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"Excellence in Metallurgical Engineering"

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New Supplier Approval

By

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Subject

Evaluation of two (SJ) SAE Grade 8 Bolts to determine their suitability for use in equipment assembly. The bolts were examined by hardness testing and metallographic examination. The reason for this study was that there was a problem with Grade 8 bolts being sold in the United States at the time of this evaluation. There are many defects that affect the life of a product that are most easily identified by metallographic examination. These defects usually cannot be found by non-destructive testing methods.

Hardness Test

The hardness testing was done according to ASTM E 384, using a Knoop indenter and a 500 gram load. The results of the testing are given in the following table.

Hardness Test Data
(Rockwell C Scale)

Sample	VICKERS	STD DEV	MAX VALUE	MIN VALUE	HARDNESS	Specification
Bolt - 1	365.00	6.99	373.00	356.00	36.44 RC	33 – 39 RC
Bolt - 2	388.00	5.83	397.00	383.00	38.68 RC	33 - 39 RC

The hardness testing showed that both bolts had the correct hardness for SAE Grade 8 bolts.

Metallographic Examination

Figures 1 and 2 show thread defects found in Bolt 1. The defects were likely the result of seams on the steel bar or wire used to manufacture the bolts. Most of the threads examined had at least one surface defect. The defect in the right hand threads of Figures 1 and 2 were sharp, and could act as stress risers for fatigue. The large number of thread defects found on this bolt means that it was not suitable for use in dynamically loaded applications.

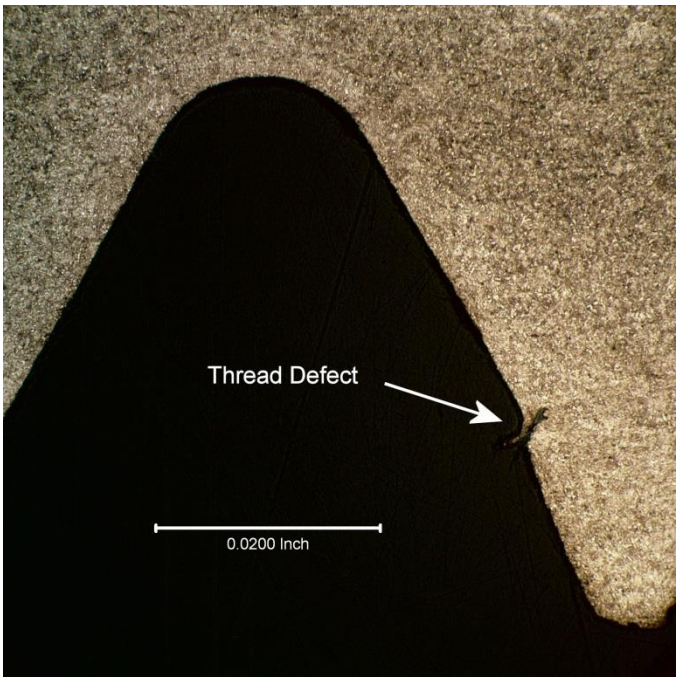

Figure 1 – 100X Thread Defect Bolt 1

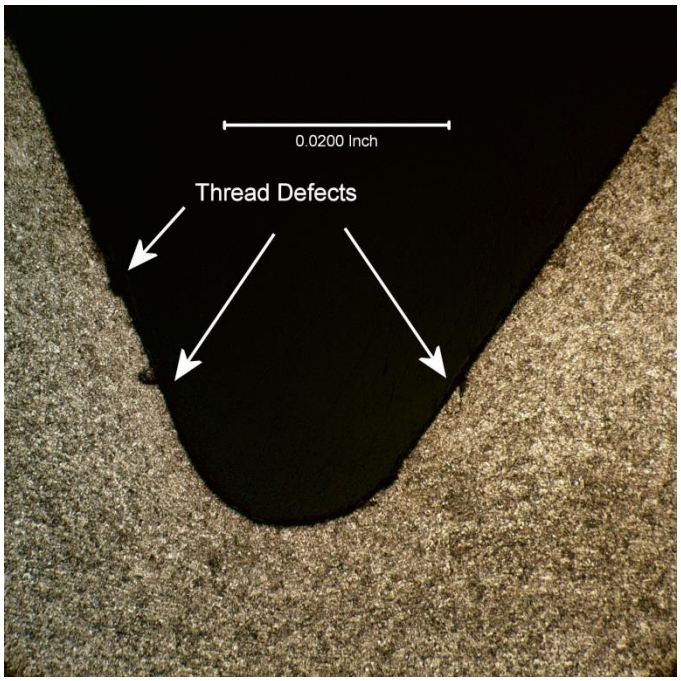

Figure 2 – 100X Thread Defects Bolt 1

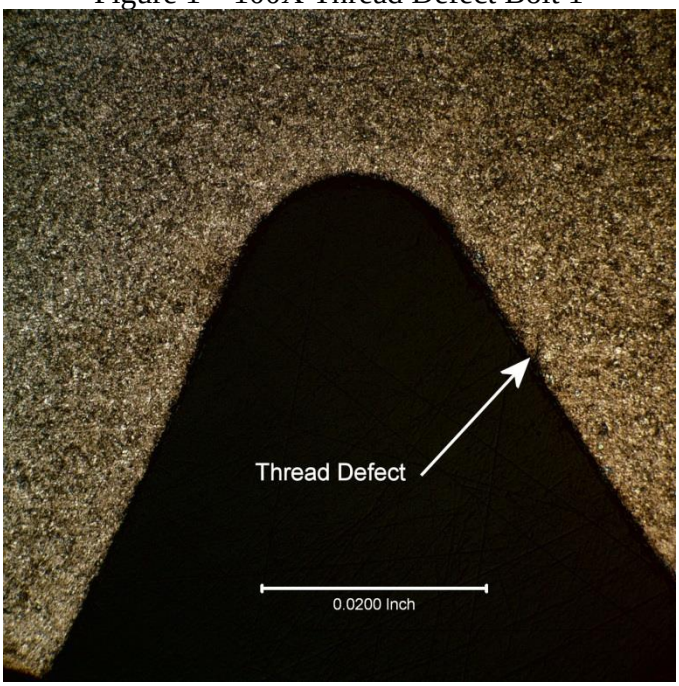

Figure 3 – 100X Thread Defect Bolt 2

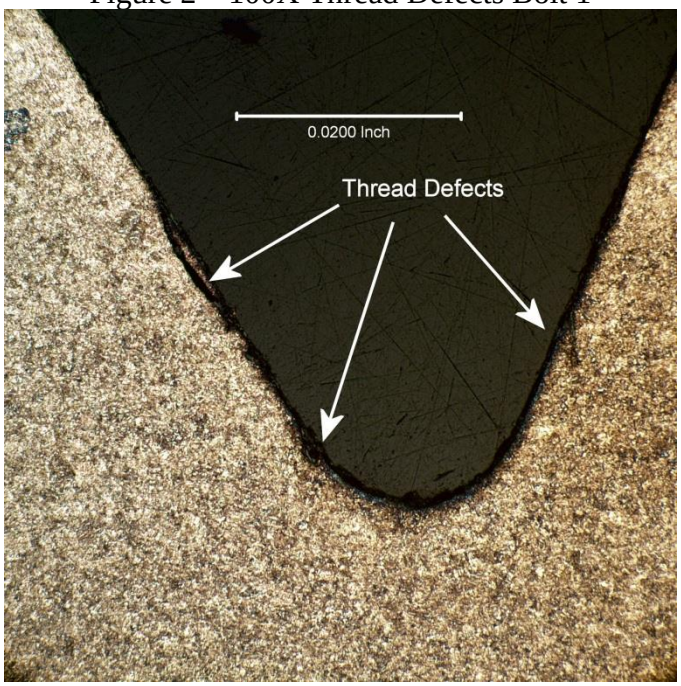

Figure 4 – 100X Thread Defects Bolt 2

Bolt 2, Figures 3 and 4, had the same type and similar number of defects found in Bolt 1. These defects were the result of defects in the steel used to produce the bolts.

The heat treatment of Bolts 1 and 2 was very good. The microstructure was tempered martensite, and the grain size was very fine. The thread surfaces were free of decarburization.

Two of the threads on Bolt 2 had defects that were the result of thread rolling, Figures 5 and 6. These defects could result in reduced clamping loads when the bolts are torqued, because of the misshaped threads increasing the friction between the bolt and nut.

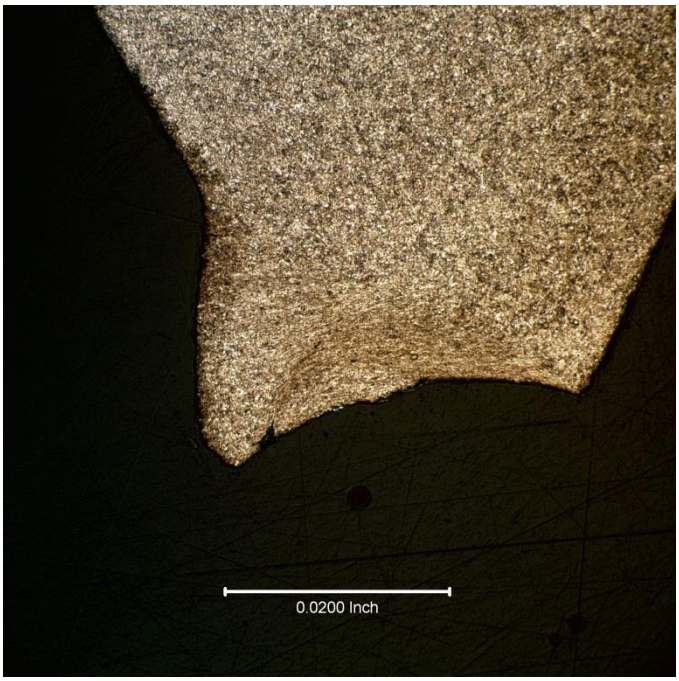

Figure 5 – 100X Thread Rolling Defect Bolt 2

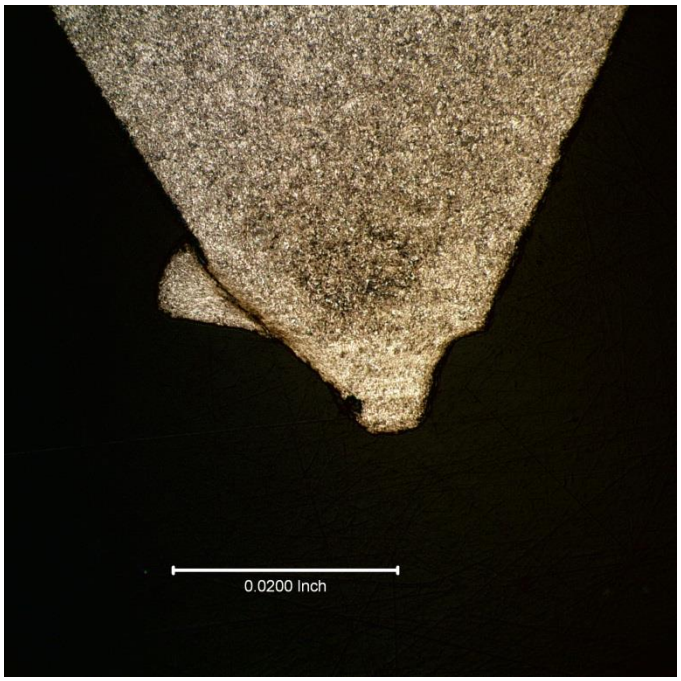

Figure 6 – 100X Thread Rolling Defect Bolt 2

Conclusion

Because of the large number of thread defects found on these two bolts, it was my conclusion that SJ Bolts were not suitable dynamically loaded products.

There were bolt supply problems at the time of this project. Many imported bolts were not meeting the normal quality standards. This was similar to the steel supply problems in the current economy.