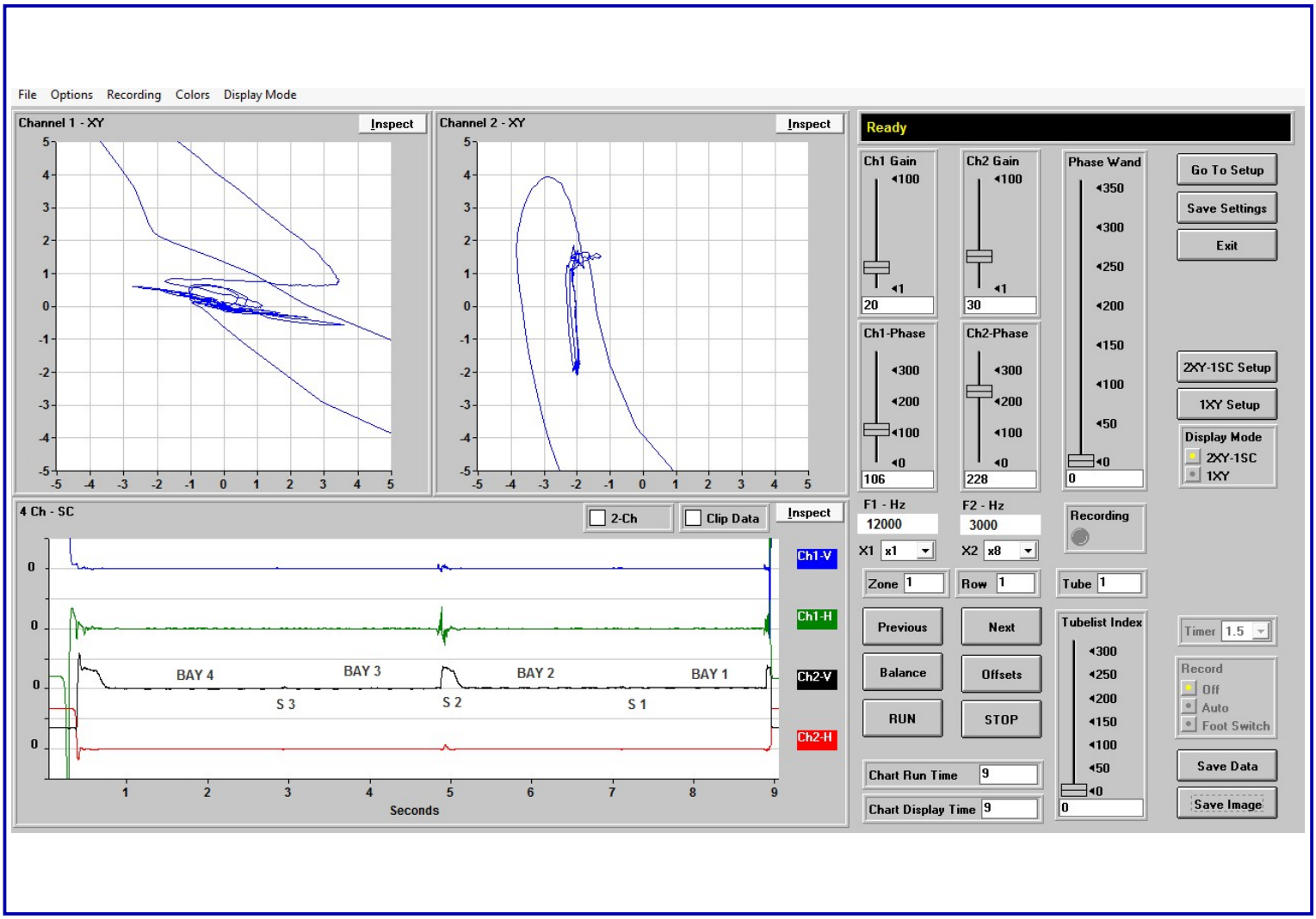
NO SIGNIFICANT DEFECTS (Row 23 Tube 10)

Condenser Section



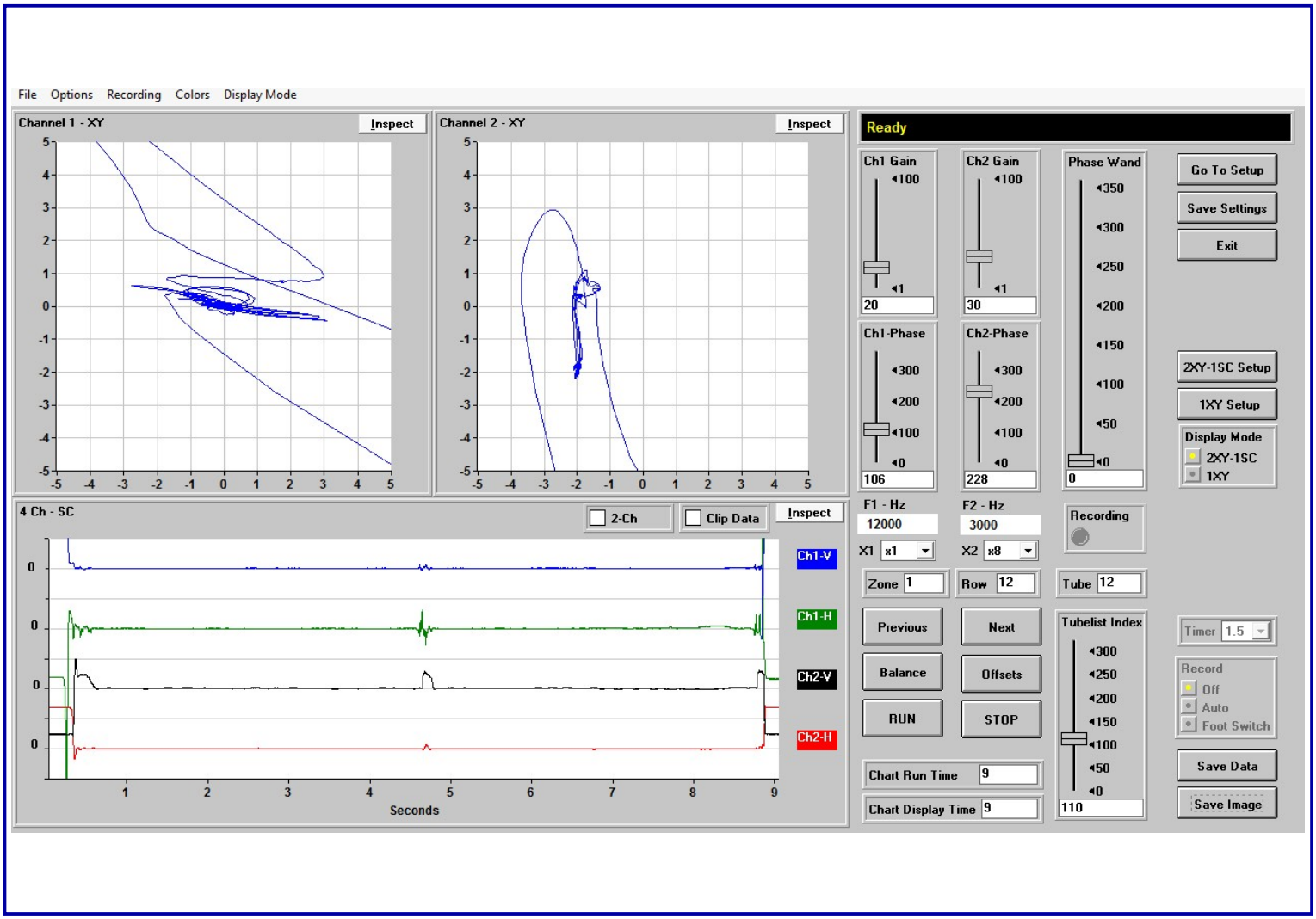
NO SIGNIFICANT DEFECTS (Row 33 Tube 8)

Evaporator Section



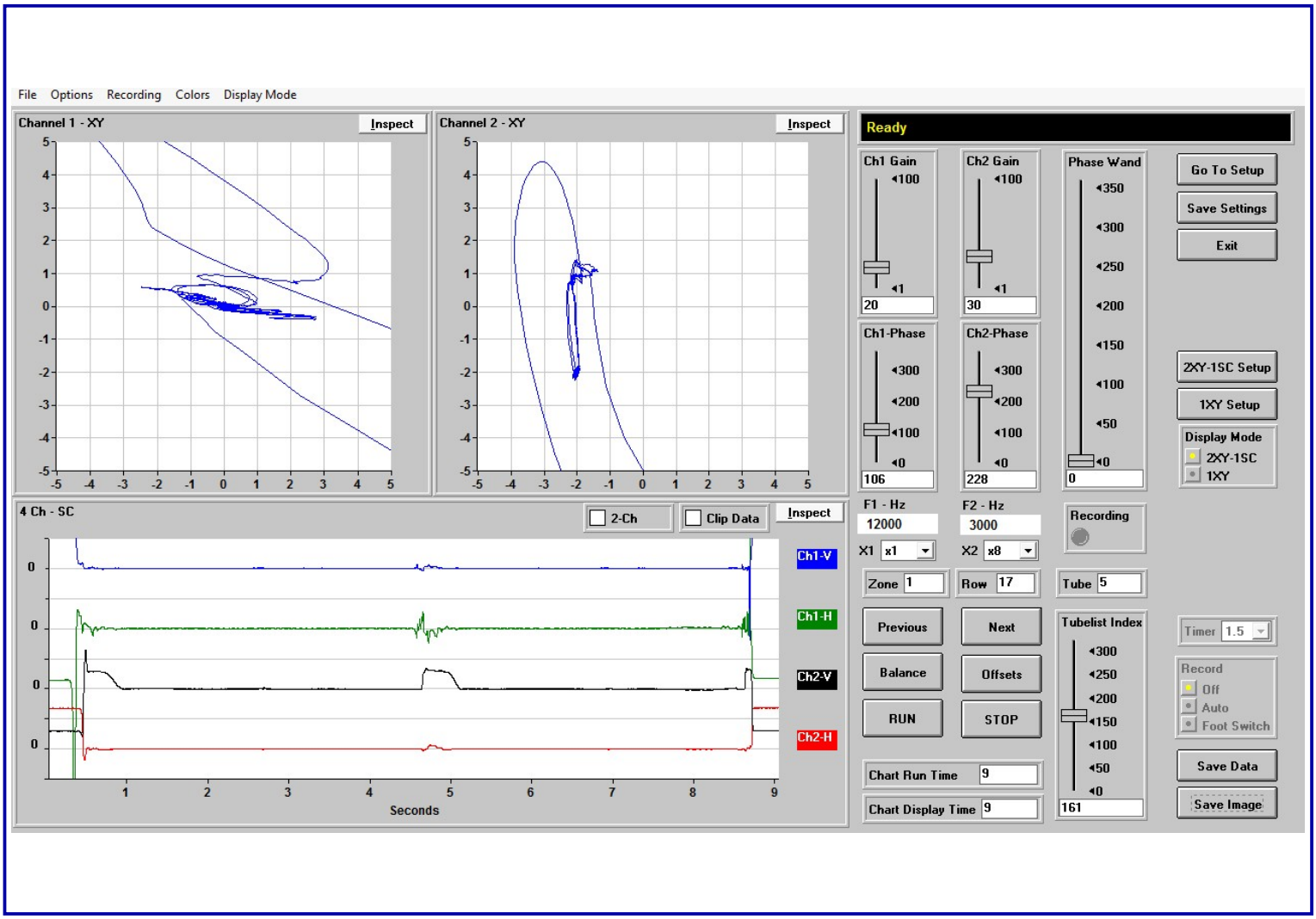
TYPICAL GOOD TUBE (Row 1 Tube 1)

Evaporator Section



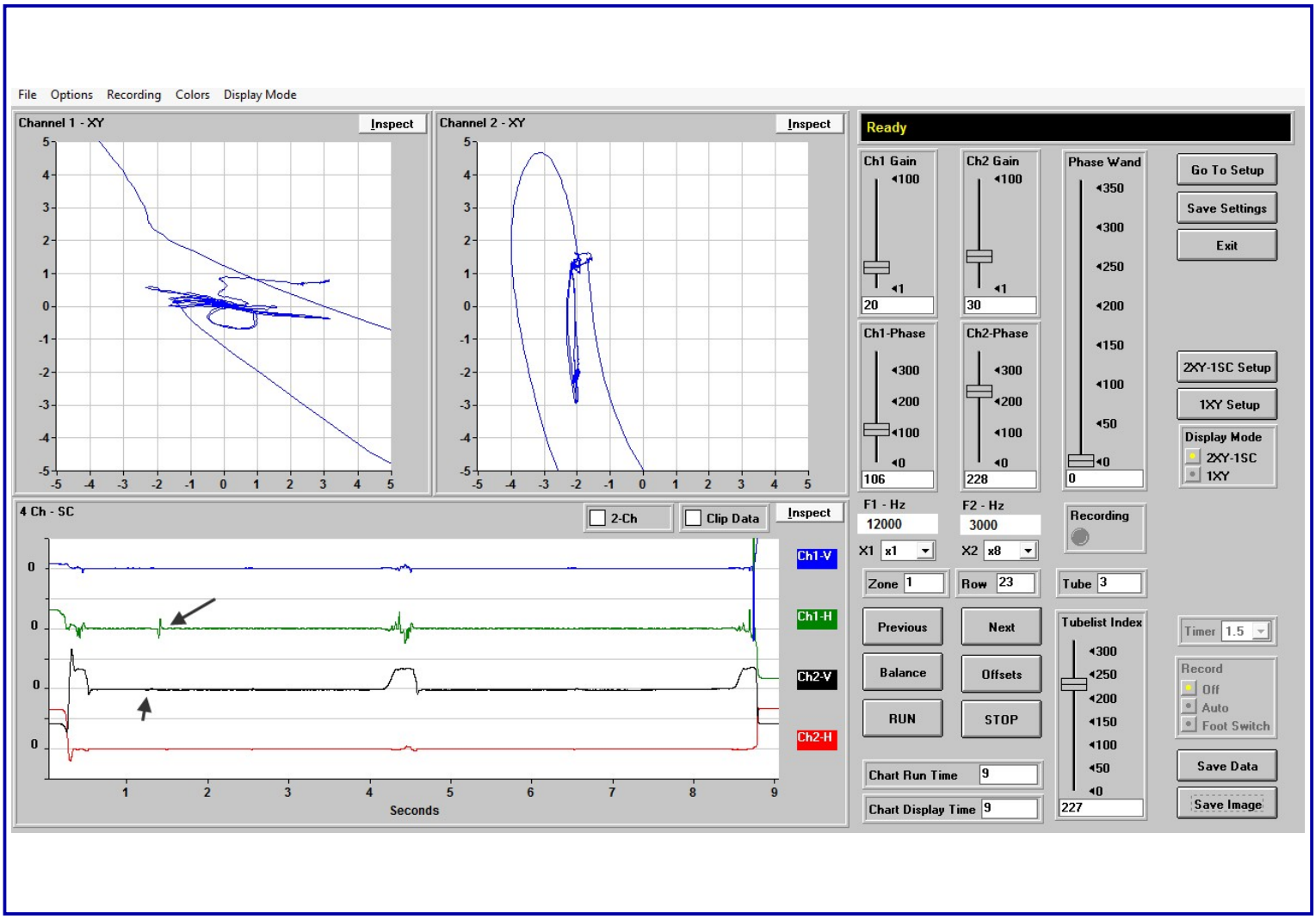
NO SIGNIFICANT DEFECTS (Row 12 Tube 12)

Evaporator Section



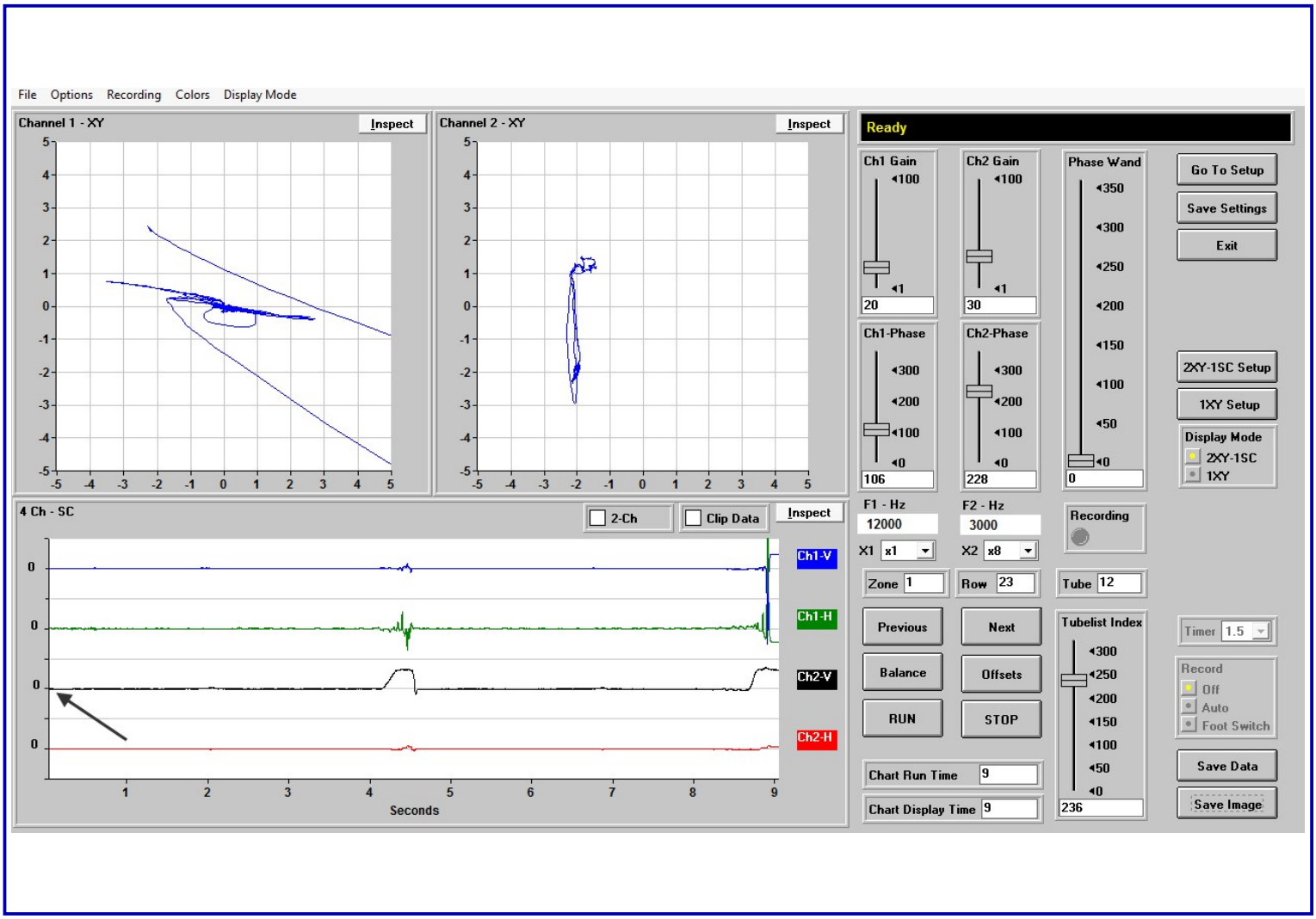
NO SIGNIFICANT DEFECTS (Row 17 Tube 5)

Evaporator Section



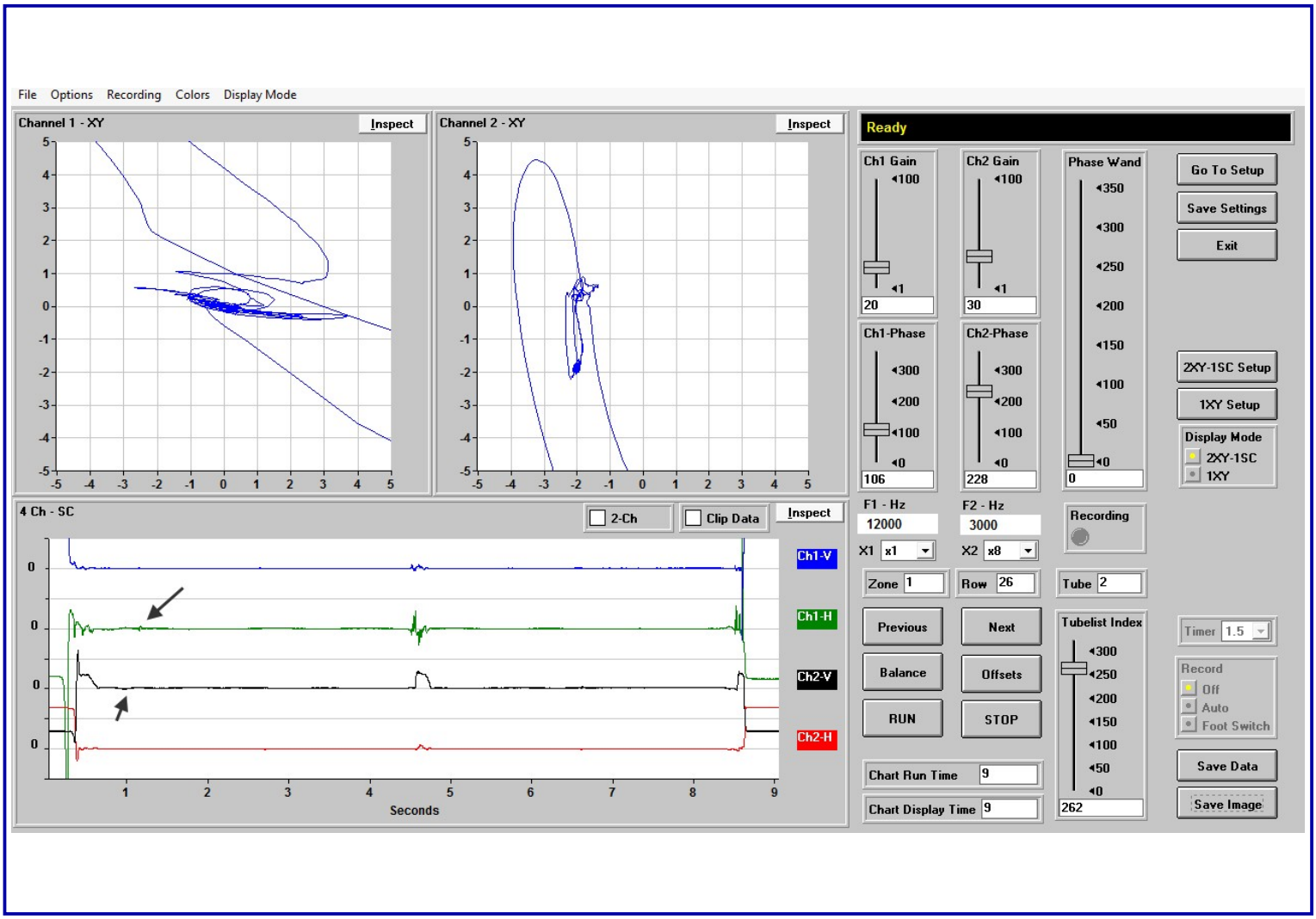
DENT, NOMINAL (Row 23 Tube 3)

Evaporator Section



RESTRICTED (Row 23 Tube 12)

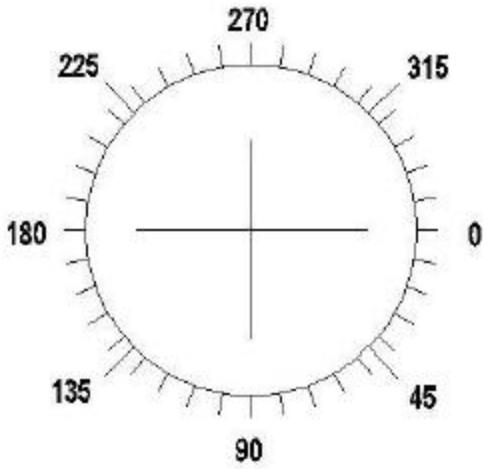
Evaporator Section

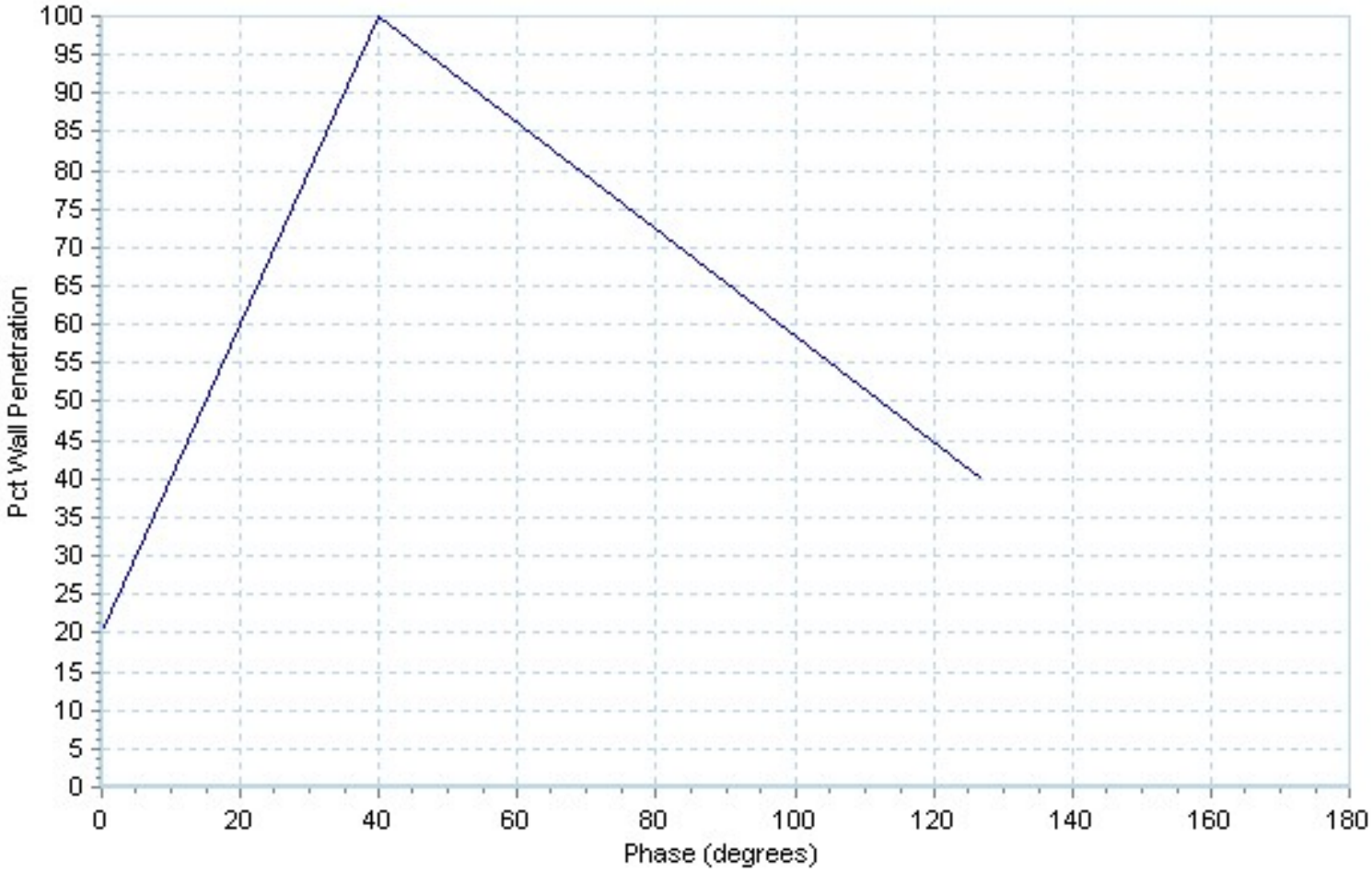


DENT, NOMINAL (Row 26 Tube 2)

Phase Chart - Condenser

Material	Tube Type	OD	Wall	Test Type	Frequency	Probe Diameter
Copper	Skip Fin IE	.750	.028	CROSS/DIFF	12000	.5625





Calibration Procedure

A calibration procedure is performed prior to an inspection, and is repeated every 2 hours, or whenever improper operation of the test instrument is suspected. Test frequencies are selected prior to an inspection through experimentation to achieve optimum phase separation, and amplitude response for the tube type and alloy being inspected. An appropriate inspection probe is selected based on tube type, wall thickness, and alloy. The inspection probe will have a minimum fill factor of 80% through the smallest areas of the tubes being inspected. Instrument sensitivity is set high enough to determine background noise inherent in the tube and to produce a .05 Volt deflection for a .031 through wall hole at .25 V/Div.

Calibration Reference Standard

A Calibration Reference Standard representing a typical production run tube of the same alloy, tube type and nominal wall thickness is used to adjust test system response. The calibration reference standard used for the inspection of finned and internally enhanced tubing, has been milled in accordance with the American Society for Testing and Materials (ASTM). Standard Recommended Practices, E-243-80, E-426-76, and E571-76. The depth of the grooves and notches used for establishing instrument response are calculated to compensate for the influence of the fins and/or internal enhancements used on finned tubes. Where applicable, calibration reference standards are milled in accordance with the American Society of Mechanical Engineers (ASME), Section V, Article 8, Appendix I.

A strip chart recording of each calibration reference standard used for the inspection has been included in this report. Each artificial discontinuity has been identified on the strip chart recording.

Explanation of Abbreviations

Abbreviation	Explanation
ABN IND	Abnormal Indication
B	Bay
FB	Freeze Bulge
FBH	Flat Bottom Hole
FM	Foreign Material
ID	Internal Diameter
ID CORROSION	Internal Diameter, Corrosion
ID DEPOSIT	Internal Diameter, Deposit
ID PIT	Internal Diameter, Pit
IDML	Internal Diameter, Metal Loss
IE	Internally Enhanced
OD	Outside Diameter
ODML	Outside Diameter, Metal Loss
ODML@S	Outside Diameter Metal Loss at Support
OD DEPOSIT	Outside Diameter, Deposit
PLF	Possible Longitudinal Flaw
PRF	Possible Radial Flaw
PSC	Possible Stress Corrosion
S	Support
WAS	Wear at Support
>	Greater Than
<	Less Than
OTE	Opposite Test End
TE	Test End