



Corrective Action
Carondelet Division - CA / PA / RGA Database
Corrective Action Type NCR
Date 8/1/2005 Revised 1-20-06
CA Originator C. Ruud
Applies to: A-1Coil

1347

Description of Defect / Non-Conformance

Wall thickness below model minimum. Localized areas were measured below the 1.375" minimum wall thickness during metrology. MetalTek independently verified wall thickness and confirmed condition.

Root Cause

The tooling produces a casting with a wall thickness less than required by the model. Measurements taken on A-3, A-4 and A-5 are consistent and lower than predicted by the model. Material losses during normal processing and heat treat with A-1 and A-2 are also a factor.

Corrective Action

Request "Use As Is" disposition on wall thickness related dimensions on A-1 coil.

Verification of Corrective Action

Not required. PPPL independently verified in conjunction with ORNL the design performance at a wall thickness of 1.05". Results were deemed adequate. Minimum measured dimension is 1.18" (to be verified).

Preventive Action


Several steps need to be taken to resolve and propose:

1. Validation of 3D Scanco data. MetalTek proposes to use Romer Arm with Laser scanner as validation technique. This instrument will be used to validate subsequent parts and minimizes measurement technique error.
 - Completed - The data provided by 3D Scanco has been validated on A1.
2. Report to PPPL/ORNL. Understanding the concern that the wall not be thinner than measured and the limitations of the process, e.g. setting a large core into a mold with overhead crane, MetalTek will submit layout results to EIO wand set teleconference to review remediations to tool.
 - It was determined to produce A2 with no tooling changes.
3. Upon verification of 3D Scanco data, MetalTek will confirm results to EIO team to begin root cause determination. Additional layout may be required to assure compliance of tooling, depending on results of layout.
 - Transfer caliper dimensions were taken on A-2 and A-3 at pre-clean step and shown to exceed required minimum wall thickness. However a layout performed using Romer Arm indicated dimensions consistent with A-1.

4. Modification to tooling. Limited tooling modifications may be performed without severely impacting schedule or negating previous engineering (solidification modeling, etc.). These will be evaluated and proposed, where appropriate.
 - No tooling changes have been made.
5. Permanent deviation. Based on results of above, a permanent deviation may be required to dimensional tolerances in limited areas of the component. These will be known in greater detail later.

Actual Completion Date

All items complete, except a deviation.

Signed: C. Ruud 

CC: Roger Broman, Barry Craig, Joe Edwards, E.J. Kubick, J. Markham

NCSX Disposition to CA 1347

Analyses were performed to determine the effect of the thin section on deflections and stresses and are summarized below.

- Thin shell areas like that of A1 **has an extremely minor affect on the stresses and displacements in ANY of the coils or shells** with the thickness being either 1.18" as for A1 or even with the thickness being 1.05" which MTK projects is the minimum if the shell is not changed. Reasons:
 - a) The shape of the tee is not changed by this, and the tee provides most of the bending stiffness
 - b) Some EM forces are transferred to the shell B from the wing.
 - c) The thin wall region is not the location for the peak stress and much of the area will be machined away.

Run #	Configuration	Shell Type A		Coil Type A		All Coils	
		Max. Displacement - mm	Max. Stress - Mpa	Max. Displacement - mm	Max. Stress - Mpa	Max. Displacement - mm	Max. Stress - Mpa
1	Baseline	0.98	168	1.246	239	2.711	239
5	Updated E	1.17	160	1.513	248	2.934	248
6	Updated E; thin sect. =1.18"	1.169	161	1.516	249	2.984	249
4	Updated E; thin sect. =1.05"	1.168	161	1.517	248	2.971	248

Since the effect has been shown to be extremely minor, the disposition for the A1 winding form is **Accept As Is**.

However, since the root cause determination is still underway, this NCR should be kept open. It is requested that EIO re-issue an amended CA with the root cause determination and preventive action; PPPL will disposition that portion of the NCR at that time.

Approved:

P. Heitzenroeder, Tech. Rep.

B. Nelson, RLM



Addendum to Corrective Action

1347

10-23-05

This to provide an update on the thin wall condition found in A-1 Coil casting.

Several steps need to be taken to resolve and propose:

1. Validation of 3D Scanco data. MetalTek proposes to use Romer Arm with Laser scanner as validation technique. This instrument will be used to validate subsequent parts and minimizes measurement technique error.
2. Report to PPPL/ORNL. Understanding the concern that the wall not be thinner than measured and the limitations of the process, e.g. setting a large core into a mold with overhead crane, MetalTek will submit layout results to EIO and set teleconference to review remediations to tool.
3. Upon verification of 3D Scanco data, MetalTek will confirm results to EIO team to begin root cause determination. Additional layout may be required to assure compliance of tooling, depending on results of layout.
4. Modification to tooling. Limited tooling modifications may be performed without severely impacting schedule or negating previous engineering (solidification modeling, etc.). These will be evaluated and proposed, where appropriate.
5. Permanent deviation. Based on results of above, a permanent deviation may be required to dimensional tolerances in limited areas of the component. These will be known in greater detail later.

Status Update – October 25, 2005 [Interim]

1. The data provided by 3D Scanco has been validated on A1.
2. A2 was produced with no tooling changes.
3. Transfer caliper dimensions were taken at pre-clean step and shown to exceed required minimum wall thickness.
4. A2 will be cleaned and compliance layout performed using Romer Arm technique.
5. This is still pending.

At present, it is premature to represent A2 as compliant pending results of full layout. Even layout of A2 may not offer definitive proof of conditions leading to A1 thin wall condition. This CAR remains open pending further investigation.

A handwritten signature in black ink, appearing to be "C. Ruud".

C. Ruud

Cc: EJ Kubick, J. Edwards, R. Broman, B. Craig