



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

## Report of Eddy Current Inspection

Manufacturer: Carrier

Model: 17DA743


Serial: 01588 #6

Location: DUPONT EXPERIMENTAL STATION  
RTE. 141 BETWEEN 52 & 202  
BUILDING 315  
WILMINGTON, DE 19735

Inspected: February 11, 2014

Inspected By: JAYSON C. GREER, LEVEL III  
TAI Services, Inc.

Reviewed By:

  
TECHNICAL MANAGER, LEVEL III

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## Vessel Information

Manufacturer	Model	Style	Serial Number	Type
Carrier	17DA743	Open Drive	01588 #6	Centrifugal

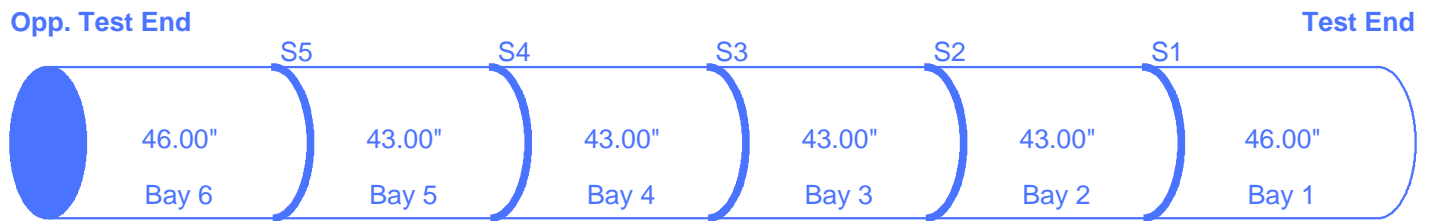
Evaporator	
TestEnd	Opposite Inlet/Outlet
Tube Count	2586
Tube Type	Skip Fin IE
Tube Material	Copper
OD	.750
*NWT/Under Fins	.028
*NWT/Bell/Land	.049
#/Type Support	5 Mild Steel
Tube Numbering	Left to Right
Row Numbering	Top to Bottom
Tube Length +- 2	264 Inches

Analyst: JAYSON C. GREER, LEVEL III

\* Nominal Wall Thickness

## Vessel Bay Length Information

**Evaporator (Length = 264 inches)**  
**S = Intermediate Support**



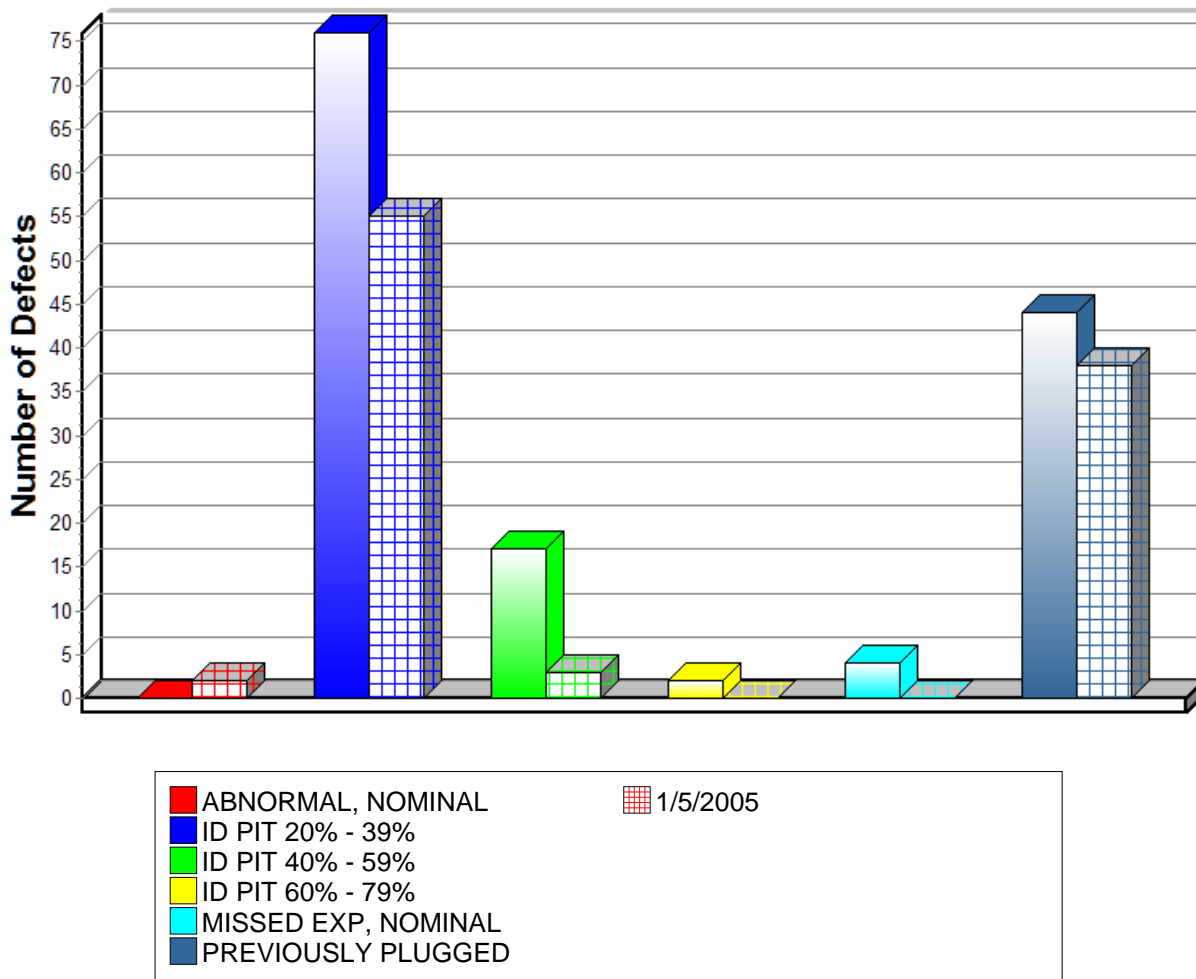
Bay 6	46.00"
Bay 5	43.00"
Bay 4	43.00"
Bay 3	43.00"
Bay 2	43.00"
Bay 1	46.00"

## Defect Summary/Comparison

Comparison of Tests Performed

2/11/2014 1/5/2005

### Evaporator Defects



Location	Model	Serial Number
DUPONT EXPERIMENTAL STATION	17DA743	01588 #6

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.

Evaporator: 2586 Tubes		
Tubes Tested: 2586 Tubes		
Significant/Measurable Indications	Number of Tubes Marked	Percent of Bundle
MISSED EXP, NOMINAL	4	.15
ID PIT 20% - 39%	76	2.94
ID PIT 40% - 59%*	17	.66
ID PIT 60% - 79%*	2	.08
PREVIOUSLY PLUGGED	44	1.70
<b>Totals</b>	<b>143</b>	<b>5.53</b>

\* REQUIRES ACTION

## 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.

### EVAPORATOR:

Tubes marked as Missed Expanded require no corrective action at this time.

Tubes indicating ID Pits of 40% or more should be isolated from the system at this time. ID Pits of less than 40% require no immediate corrective action. This type damage is usually progressive and should be monitored.

Tubes marked as Previously Plugged, had been plugged prior to this inspection.

### RE-INSPECTION RECOMMENDATIONS:

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

Evaporator: 12 February 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	17DA743	01588 #6	February 11, 2014
RTE. 141 BETWEEN 52 & 202			
WILMINGTON, DE 19735			

Row	Tube	Description	Area	Action Req.
<b>SET UP CALIBRATE &amp; STARTED</b>				
EVAPORATOR 2/11/2014 07:36 am				
1	20	PREVIOUSLY PLUGGED	TE	
1	68	PREVIOUSLY PLUGGED	TE	
1	71	PREVIOUSLY PLUGGED	TE	
2	51	ID PIT 20% - 39%	B02	
3	28	PREVIOUSLY PLUGGED	TE	
3	36	PREVIOUSLY PLUGGED	TE	
3	73	PREVIOUSLY PLUGGED	TE	
4	34	PREVIOUSLY PLUGGED	TE	
5	35	ID PIT 40% - 59%	B03	✓
5	44	ID PIT 20% - 39%	B06	
6	68	ID PIT 20% - 39%	B04	
7	23	ID PIT 40% - 59%	B03	✓
7	59	ID PIT 20% - 39%	B02	
7	62	ID PIT 20% - 39%	B04	
10	10	ID PIT 40% - 59%	B05	✓
10	28	PREVIOUSLY PLUGGED	TE	
10	40	PREVIOUSLY PLUGGED	TE	
11	24	PREVIOUSLY PLUGGED	TE	
12	24	ID PIT 20% - 39%	B03	

Row	Tube	Description	Area	Action Req.
12	56	PREVIOUSLY PLUGGED	TE	
12	58	ID PIT 40% - 59%	B03	✓
12	70	ID PIT 20% - 39%	B02	
13	3	PREVIOUSLY PLUGGED	TE	
13	21	ID PIT 20% - 39%	B01	
13	22	ID PIT 20% - 39%	B06	
13	31	ID PIT 20% - 39%	B06	
13	48	ID PIT 20% - 39%	B06	
13	50	PREVIOUSLY PLUGGED	TE	
13	51	PREVIOUSLY PLUGGED	TE	
13	65	ID PIT 20% - 39%	B01	
14	5	ID PIT 40% - 59%	B05	✓
14	9	PREVIOUSLY PLUGGED	TE	
14	18	ID PIT 20% - 39%	B02	
14	38	PREVIOUSLY PLUGGED	TE	
14	56	PREVIOUSLY PLUGGED	TE	
14	61	ID PIT 20% - 39%	B01	
14	67	PREVIOUSLY PLUGGED	TE	
14	74	ID PIT 40% - 59%	B03	✓
15	9	ID PIT 40% - 59%	B03	✓
15	51	ID PIT 20% - 39%	B06	
15	58	ID PIT 20% - 39%	B05	
16	8	PREVIOUSLY PLUGGED	TE	
16	9	ID PIT 20% - 39%	B03	
16	25	PREVIOUSLY PLUGGED	TE	
16	26	PREVIOUSLY PLUGGED	TE	

Row	Tube	Description	Area	Action Req.
16	28	PREVIOUSLY PLUGGED	TE	
16	36	ID PIT 20% - 39%	B01	
16	48	ID PIT 20% - 39%	B05	
16	54	PREVIOUSLY PLUGGED	TE	
16	65	ID PIT 20% - 39%	B06	
16	68	PREVIOUSLY PLUGGED	TE	
17	45	ID PIT 20% - 39%	B05	
17	53	ID PIT 20% - 39%	B05	
17	68	PREVIOUSLY PLUGGED	TE	
18	14	PREVIOUSLY PLUGGED	TE	
18	27	PREVIOUSLY PLUGGED	TE	
18	35	PREVIOUSLY PLUGGED	TE	
18	59	ID PIT 40% - 59%	B05	✓
18	60	ID PIT 20% - 39%	B05	
19	1	PREVIOUSLY PLUGGED	TE	
19	2	PREVIOUSLY PLUGGED	TE	
19	3	PREVIOUSLY PLUGGED	TE	
19	7	ID PIT 40% - 59%	B03	✓
19	8	ID PIT 20% - 39%	B05	
19	22	PREVIOUSLY PLUGGED	TE	
19	56	ID PIT 20% - 39%	B06	
19	61	ID PIT 20% - 39%	B05	
19	66	ID PIT 20% - 39%	B04	
20	61	ID PIT 20% - 39%	B02	
20	71	ID PIT 20% - 39%	B06	
21	6	ID PIT 40% - 59%	B05	✓

Row	Tube	Description	Area	Action Req.
21	54	ID PIT 20% - 39%	B05	
21	56	ID PIT 20% - 39%	B05	
21	68	PREVIOUSLY PLUGGED	TE	
24	12	ID PIT 20% - 39%	B01	
24	45	PREVIOUSLY PLUGGED	TE	
24	63	ID PIT 20% - 39%	B04	
25	11	PREVIOUSLY PLUGGED	TE	
25	14	ID PIT 20% - 39%	B03	
25	18	ID PIT 20% - 39%	B04	
25	24	ID PIT 20% - 39%	B01	
25	31	ID PIT 40% - 59%	B02	✓
26	60	PREVIOUSLY PLUGGED	TE	
26	66	PREVIOUSLY PLUGGED	TE	
28	18	ID PIT 40% - 59%	B03	✓
28	27	ID PIT 20% - 39%	B02	
28	29	PREVIOUSLY PLUGGED	TE	
28	57	PREVIOUSLY PLUGGED	TE	
28	59	PREVIOUSLY PLUGGED	TE	
29	33	PREVIOUSLY PLUGGED	TE	
29	50	ID PIT 20% - 39%	B02	
31	6	ID PIT 20% - 39%	B04	
32	21	ID PIT 20% - 39%	B06	
33	36	PREVIOUSLY PLUGGED	TE	
33	39	ID PIT 40% - 59%	B04	✓
37	11	ID PIT 20% - 39%	B01	
39	4	PREVIOUSLY PLUGGED	TE	

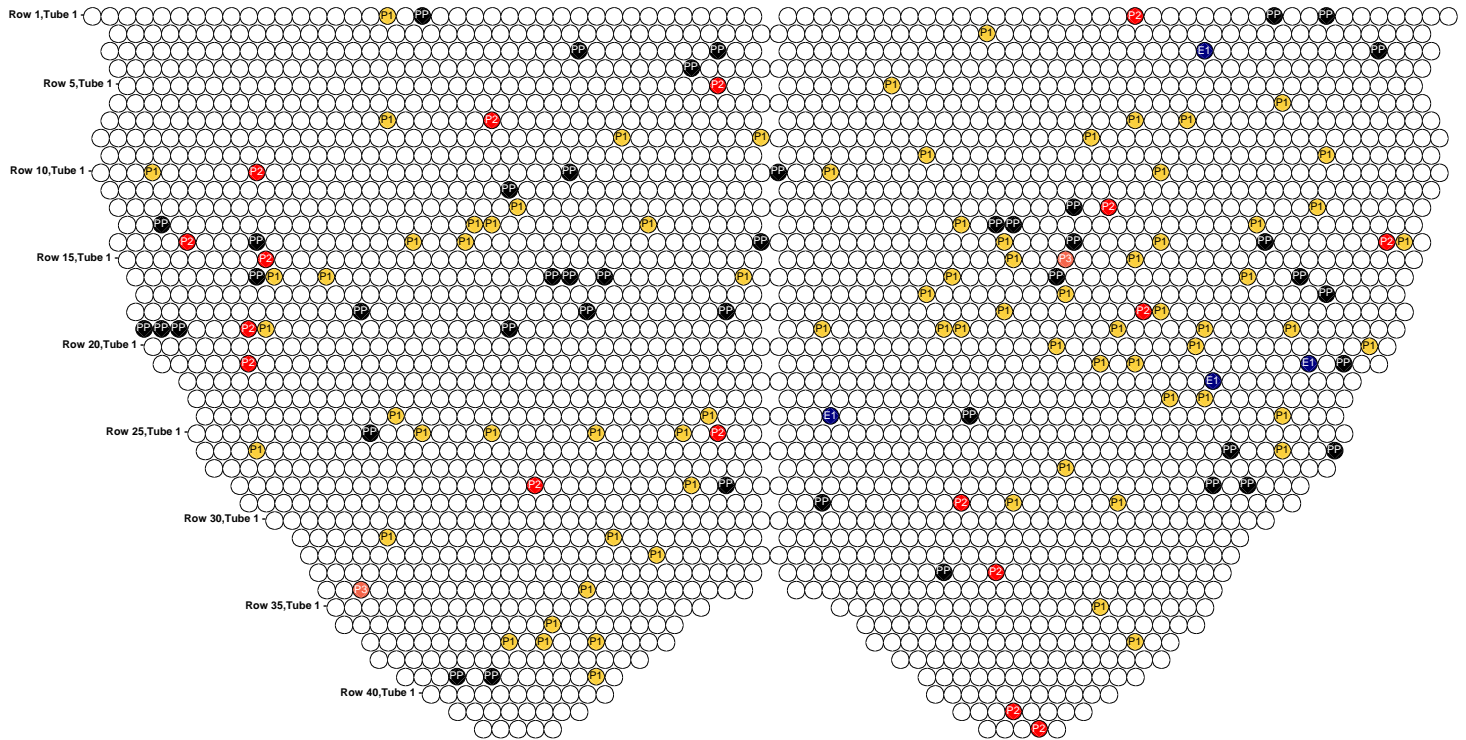
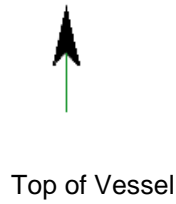
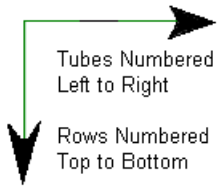
Row	Tube	Description	Area	Action Req.
39	6	PREVIOUSLY PLUGGED	TE	
<b><i>CALIBRATION CHECK 2/11/2014 03:02 pm</i></b>				
<b><i>CALIBRATION CHECK 2/12/2014 08:30 am</i></b>				
1	18	ID PIT 20% - 39%	B06	
1	60	ID PIT 40% - 59%	B06	✓
3	63	MISSED EXP, NOMINAL	S04	
7	17	ID PIT 20% - 39%	B03	
8	31	ID PIT 20% - 39%	B06	
8	39	ID PIT 20% - 39%	B06	
8	58	ID PIT 20% - 39%	B03	
9	47	ID PIT 20% - 39%	B03	
9	70	ID PIT 20% - 39%	B03	
10	4	ID PIT 20% - 39%	B05	
10	43	ID PIT 20% - 39%	B03	
10	62	ID PIT 20% - 39%	B02	
14	21	ID PIT 20% - 39%	B03	
14	52	ID PIT 20% - 39%	B04	
14	75	ID PIT 20% - 39%	B05	
15	54	ID PIT 60% - 79%	B01	✓
16	12	ID PIT 20% - 39%	B03	
18	51	ID PIT 20% - 39%	B04	
19	39	ID PIT 20% - 39%	B02	
19	46	ID PIT 20% - 39%	B02	
19	47	ID PIT 20% - 39%	B01	
20	53	ID PIT 20% - 39%	B05	
21	66	MISSED EXP, NOMINAL	S02	

Row	Tube	Description	Area	Action Req.
22	60	MISSED EXP, NOMINAL	S01	
23	56	ID PIT 20% - 39%	B05	
23	58	ID PIT 20% - 39%	B06	
24	30	ID PIT 20% - 39%	B03	
24	37	MISSED EXP, NOMINAL	S01	
25	29	ID PIT 20% - 39%	B01	
26	4	ID PIT 20% - 39%	B02	
26	63	ID PIT 20% - 39%	B01	
27	49	ID PIT 20% - 39%	B03	
29	41	ID PIT 40% - 59%	B01	✓
29	44	ID PIT 20% - 39%	B01	
31	19	ID PIT 20% - 39%	B06	
34	3	ID PIT 60% - 79%	B03	✓
34	16	ID PIT 20% - 39%	B04	
35	38	ID PIT 20% - 39%	B01	
36	13	ID PIT 20% - 39%	B05	
37	9	ID PIT 20% - 39%	B06	
37	14	ID PIT 20% - 39%	B05	
37	34	ID PIT 20% - 39%	B02	
39	12	ID PIT 20% - 39%	B02	
41	12	ID PIT 40% - 59%	B02	✓
42	9	ID PIT 40% - 59%	B06	✓
<b>CALIBRATION CHECK &amp; COMPLETED</b>				
EVAPORATOR 2/12/2014 07:27 pm				

# Evaporator Section

S/N 01588 #6

Opposite Inlet/Outlet

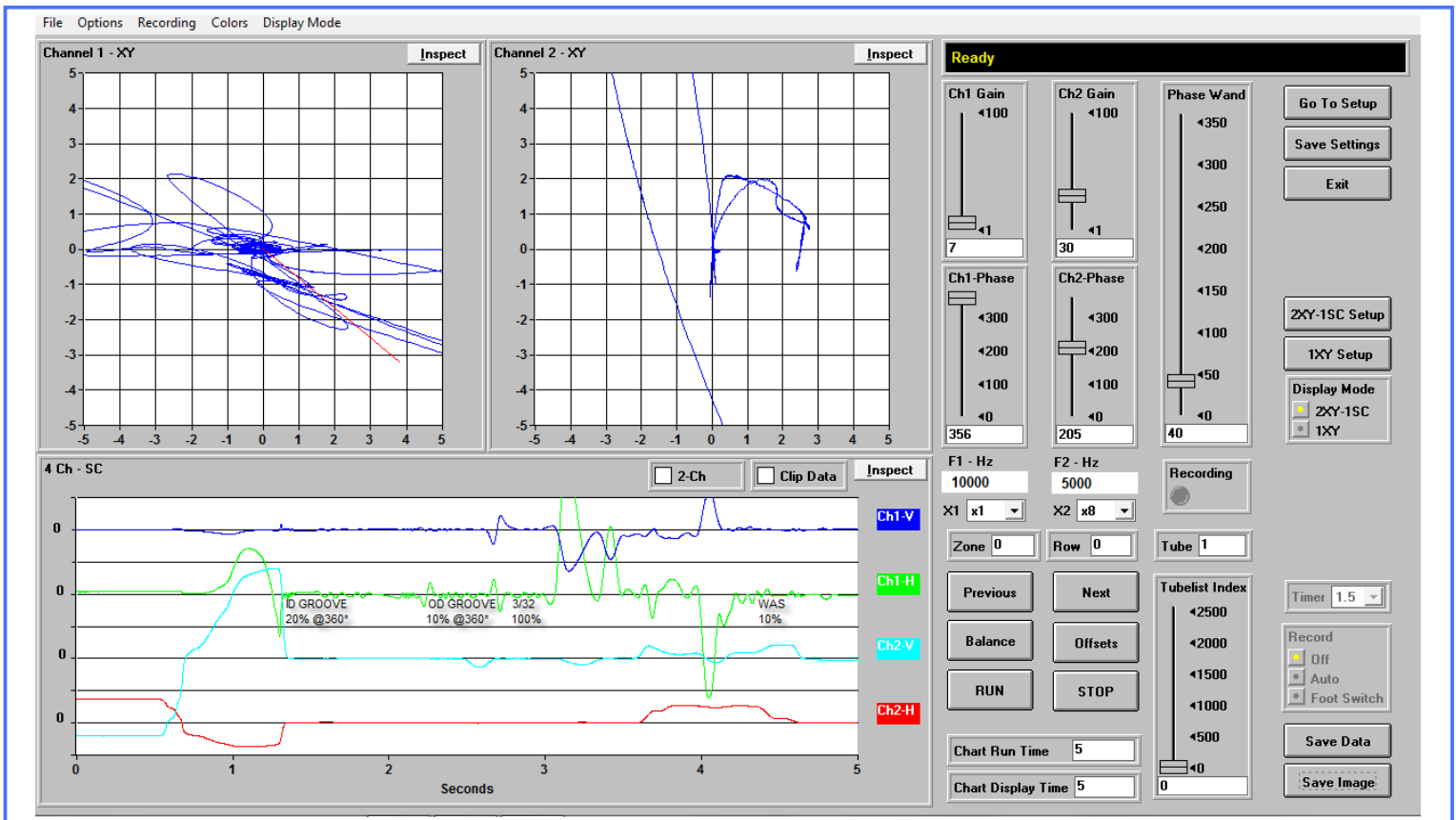


- = MISSED EXP, NOMINAL
- = ID PIT 20% - 39%
- = ID PIT 40% - 59%      **REQUIRES ACTION**
- = ID PIT 60% - 79%      **REQUIRES ACTION**
- = PREVIOUSLY PLUGGED

### Calibration Page

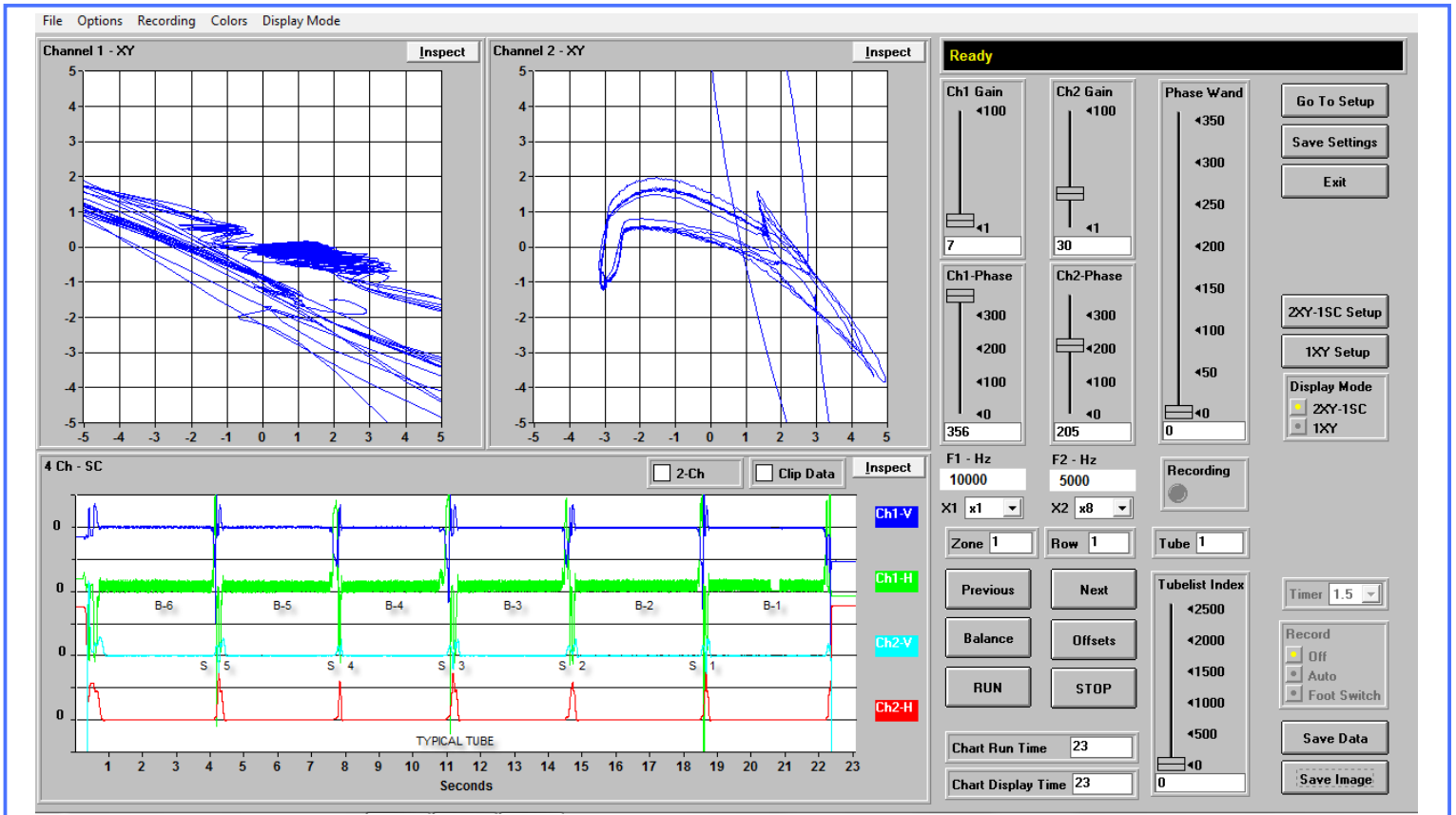
Tube Type	Material	Nom Wall Thick	End Wall Thick	OD	Test Type	Probe Diameter
Skip Fin IE	Copper	.028	.049	.750	Cross/Diff	.5625

Evaporator



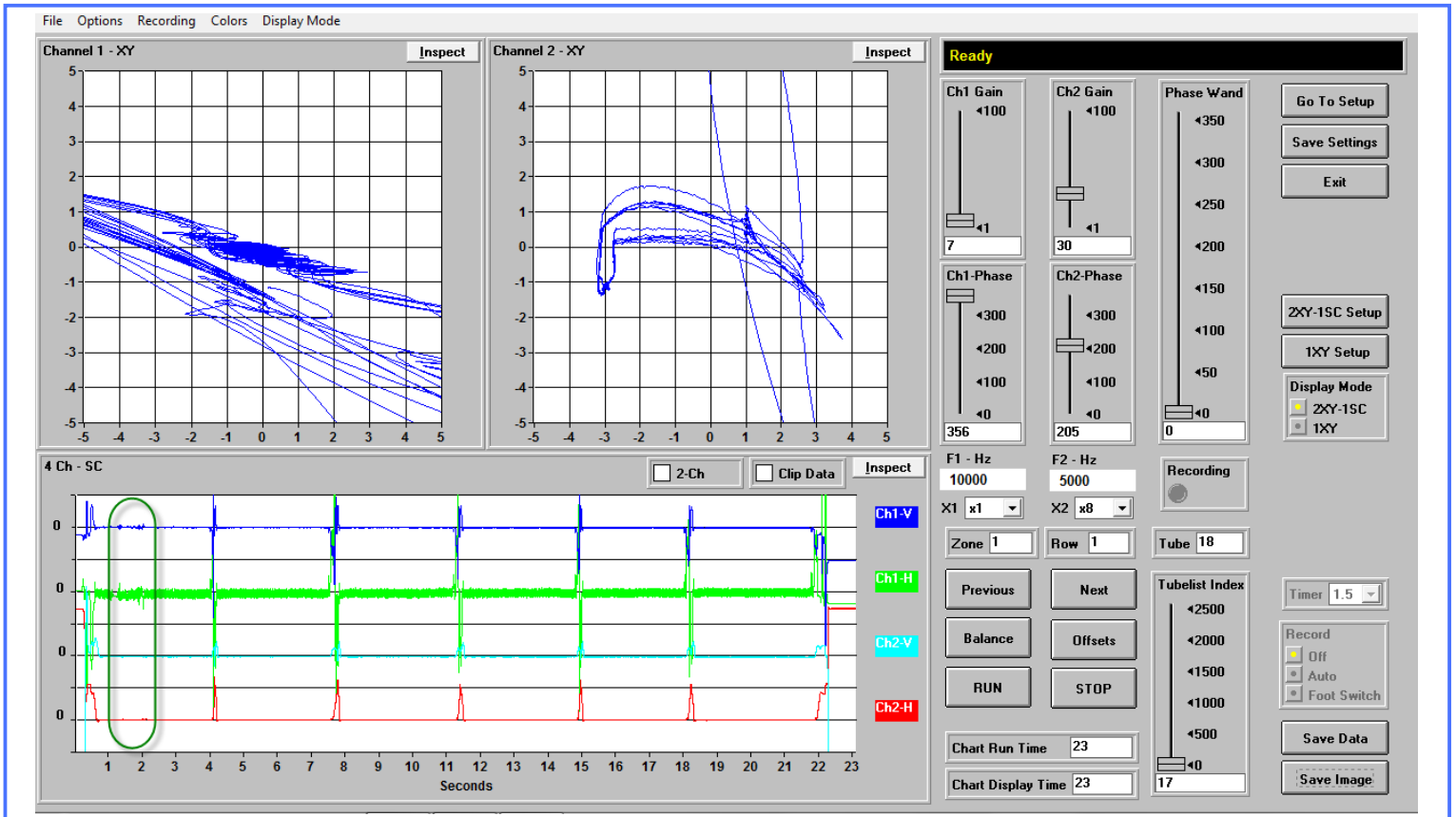
Note: Defects are compared to machined standards.  
Actual Defect Geometry may differ.

# Evaporator Section



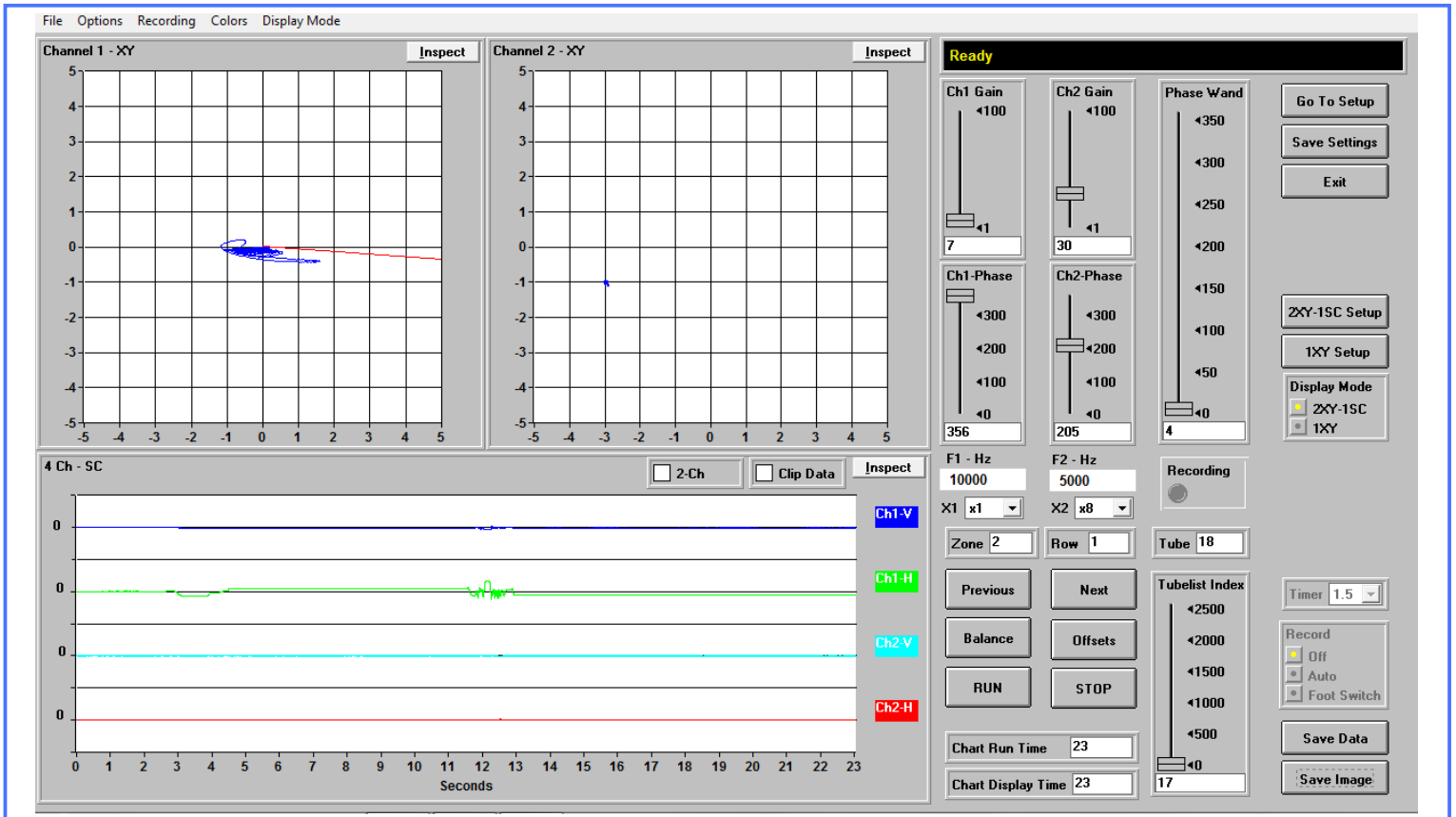
TYPICAL TUBE (Row 1 Tube 1)

# Evaporator Section



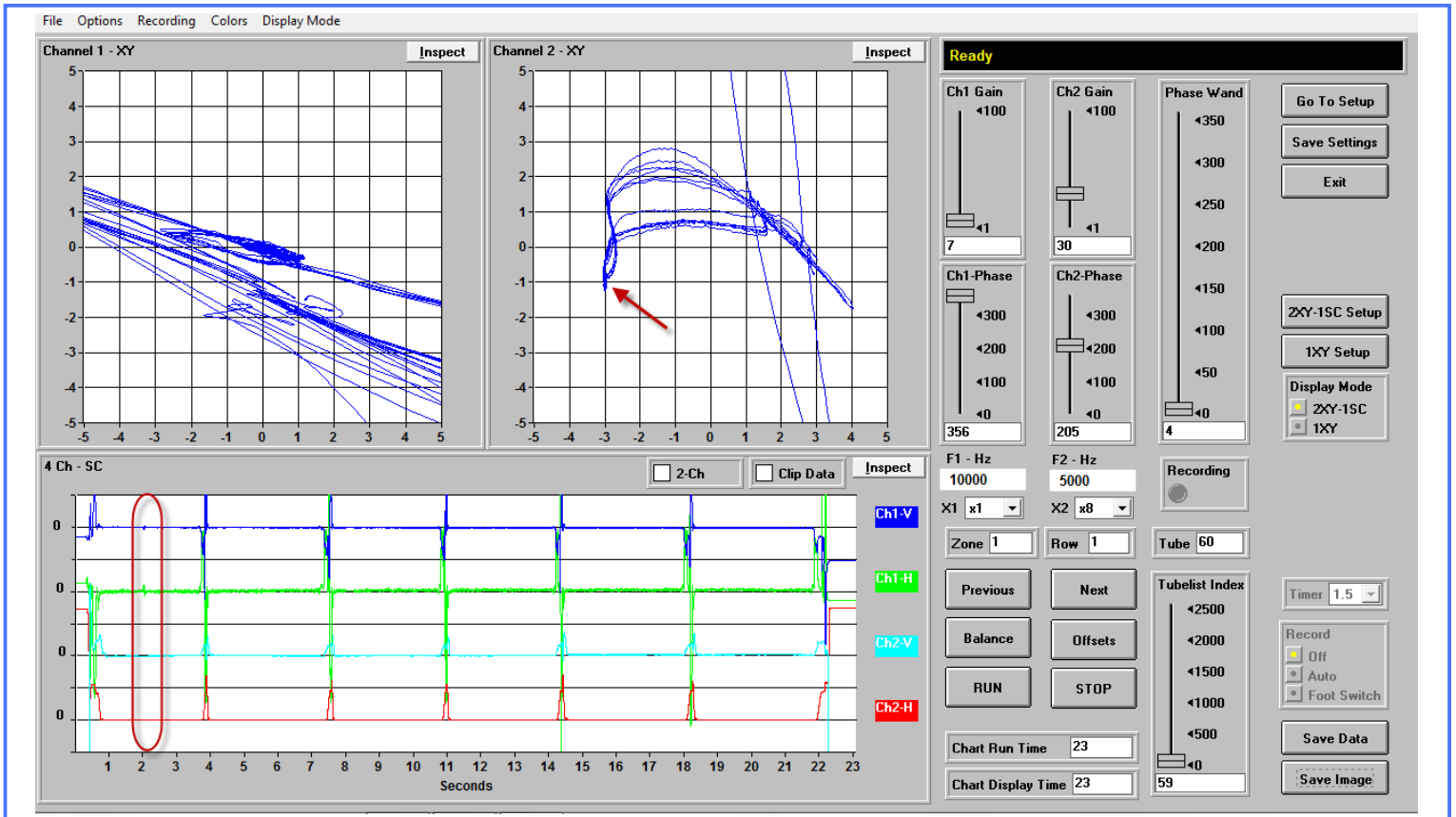
ID PIT 20% - 39% (Row 1 Tube 18)

# Evaporator Section



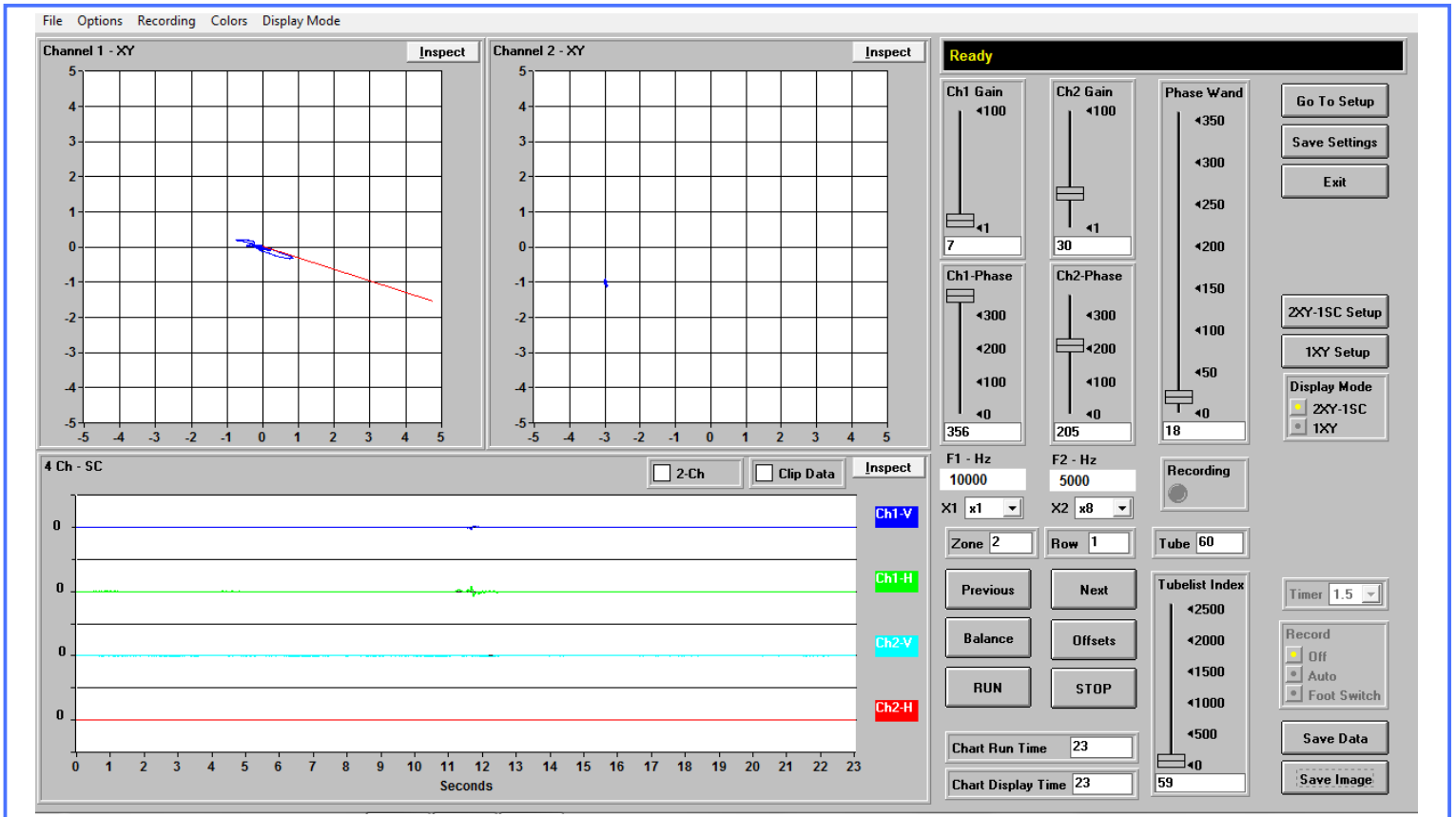
ID PIT 20% - 39% (Row 1 Tube 18)

# Evaporator Section



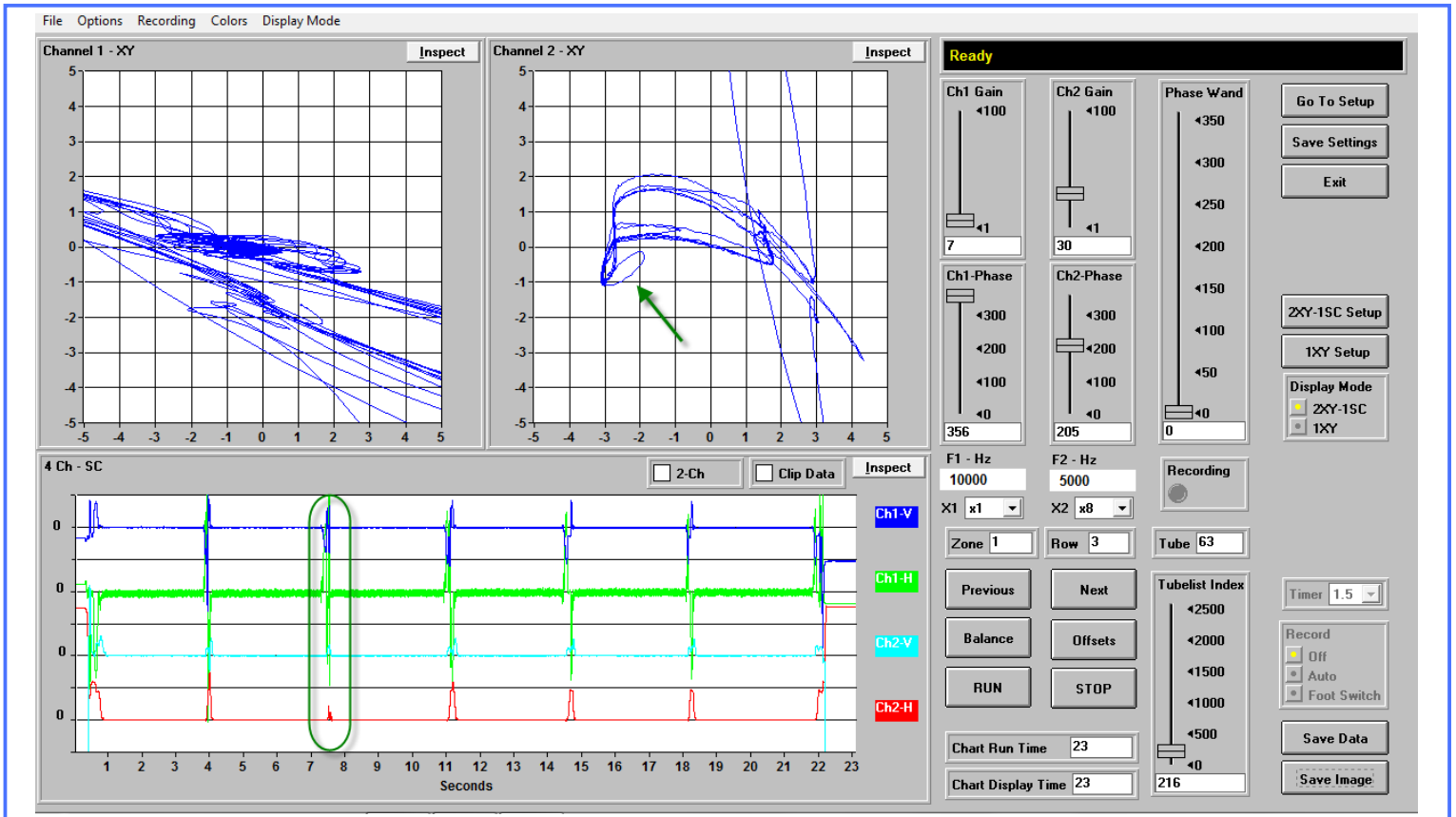
ID PIT 40% - 59% (Row 1 Tube 60)

# Evaporator Section



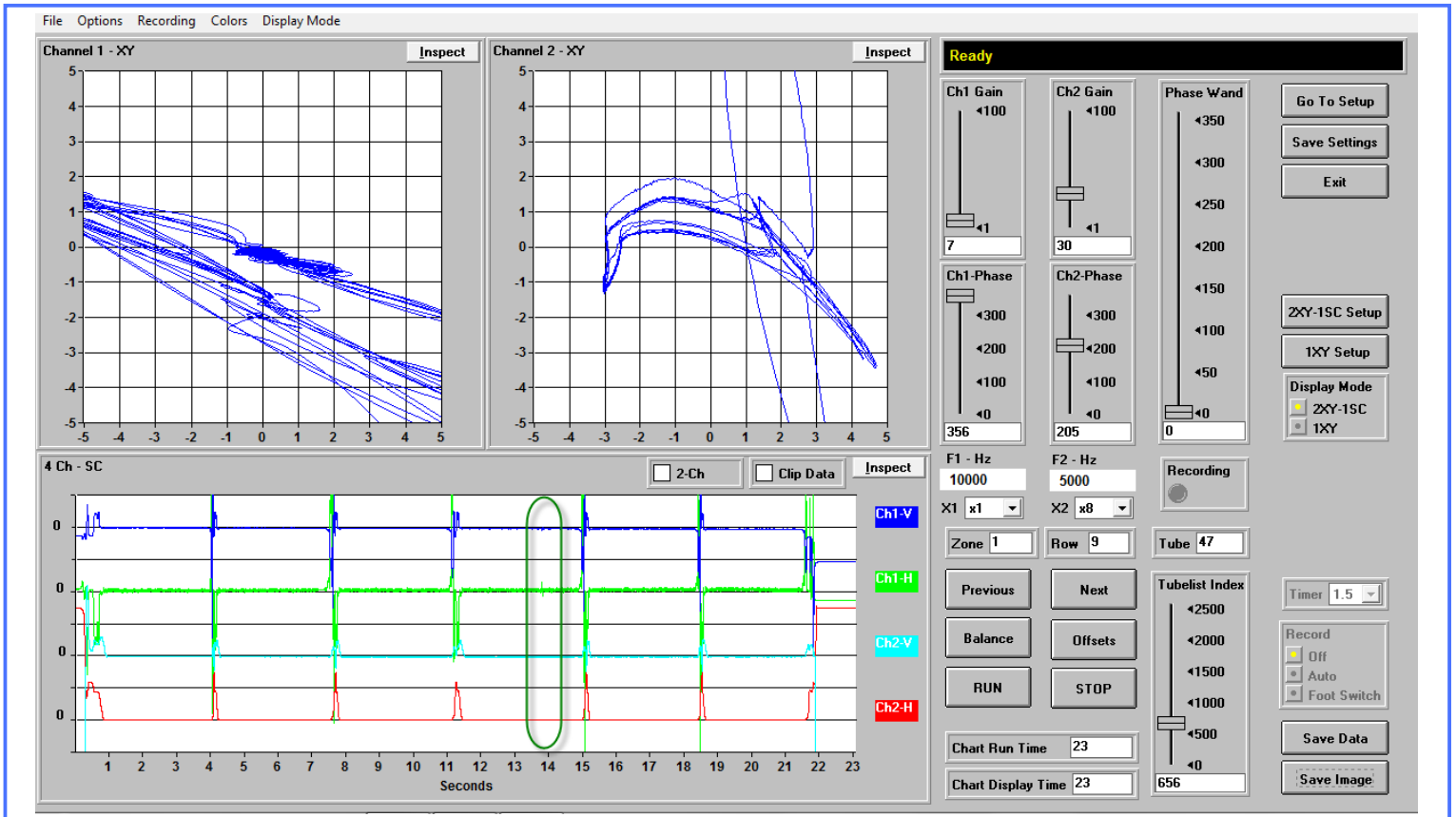
ID PIT 40% - 59% (Row 1 Tube 60)

# Evaporator Section



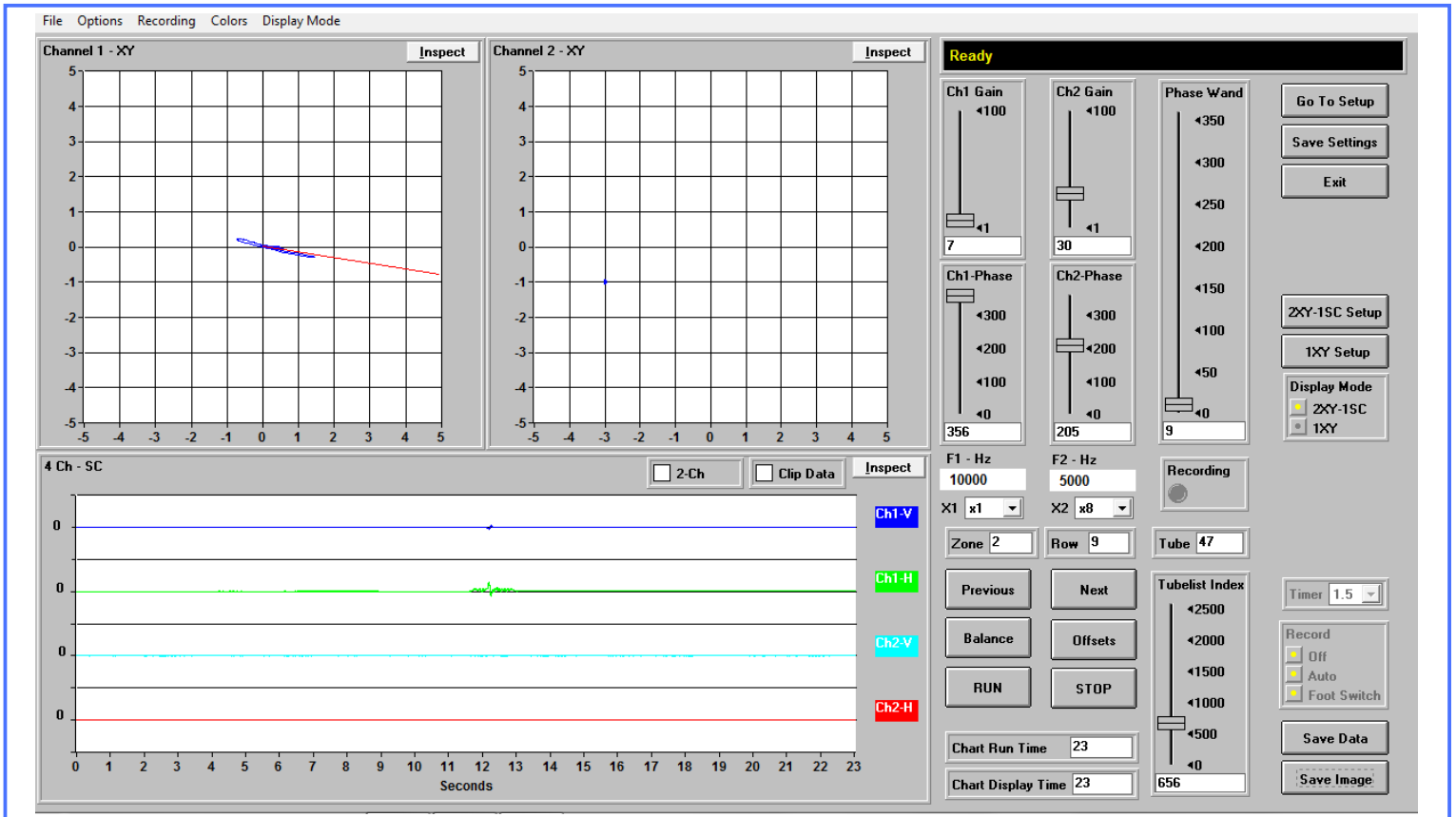
MISSED EXP, NOMINAL (Row 3 Tube 63)

# Evaporator Section



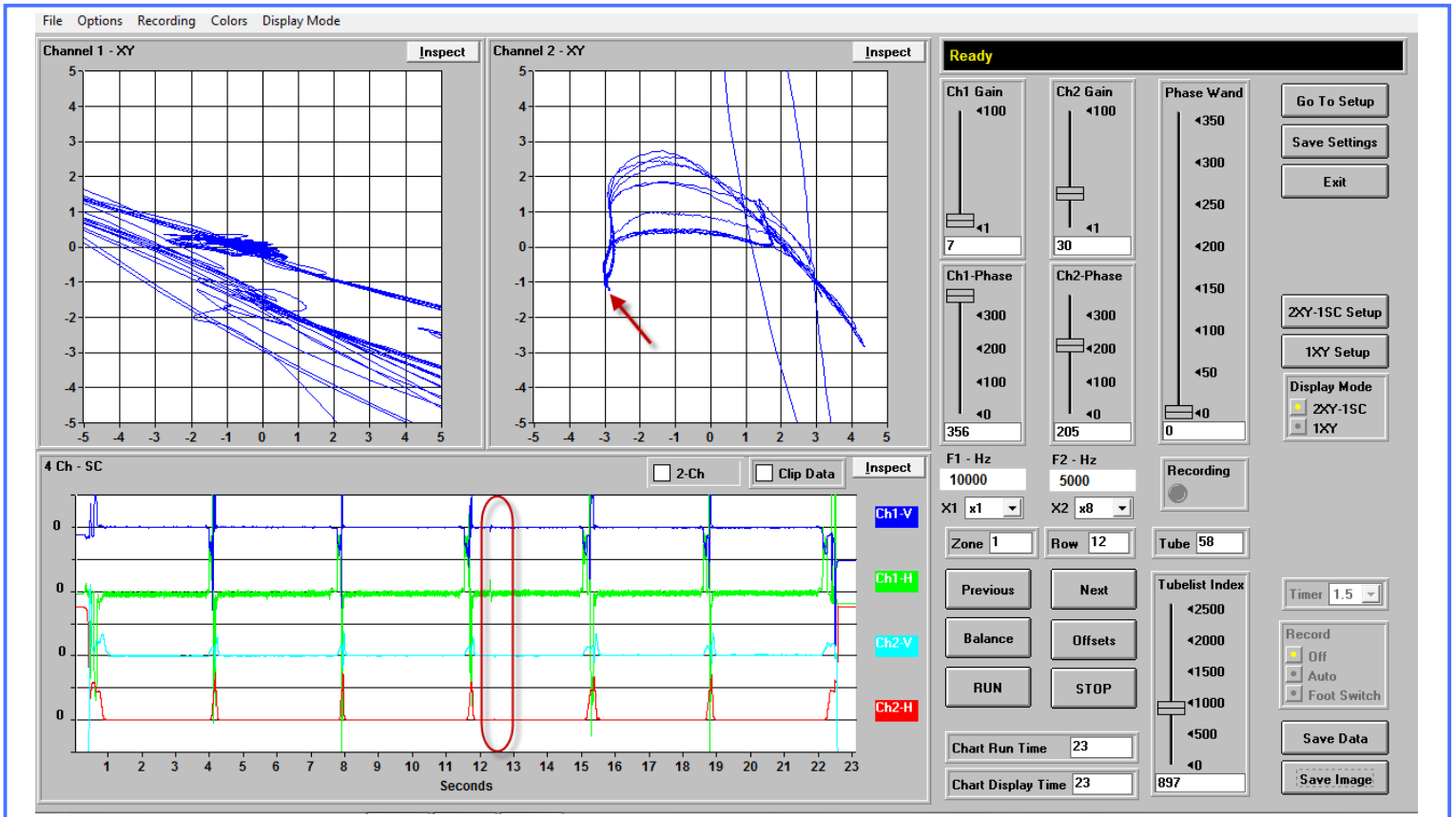
ID PIT 20% - 39% (Row 9 Tube 47)

# Evaporator Section



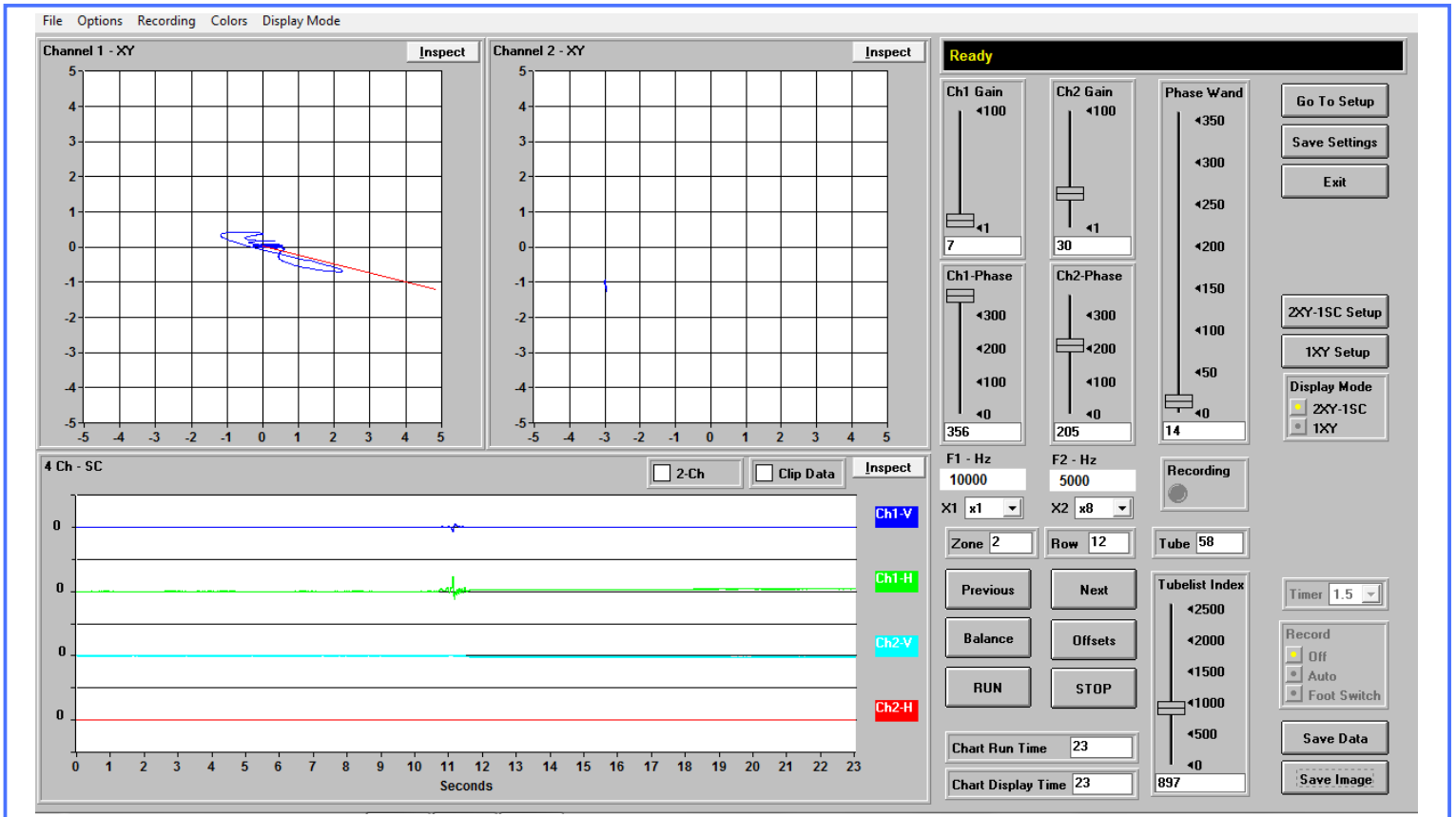
ID PIT 20% - 39% (Row 9 Tube 47)

# Evaporator Section



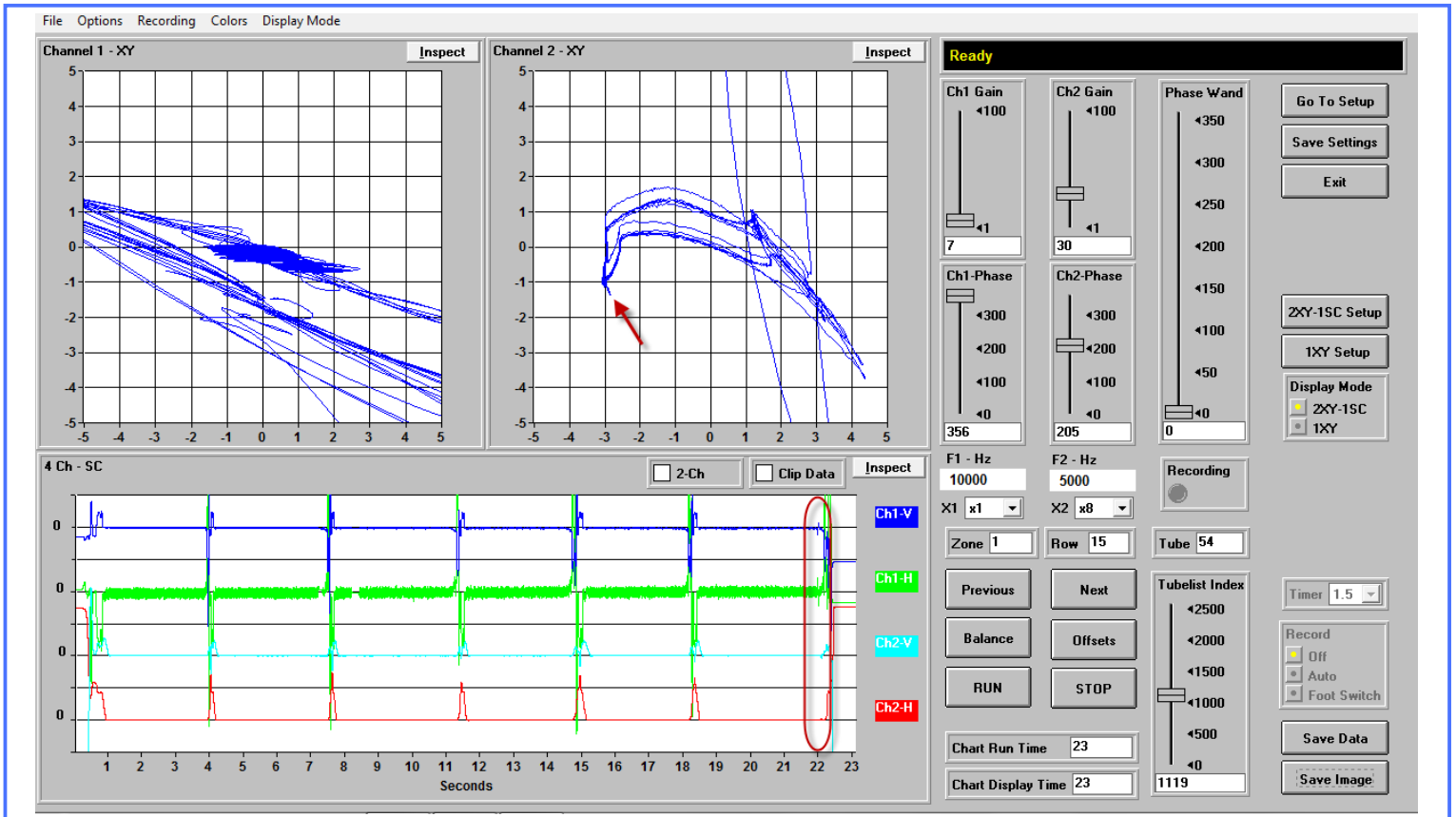
ID PIT 40% - 59% (Row 12 Tube 58)

# Evaporator Section



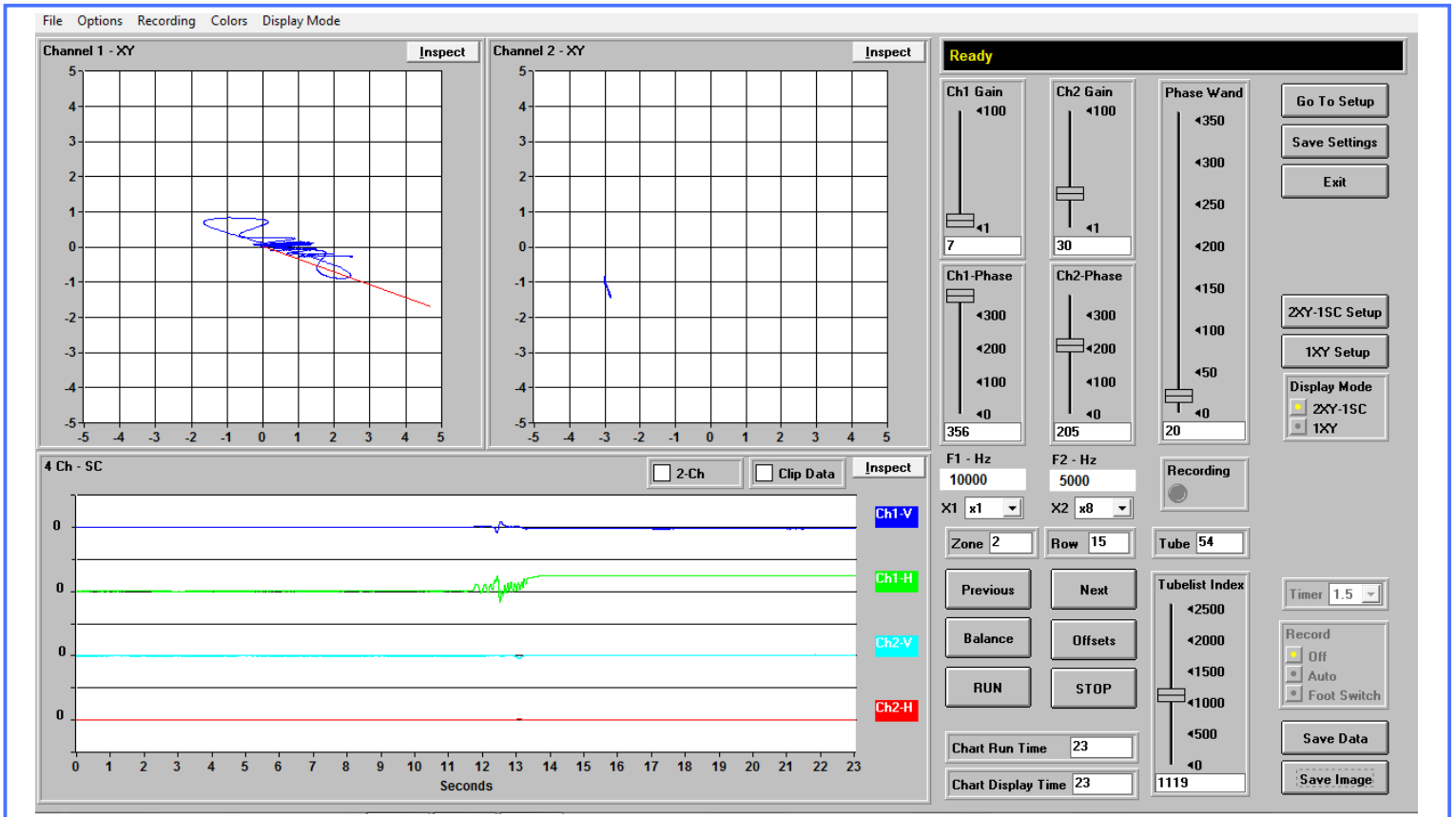
ID PIT 40% - 59% (Row 12 Tube 58)

# Evaporator Section



ID PIT 60% - 79% (Row 15 Tube 54)

# Evaporator Section



ID PIT 60% - 79% (Row 15 Tube 54)

## 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