



JOHNSON CONTROLS - BRANCH 260
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Delmarva Branch N28
Wilmington, DE 19804
(302)996-0275

Report of Eddy Current Inspection

Manufacturer: York

Model: OTT4G2-ZBES

Serial: GACM127698 #9

Location: DUPONT EXPERIMENTAL STATION
RT 141 BETWEEN RT 202 & 52
WILMINGTON, DE 19880

Inspected: April 24, 2013

Inspected By: DAVID H. AMENT, LEVEL II
TAI Services, Inc.

Reviewed By: 
TECHNICAL MANAGER, LEVEL III

Table of Contents

Section A	Inspection Report
Part I	Vessel Information
Part II	Summary of Inspection
Part III	Defect Summary
Part IV	Recommendations
Part V	Data Sheets
Part VI	Tube Chart Layout
Part VII	Tube Strip Charts
Section B	Calibration Settings and Graphs
	Calibration Procedures
Section C	Explanation of Abbreviations

Vessel Information

Manufacturer	Model	Style	Serial Number	Type
York	OTT4G2-ZBES	Open Drive	GACM127698 #9	Centrifugal

Condenser	
TestEnd	Inlet End
Tube Count	883
Tube Type	Skip Fin IE
Tube Material	Copper
OD	.750
*NWT/Under Fins	.028
*NWT/Bell/Land	.055
#/Type Support	4 Mild Steel
Tube Numbering	Left to Right
Row Numbering	Top to Bottom
Tube Length +/- 2	180 Inches

Evaporator	
TestEnd	Inlet/Outlet End
Tube Count	699
Tube Type	Skip Fin IE
Tube Material	Copper
OD	.750
*NWT/Under Fins	.028
*NWT/Bell/Land	.052
#/Type Support	4 Mild Steel
Tube Numbering	Left to Right
Row Numbering	Top to Bottom
Tube Length +/- 2	180 Inches

Analyst: DAVID H. AMENT, LEVEL II

* Nominal Wall Thickness

Vessel Bay Length Information

Condenser (Length = 180 inches) S = Intermediate Support



Bay 5	36.00"
Bay 4	36.00"
Bay 3	36.00"
Bay 2	36.00"
Bay 1	36.00"

Evaporator (Length = 180 inches) S = Intermediate Support



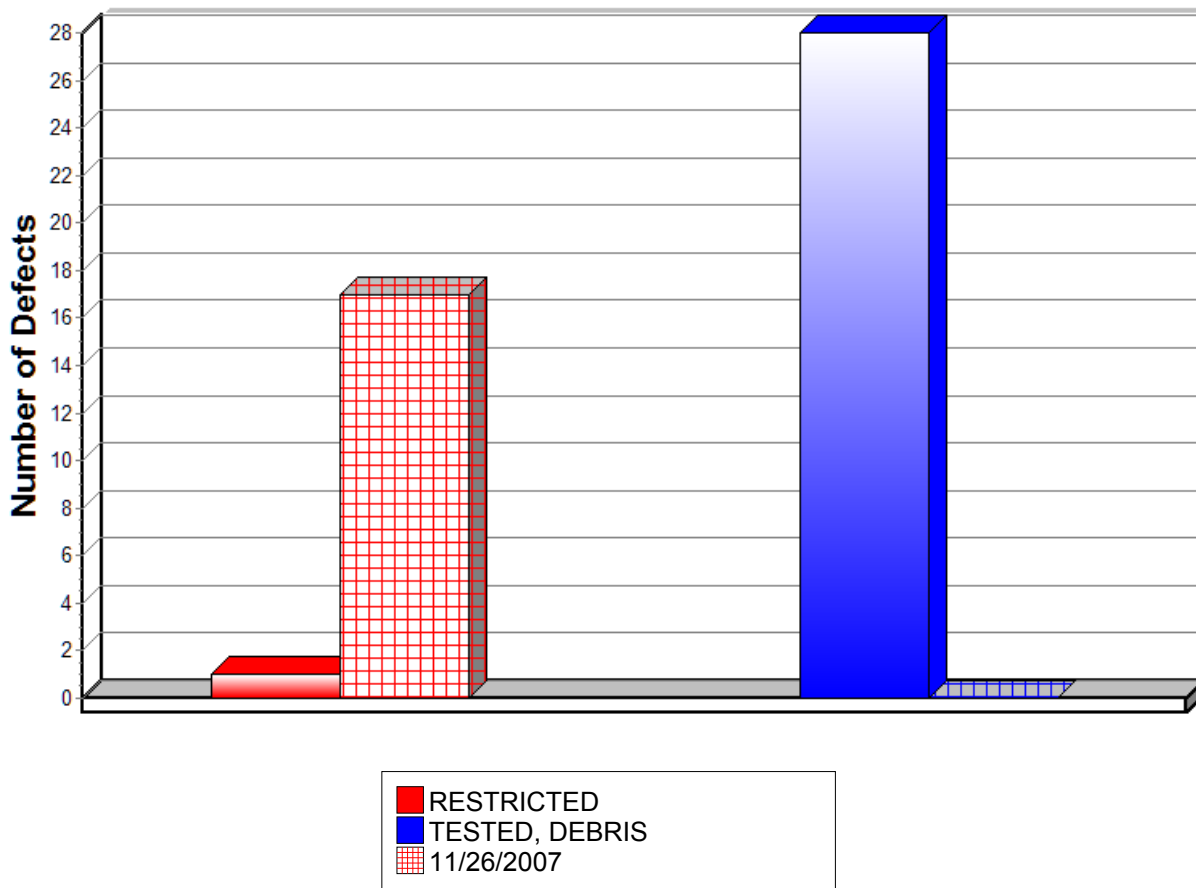
Bay 5	36.00"
Bay 4	36.00"
Bay 3	36.00"
Bay 2	36.00"
Bay 1	36.00"

Defect Summary/Comparison

Comparison of Tests Performed

4/24/2013 11/26/2007

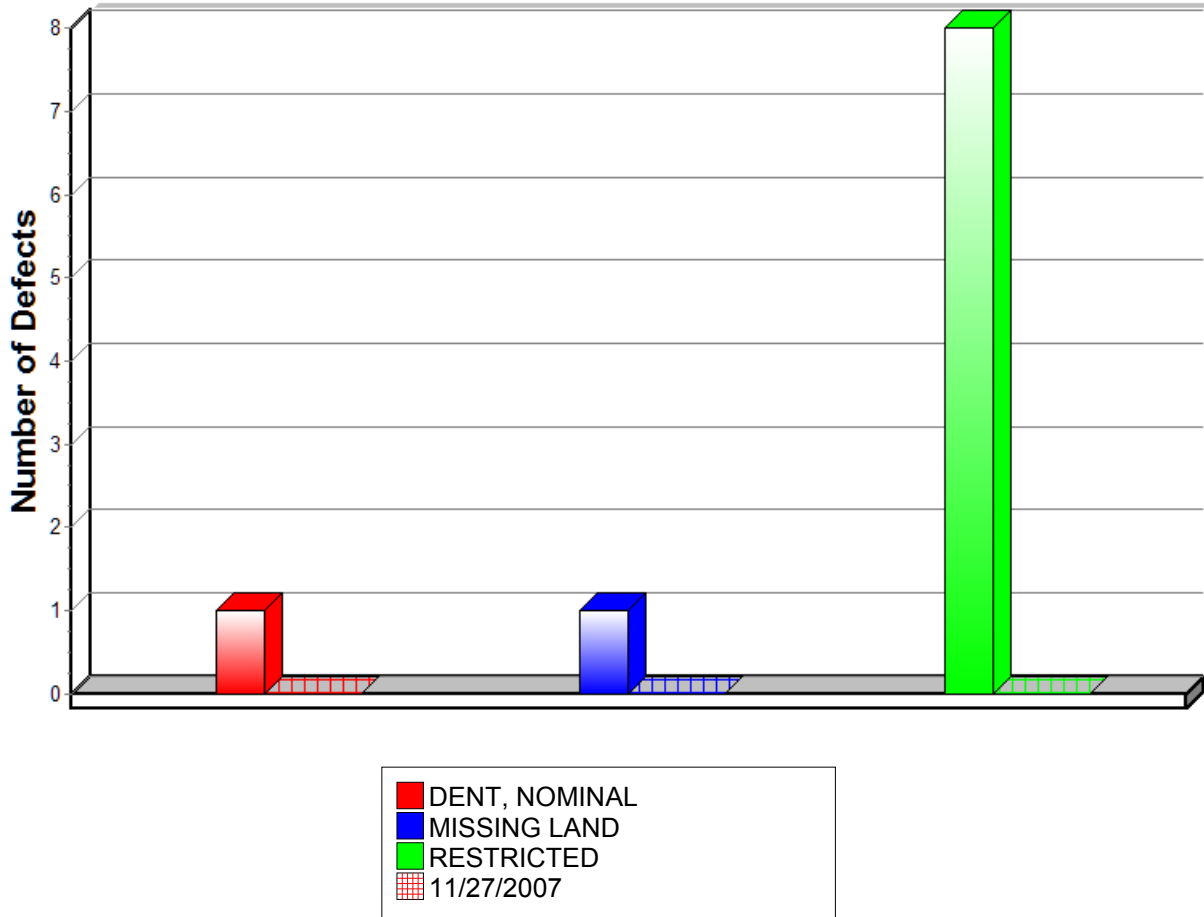
Condenser Defects



Location	Model	Serial Number
DUPONT EXPERIMENTAL STATION	OTT4G2-ZBES	GACM127698 #9

Note: The Graph will indicate a Comparison Analysis when the unit has been previously tested by TAI Services.

Evaporator Defects



Location	Model	Serial Number
DUPONT EXPERIMENTAL STATION	OTT4G2-ZBES	GACM127698 #9

Note: The Graph will indicate a Comparison Analysis when the unit has been previously tested by TAI Services.

Summary of Inspection

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

Condenser: 883 Tubes		
Tubes Tested: 883 Tubes		
Significant/Measurable Indications	Number of Tubes Marked	Percent of Bundle
RESTRICTED	1	.11
TESTED, DEBRIS	28	3.17
Totals	29	3.28

Evaporator: 699 Tubes		
Tubes Tested: 699 Tubes		
Significant/Measurable Indications	Number of Tubes Marked	Percent of Bundle
DENT, NOMINAL	1	.14
MISSING LAND	1	.14
RESTRICTED	8	1.14
Totals	10	1.42

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:

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.

Tubes marked as Restricted/Tested Debris contained foreign material or other obstruction and could not be tested with the size probe normally used. These tubes were tested using a smaller diameter probe. No tube damage was detected. It should be noted that using a smaller probe can increase inspection noise, and reduce sensitivity.

(NOTE: Many tubes in this bundle had plastic debris from the water tower in them.)

EVAPORATOR:

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

Tubes missing support landings showed no detectable loss and require no corrective action.

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: 24 April 2016

Evaporator: 24 April 2016

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
DUPONT EXPERIMENTAL STATION	OTT4G2-ZBES	GACM127698 #9	April 22, 2013
RT 141 BETWEEN RT 202 & 52			
WILMINGTON, DE 19880			

Row	Tube	Description	Area	Action Req.
SET UP CALIBRATE & STARTED				
CONDENSER 4/24/2013 08:22 am				
2	11	TESTED, DEBRIS	B01	
3	12	TESTED, DEBRIS	B01	
5	4	TESTED, DEBRIS	B01	
5	8	RESTRICTED	B04	
6	5	TESTED, DEBRIS	B01	
9	2	TESTED, DEBRIS	B01	
10	11	TESTED, DEBRIS	B01	
14	5	TESTED, DEBRIS	B01	
17	6	TESTED, DEBRIS	B01	
17	14	TESTED, DEBRIS	B01	
18	15	TESTED, DEBRIS	B01	
22	1	TESTED, DEBRIS	B01	
22	17	TESTED, DEBRIS	B01	
23	25	TESTED, DEBRIS	B01	
24	25	TESTED, DEBRIS	B01	
24	16	TESTED, DEBRIS	B01	
25	31	TESTED, DEBRIS	B01	
26	21	TESTED, DEBRIS	B01	
27	12	TESTED, DEBRIS	B01	

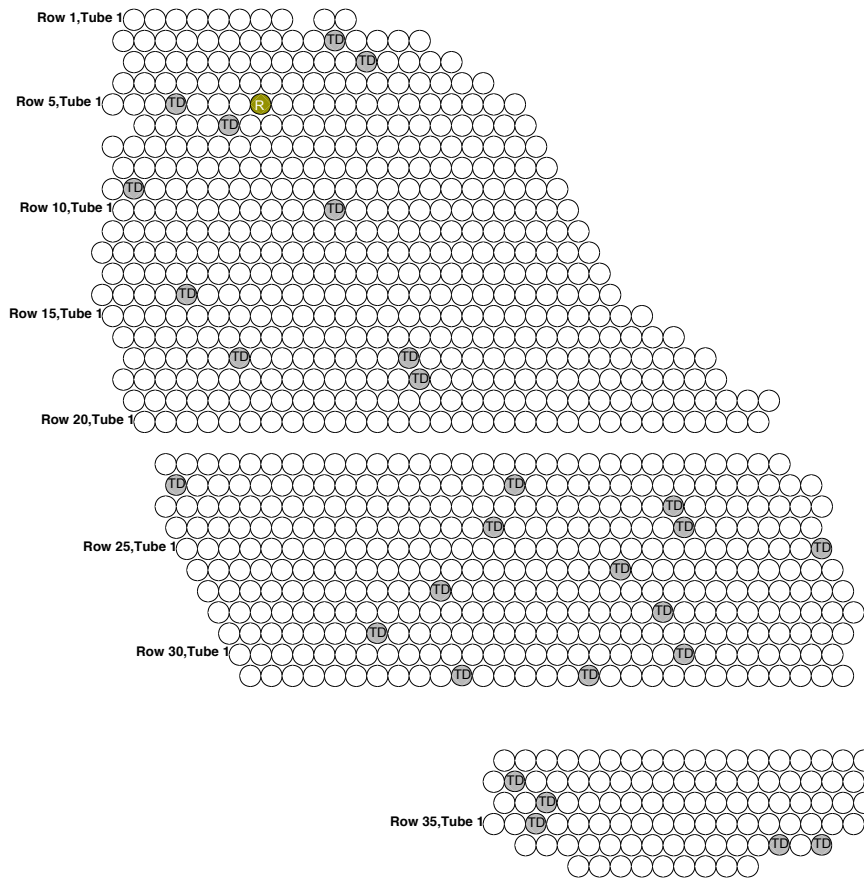
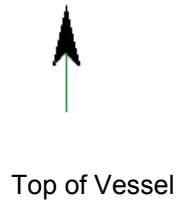
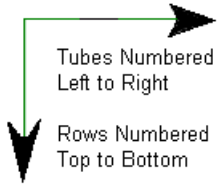
Row	Tube	Description	Area	Action Req.
28	22	TESTED, DEBRIS	B01	
29	8	TESTED, DEBRIS	B01	
30	22	TESTED, DEBRIS	B01	
31	11	TESTED, DEBRIS	B01	
31	17	TESTED, DEBRIS	B01	
33	2	TESTED, DEBRIS	B01	
34	3	TESTED, DEBRIS	B01	
35	3	TESTED, DEBRIS	B01	
36	13	TESTED, DEBRIS	B01	
36	15	TESTED, DEBRIS	B01	
<i>CALIBRATION CHECK & COMPLETED</i>				
CONDENSER 4/24/2013 08:56 am				
<i>SET UP CALIBRATE & STARTED</i>				
EVAPORATOR 4/24/2013 09:02 am				
2	4	RESTRICTED	TE	
11	4	RESTRICTED	OTE	
12	9	RESTRICTED	OTE	
12	15	RESTRICTED	OTE	
15	6	RESTRICTED	OTE	
15	10	RESTRICTED	OTE	
16	8	RESTRICTED	OTE	
6	27	RESTRICTED	B01	
2	5	DENT, NOMINAL	B02	
18	21	MISSING LAND	S03	
<i>CALIBRATION CHECK & COMPLETED</i>				
EVAPORATOR 4/24/2013 11:42 am				

Row	Tube	Description	Area	Action Req.
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Condenser Section

S/N GACM127698 #9

Inlet End



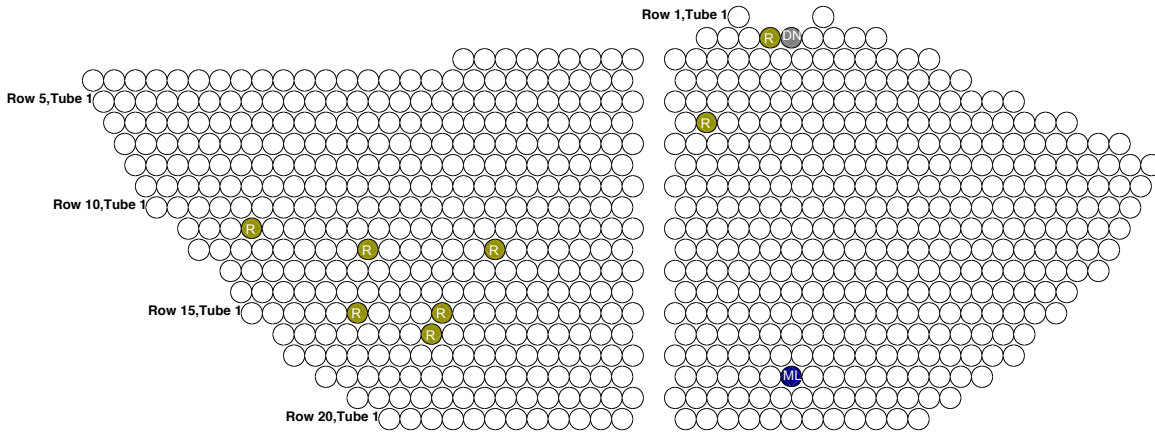
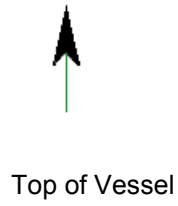
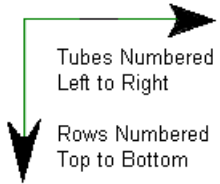
 = RESTRICTED

 = TESTED, DEBRIS

Evaporator Section

S/N GACM127698 #9

Inlet/Outlet End

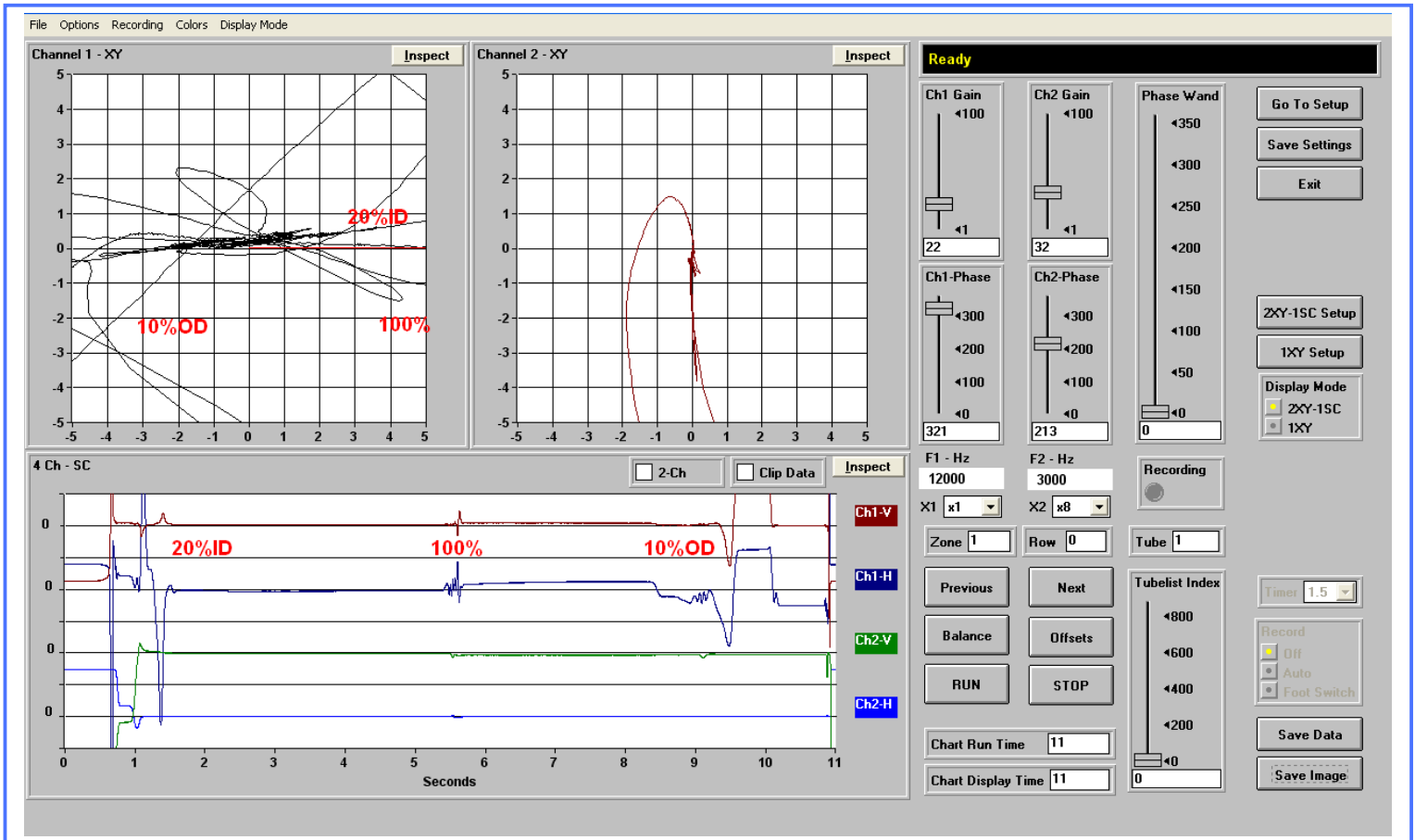


- = DENT, NOMINAL
- = MISSING LAND
- = RESTRICTED

Calibration Page

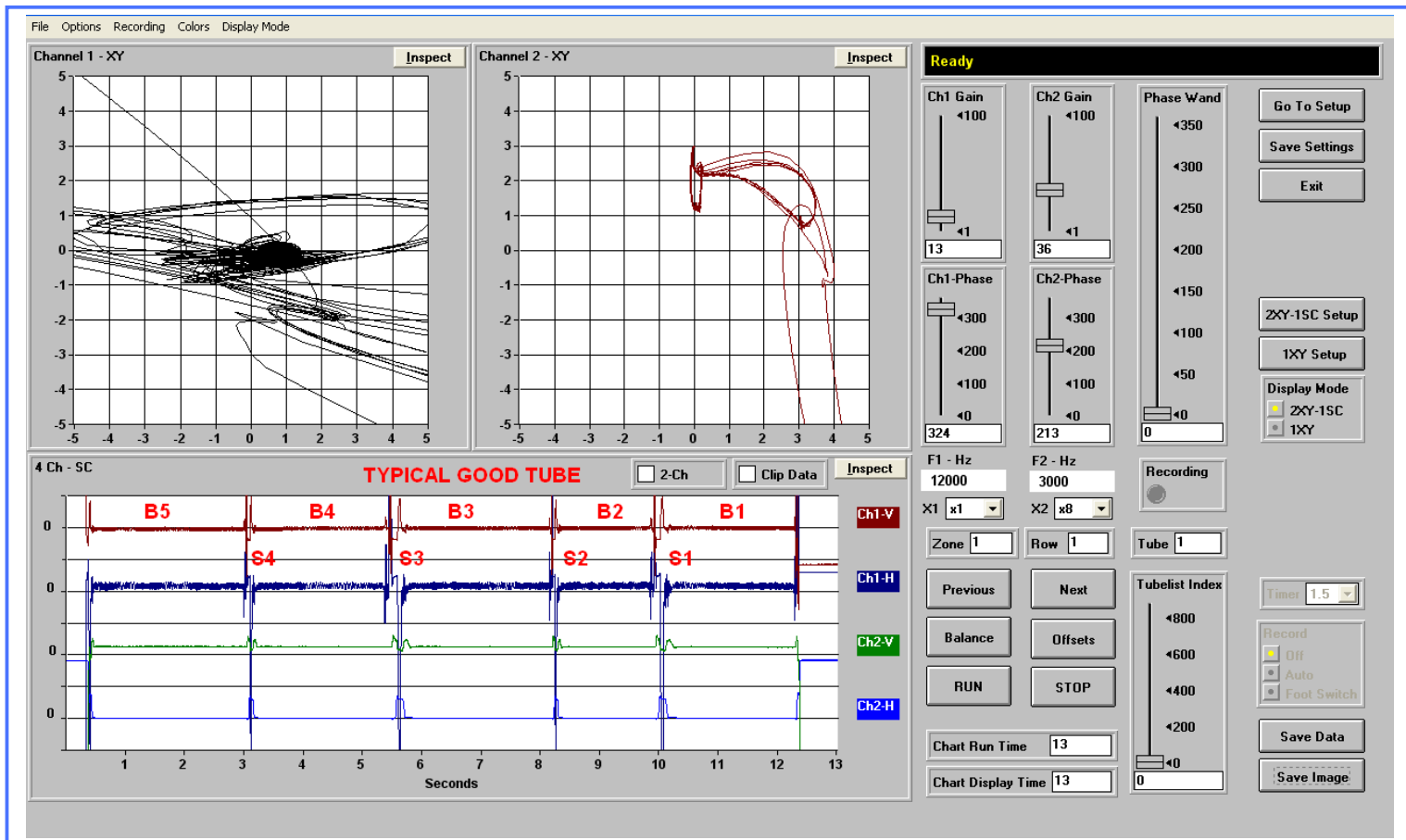
Tube Type	Material	Nom Wall Thick	End Wall Thick	OD	Test Type	Probe Diameter
Skip Fin IE	Copper	.028	.055	.750	Cross/Diff	.500

Condenser
Evaporator



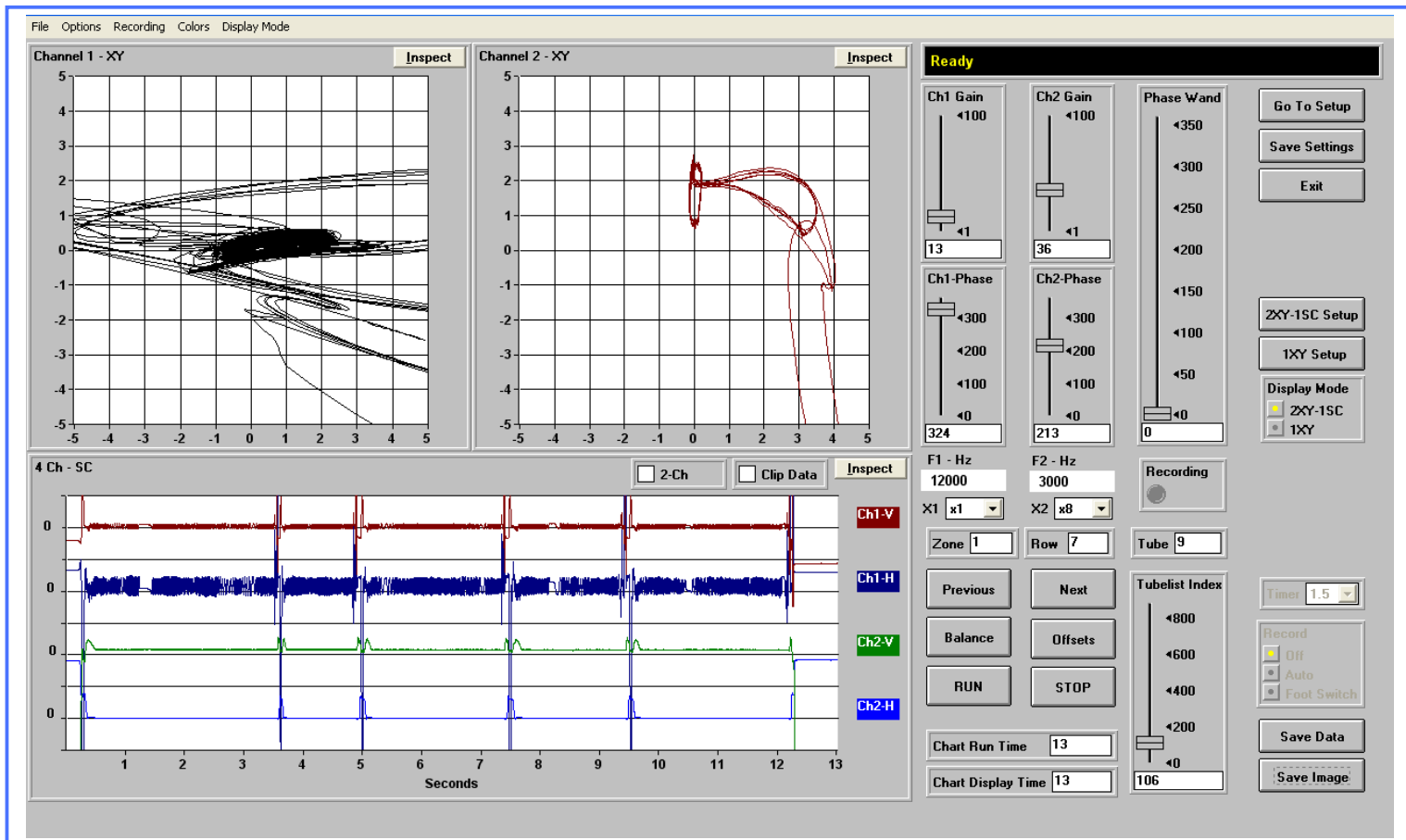
Note: Defects are compared to machined standards.
Actual Defect Geometry may differ.

Condenser Section



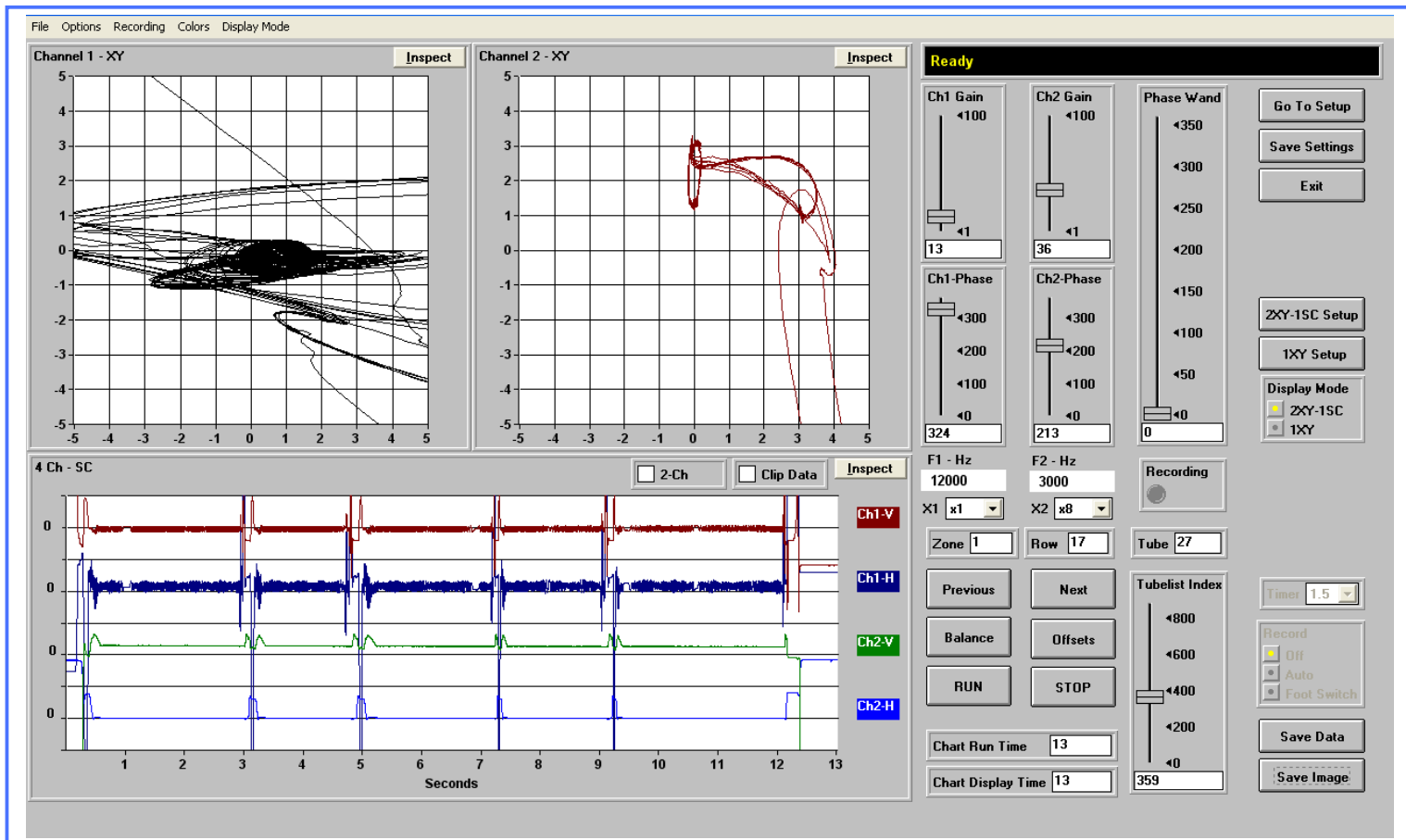
NO SIGNIFICANT DEFECTS (Row 1 Tube 1)

Condenser Section



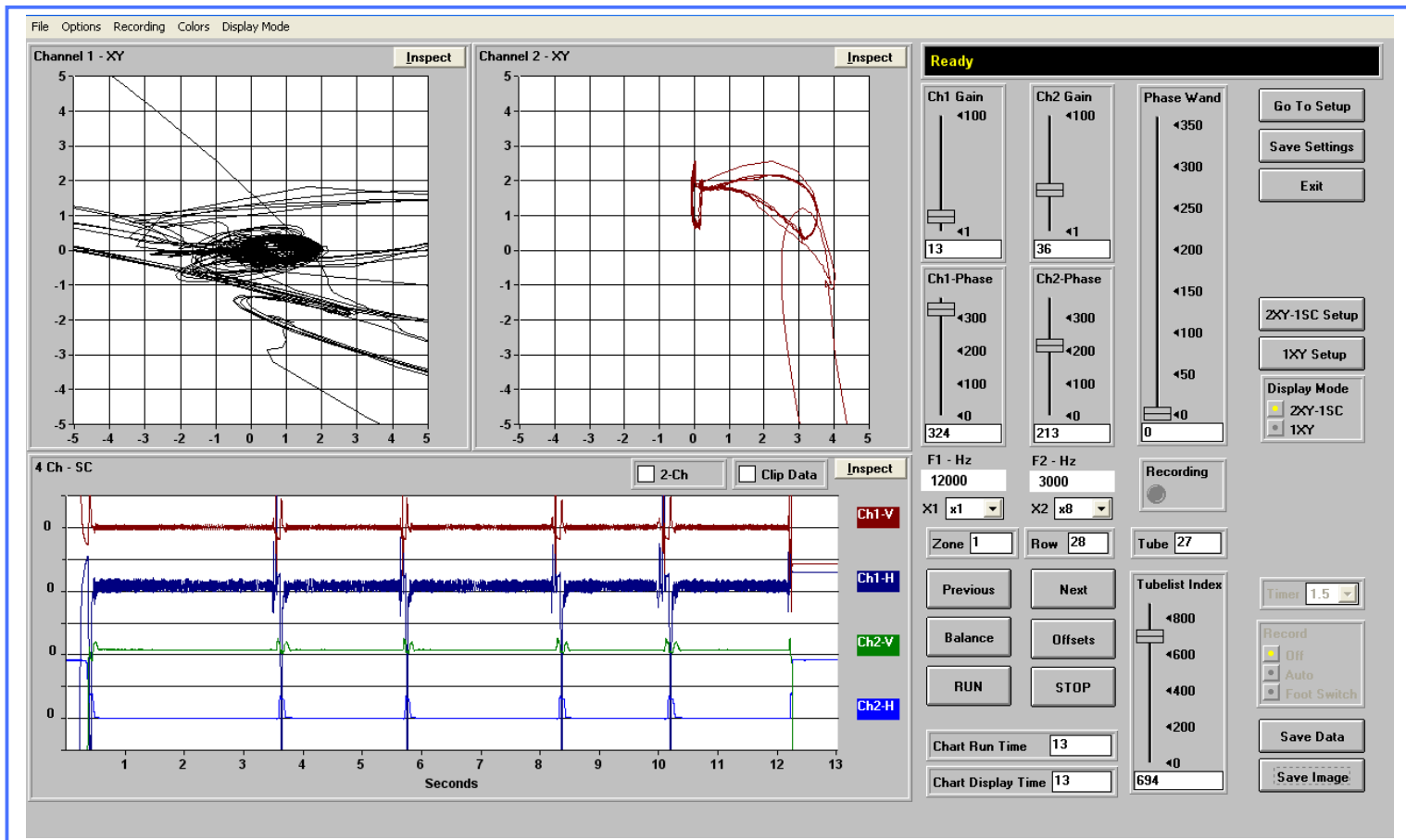
NO SIGNIFICANT DEFECTS (Row 7 Tube 9)

Condenser Section



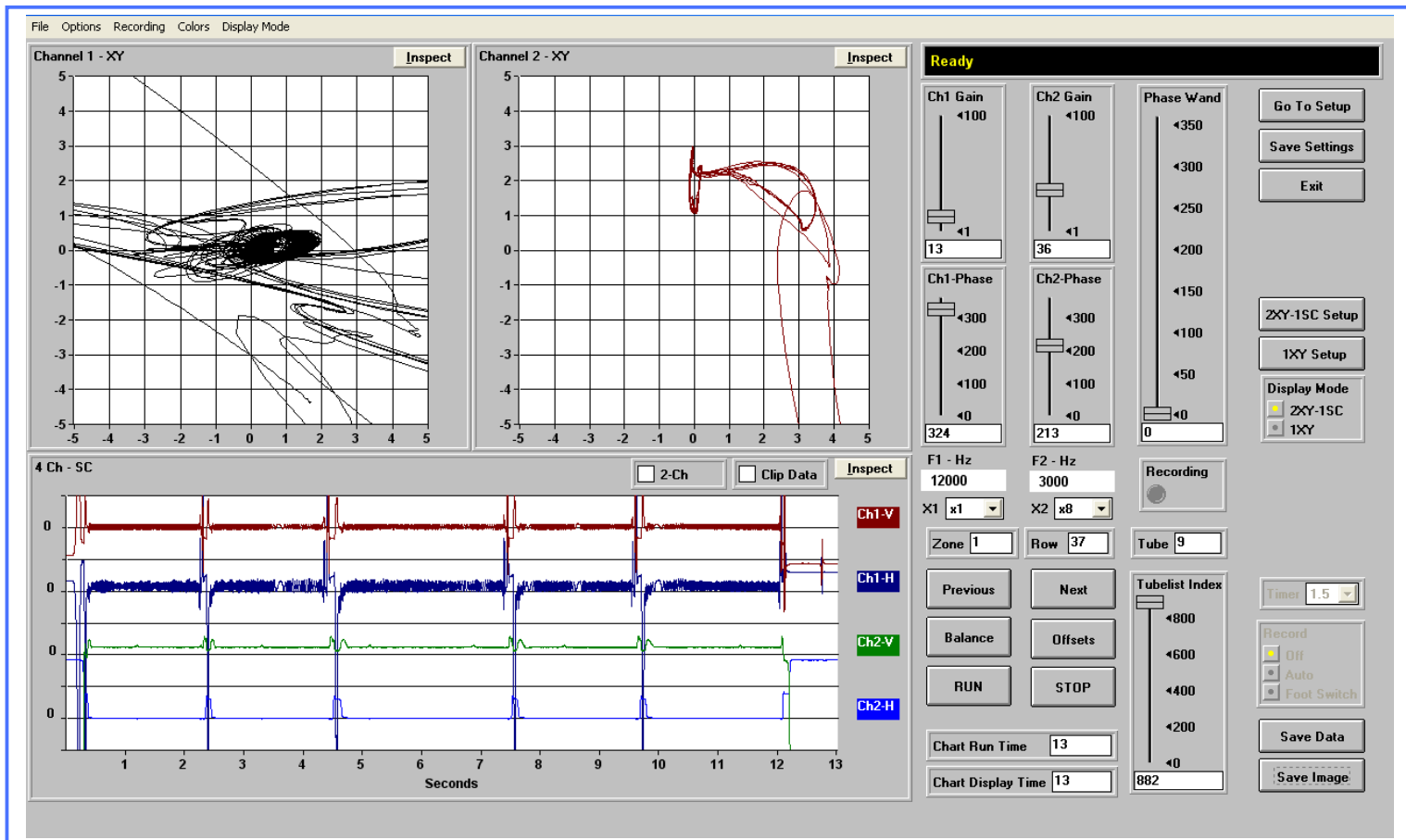
NO SIGNIFICANT DEFECTS (Row 17 Tube 27)

Condenser Section



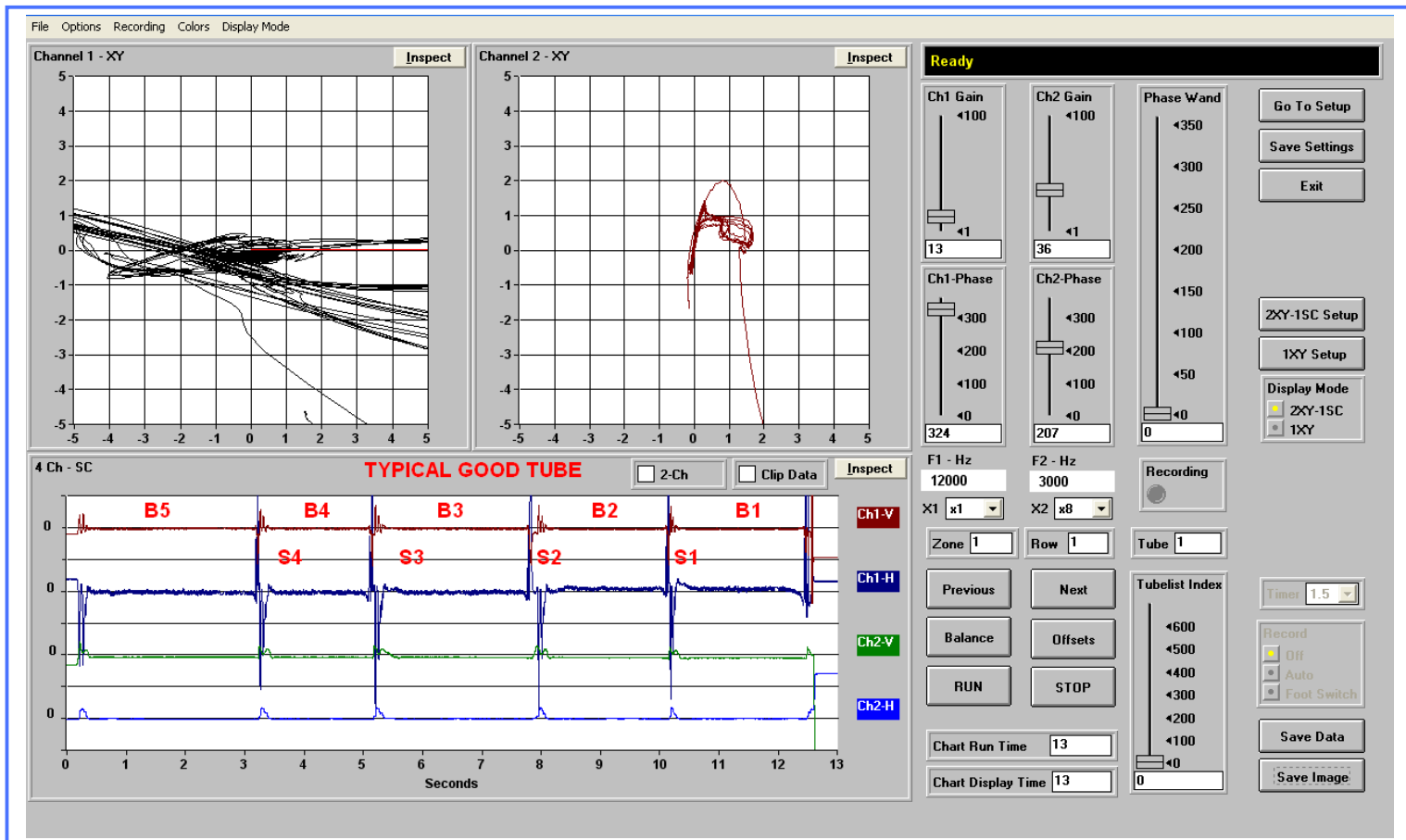
NO SIGNIFICANT DEFECTS (Row 28 Tube 27)

Condenser Section



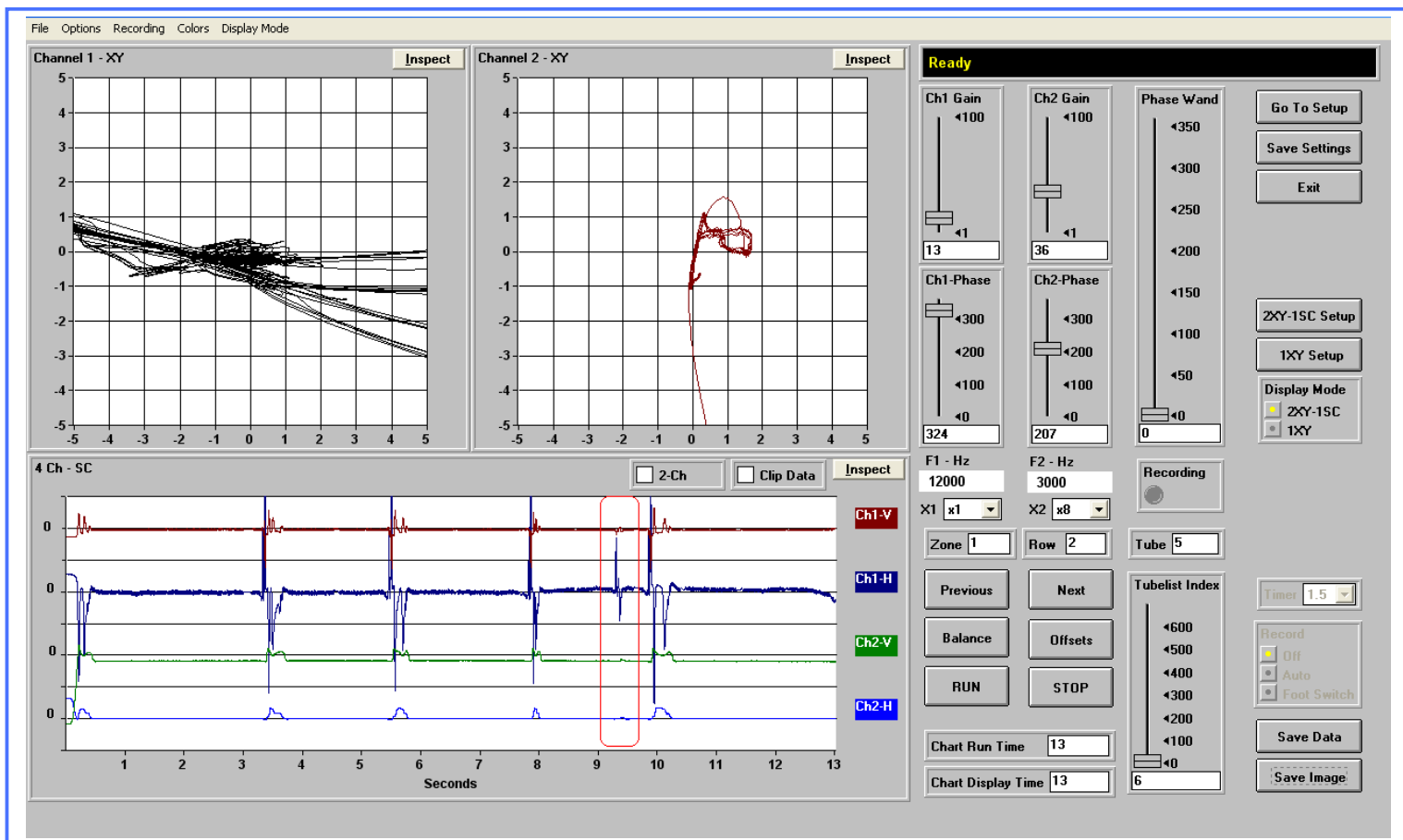
NO SIGNIFICANT DEFECTS (Row 37 Tube 9)

Evaporator Section



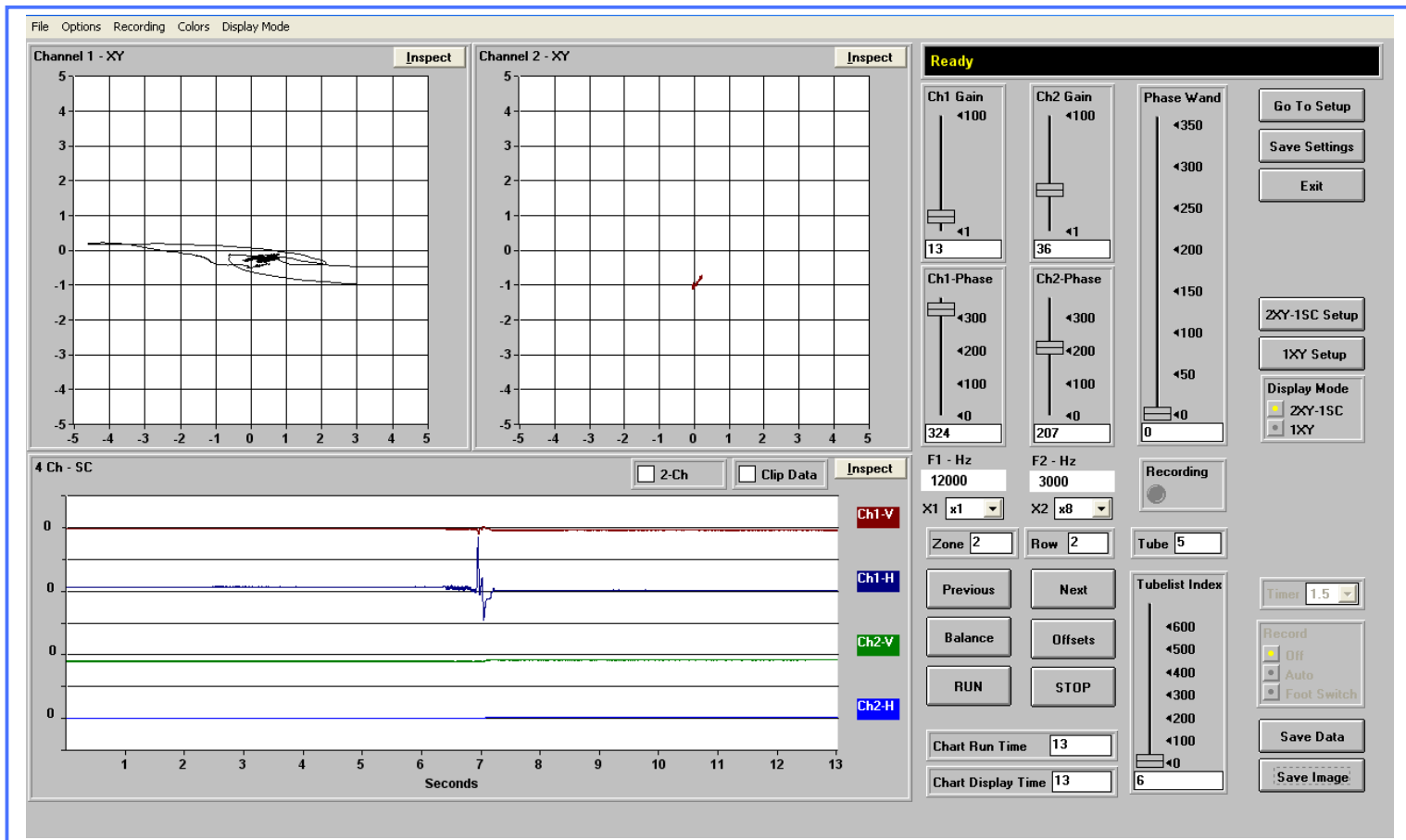
NO SIGNIFICANT DEFECTS (Row 1 Tube 1)

Evaporator Section



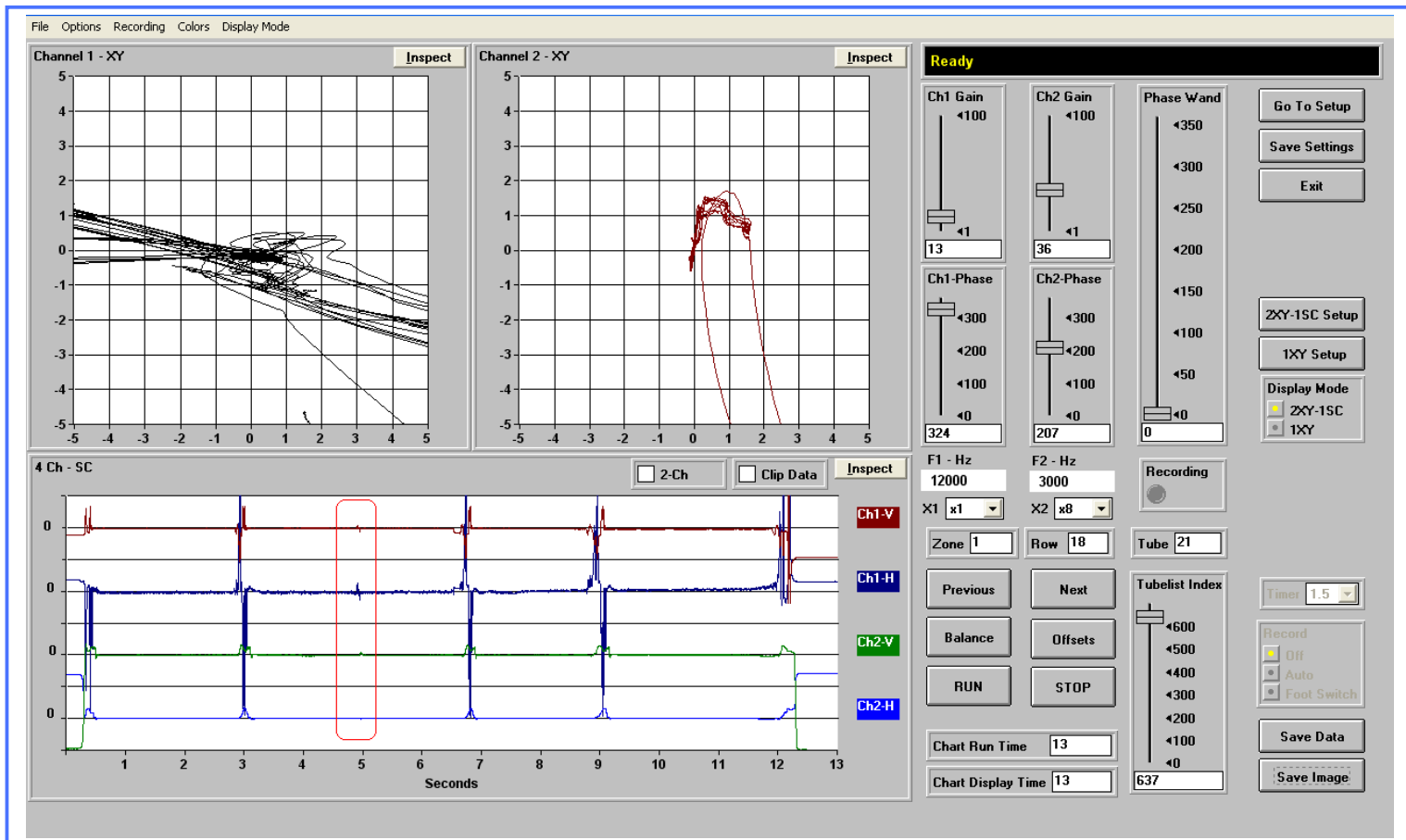
DENT, NOMINAL (Row 2 Tube 5)

Evaporator Section



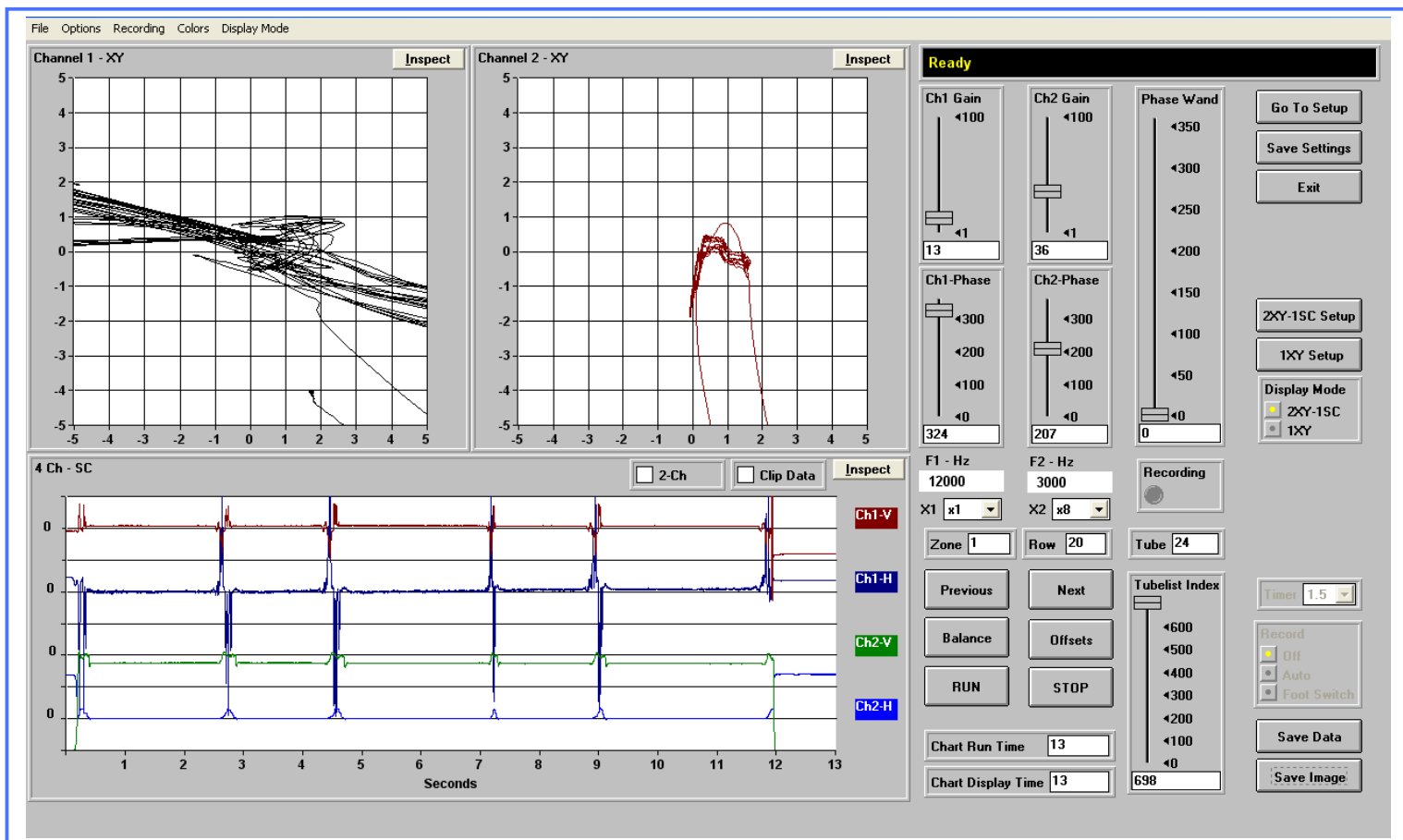
DENT, NOMINAL (Row 2 Tube 5)

Evaporator Section



MISSING LAND (Row 18 Tube 21)

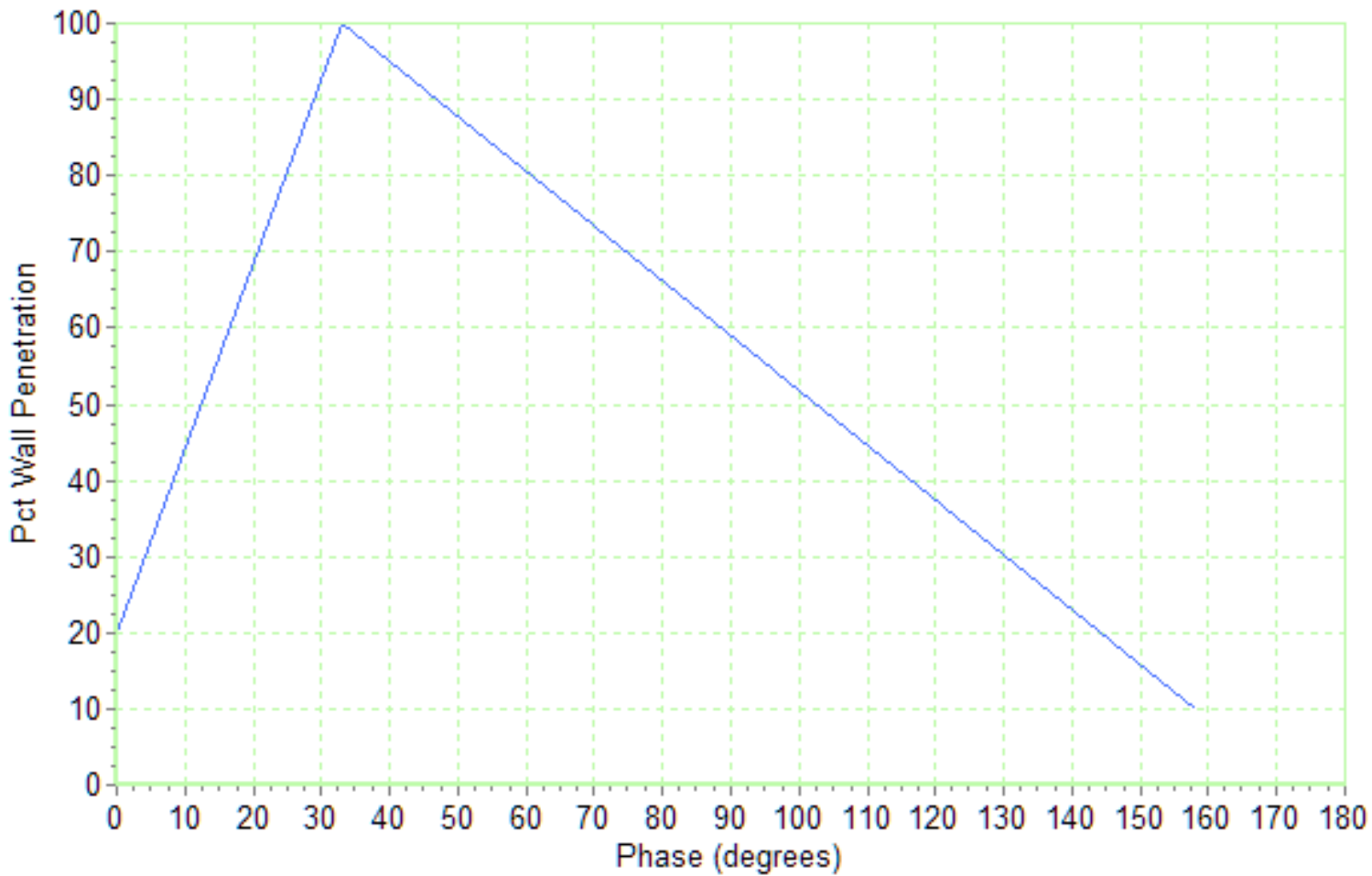
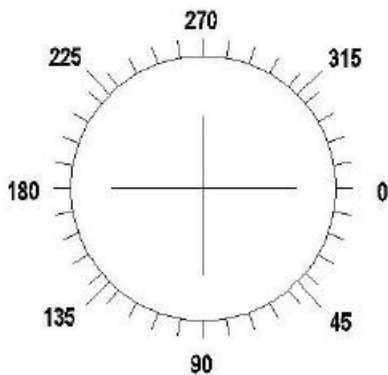
Evaporator Section



NO SIGNIFICANT DEFECTS (Row 20 Tube 24)

Phase Chart - Condenser

Material	Tube Type	OD	Wall	Test Type	Frequency	Probe Diameter
Copper	Skip Fin IE	.750	.052	CROSS/DIFF	3K	.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