



## Carondelet Division

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Corrective Action 1695  
Carondelet Division  
Corrective Action Type NCR  
Date 4-30-06 Revised 7-11-06  
CA Originator C. Ruud  
Applies to: Coils and plates

### Description of Defect / Non-Conformance

Parts failed magnetic permeability during inspection at Major Tool.

### Root Cause

Surface of part holds small amount of foreign material that is slightly magnetic. CAF Sevren gauge insert marked 1.02 was actually reading 1.03.

Investigation: Plates that failed at MT were returned and evaluated on 4-27-06 using CAF Sevren gauge. Areas were marked by MT as high on 5 of the 6 parts returned. Points (approx. 1/8" dia.) within the areas marked that pulled at 1.02. 20% of the areas marked passed with CAF gauge. However, all but 1 pulled at the 1.01 insert. On one plate the 8-10 points that exceeded the 1.02 were stamped indicating the points. The part was sandblasted and retested. All areas passed the 1.02 and all but 1 point passed the 1.01. This testing led CAF to believe our gauge may be off. The gauge was sent to the manufacturer for evaluation. They reported the 1.02 insert was reading 1.03 and the 1.01 insert was reading 1.02. Another potential cause for the high magnetic permeability is that contamination in the garnet used to sandblast becomes imbedded in the part. This is not likely due to the above test where sandblasting was used to remediate the high spots. The dust collector separates the fine particulate from the blast media. This would include contaminants. To determine the amount of magnetic material in the garnet a magnet was cleaned then placed in the garnet in the sandblast machine. A small amount of material was attracted to the magnet. Molding sand has a small amount of iron oxide added to reduce sand expansion defects. Past testing showed that adhering sand frequently caused magnetic permeability failures. The magnet test was repeated in molding sand and found similar results. Tests were also conducted to determine the impact of testing the casting while LPI developer was on the part. Several areas were tested and found that failures remained failures after developer applied and retested.

### Corrective Action

Gauge was returned to the manufacturer for evaluation and correction.  
Parts at Major Tool will be inspected by MetalTek personnel and reworked as needed.  
This work was performed on A1, A3, A4, A5, A6, B2 and C6 the week of May 15, 2006. See attached report.  
Coils A2 and B1 could not be inspected as they were on machines at the time. They will be evaluated and remediation plans will be made. Grinding of A-2 coil was completed on June 19, 2006. B-1 was not available at that time. See report below. **The testing and any needed remediation of B-1 coil will be performed by Major Tool as part of the normal process prior to shipment.**  
Coils B3 through B6 will be tested after all penetrant testing is completed and the part has been blasted free of all developer.

**Actual Completion Date**

Complete.

Signed: C. Ruud



CC: B. Craig, J. Edwards, J. Markham, J. Galaske

Bob Carlton Report follows

On 5/15/06 Ken Morris and I traveled to Indiana to remediate the areas of high magnetic permeability on the coils at MTM. Ken and I tested the non-machined surface on seven of the coils at MTM. We used MTM's Severn gauge as the CAF gauge was in use back at the plant.

Each coil contained areas where the limit of 1.02 was exceeded. Cause primarily due to adhering sand. A few places it appeared that nonconformance was caused by small sand inclusions and to possibly heat treat scale. We also found a few spots where an oily substance was the cause.

Sand related causes accounted for about 75% of the nonconformances. Cause not readily determined accounted for 20% and oily substance 5%.

We tested discolored surfaces more closely than the rest. We found that discolored areas did not fail anymore than nondiscolored areas. There does not appear to be a direct correlation between discolored surfaces and not passing magnetic permeability.

All areas of high magnetic permeability were remediated by grinding with the exception of the oily substance. This was removed by cleaning with acetone.

We also witnessed one of the parts being turned over with chains and a forklift, the same way we do at Carondelet. The chain had made a deep scratch into the part and after checking for magnetic permeability the area was rejected for a higher reading than the 1.02 allowed. Also, the forklift scrapped across a 4" surface and this area was also checked and rejected for a higher reading than the 1.02 allowed.

MTM personnel were very helpful especially Mike Griffin.

***Bob Carlton***

Quality Assurance

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## Bob Carlton Report follows

On 6/19/06 I traveled to Indiana to remediate the area of high magnetic permeability on the A2 Coil at MTM. I tested the non-machined surfaces with MTM's severn gauge and found that the A2 coil contained areas where the limit of 1.02 was exceeded.

The results where the same as the previous visit on 5/15/06, cause was mainly due to adhering sand. A few places it appeared that nonconformance was caused by small amounts of sand inclusions and heat treat scale. I did find one spot that an oily substance was the cause.

Sand related causes accounted for about 75% of the nonconformances. Cause not redily determined accounted for 20% and the oily substance 5%.

All areas of high magnetic permeability was remediated by grinding with the exception of the oily substance. This was removed by cleaning with acetone.

Mike Griffin was again very helpful along with other MTM personnel.

*Bob Carlton*

Quality Assurance

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