Summary of Replies for AMS6345D

Print

Name	Committee	Comment Type	Section/Paragraph
Charles Himmelblau	AMSE	I	3.2

Same comments to 3.2 and 3.3.1 as in my responses to ballot AMS6485K.

Robert Hodder	AMSE	T	3.2 Subs

Use of "or otherwise heat treated" (apparently inserted as part of the last revision) is newly proposed text in four other AMSs being revised at this time, except that the others are "annealed" rather than "normalized" - as an example see proposed AMS6350N. Whatever action is taken for those other specs would seem to be applicable to this spec.

However, it's interesting to note that this spec includes MINIMUM strength requirements while proposed AMS6350N for the same product includes a MAXIMUM strength/hardness requirement. This suggests a true normalizing cycle - not a softening treatment - may be required for this spec. A producer of material supplied to this spec can offer technical insight.

Fred Cone	AMSE	I	3.2 and 3.3.2

Need to resolve discussions in other disapproving ballots.

Brian DeLisa	AMSE	I	3.2.1, 3.2.2, 3.2.2.1

Although these paragraphs were not changed in the ballot, it has been my experience that producers use the "or otherwise heat treated" option, but customers want the material normalized.

Ronald Hahn	AMSE	T	3.3.2

Presumably the control on average grain size was included to determine if each lot of material had been properly processed. There has not been any data presented that ensures that abused (overheated) material will have the proper grain size in the final product. Thus I disagree with changing the sampling from per “lot” to per “heat” and the use of “grain refiners” to qualify a heat until this data is presented.

If either grain size revision is not accepted then the "Report" paragraph will need revision.

Grain size test in AMS specs is a heat capability test

Iul#Dxj#34#4;=3;=65#HGW#5347#e|#**Michael He**

Your T comment appears to be based on a concern that the grain size of the final heat treated condition be verified to ensure fitness for service. “Per Heat” testing certainly does not accomplish that. However, the specification in question does not cover material supplied in the final heat treated condition, so the concern you’ve raised is beyond the scope of this document. If the grain size in the final heat treated condition is truly required, then all AMS Committee E specifications need to be changed to state that. This means whoever supplies the finished component will suddenly have to start reporting grain size in the final heat treated condition. For many materials covered by Committee E, it is not possible to reveal grain size in this condition. What would a supplier do in that case?

Also, if grain size in the final heat treated condition must be reported, then a specific method for evaluating grain size which does not require re-austentization of the specimen must be clearly stated in the specification.

Grain size testing per ASTM E112 is a capability test, which means the result is not dependent on previous heat treatment of the test specimen. Rather, it’s a test to show the material’s response to a lab furnace cycle that is intended to mimic the actual austenitizing temperature that the material would be subject to. Since the specimen is austenized during the preparation phase of the test, the resultant grain size is mainly chemistry dependent. The method outlined in ASTM E112 does not allow a user to draw any conclusions about the quality of the heat treatment applied to the parts but only to conclude that when heat treated in a manner similar to that used on the specimen, the heat is capable of producing the measured grain size.

Heat vs Lot- versus chemistry- evidence of good processing

P rq#Dxj#37#44=63=3<#HGW#5347#e|#**Ronald Hahn**

The requirement of AMS6345 is “Average Austenitic Grain Size”. The origin spec of MIL-S-18729 is just “grain size” as follows:
“4.8 Grain size
4.8.1 Sampling. One sample shall be selected to represent each heat of steel from which material is presented for acceptance.
4.8.2 Method. Specimens shall be sectioned and polished to appropriate fineness by metallographic methods and suitably etched to reveal the grain structure. The austenitic grain size shall be determined in accordance with Method 311 of Fed. Test Method Std. No. 151.”

Note that this does not allow heat treatment.

I was unable to get to Method 311, but there is a reference to ASTM E 112 in the Change Notices of FED-STD-151.

The requirement in AMS6345 was “Average grain size”, in AMS6345A it had morphed into “average austenitic grain size”.

The requirement is in the section that is still under the as shipped condition of “normalized or otherwise heat treated”. Thus looking at 4.8.2 it is questionable as to what grain size is required. Is it the condition of AMS6345 para. 3.2 or some heat treated condition imposed by ASTM E 112. Or can you see the austenitic grain size on an etched sample of normalized alloy steel.

Other specs require “average grain size” (not “average austenitic grain size”) on the as supplied condition. While other AMS specs require the grain size to be conducted on a hardened capability test sample. So is the grain size requirement in the wrong place in some alloy steel specs?

Per previous comments: If the grain size measurement is not useful for determining that the material is ensured to be useful in service, then what good is it? There are two areas where grain size is required, on as softened material and on hardened material.

Before we go imposing grain size on a “heat” basis, we need to determine what we really are trying to do and how does that realistically protect material against being abused in processing.

This applies to all the plate specs where it is being proposed to do only heat lot or heat chemistry as the basis for resolving the grain size question.

Grain size capability

Wxh#Dxj#38#48=43=64#HGW#5347#e|#**Terry Tressler**

I believe that the germane points have been made by others and are as follows;
For material that is provided without the final heat treatment, a final actual grain size cannot yet be determined.
What can be determined at this semi-finished condition is a grain size that represents the capability of the material given processing simulating that typical of final austenitizing heat treatment.
On this basis the appropriate test frequency is per heat.

Several previous and current requirements.

Wxh#Dxj#45#43=49=54#HGW#5347#e|#**Ronald Hahn**

There are several scenarios that need to be addressed. It is not clear that any of these can resolve whether mistreated/miss-processed material would have good grain size afterwards.
1. Sampling of finished material from each heat presented at one time and polished and etched. Origin of AMS6345, i.e. MIL-S-18729.
2. Finished material “average grain size” per ASTM E 112. Polished and etched. MIL-S-18729
3. Finished material “average grain size” per ASTM E 112. AMS6350 (originally on rerolling slab)
4. Finished material “average austenitic grain size” per ASTM E 112. AMS6345C
5. Finished material capability tested for “average grain size” after specified heat treatment.
6. Grain Size: Shall be predominantly 5 or finer with occasional grains as large 3 permissible, determined in accordance with ASTM E112, Appendix III, Section A1, Treatment (2). AMS6385A (full AMS6385 text not available.)
7. Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112, McQuaid-Ehn Test. AMS6395

Robert Hodder	AMSE	T	3.3.2

Do not add the inserted words, nor 3.3.2.1 and 3.3.2.2.

This proposal should not be accepted for the following reasons: (1) Hot work of the product could abuse/overheat the metal, thereby causing large grain size compared to that of a different product made from the same heat, or could result in causing large grain in spite of the aluminum content. (2) A run-away thermal cycle used for softening could result in undetected grain coarsening. (3) Because this is an aerospace material spec demanding appropriate quality control the existing grain size sampling is warranted. (4) The proposed can be identified as a downgrade, which SAE/AMS policy does not permit.

Related to Control of Grain Size (3.3.2)

Prq#Dxj#4;#49=66=69#HGW#5347#e|#**Robert Hodder**

The purpose of this posting is to supplement my initial vote as follows:

All of us will agree that control of grain size is important, especially as relates to properties for which our AMSs typically don't test .....such as fatigue and fracture toughness. With that in mind,I call our attention to text presented in ASTM E 112, specifically within Note A.3.1 that reads: "Austenitic grain size is also influenced by most previous treatmentsto which the steel may have been subjected as, for example, austenitizing temperature, quenching, normalizing, hot work, and cold working. It is therefore advisable, when testing for austenite grain size, to consider the effects of prior or subsequent treatments, or both, on the precise piece (or typical piece) that is under consideration." Thusly, the quality control concern relates to each production lot, not to an all-inclusive heat.

Perhaps part of the concern associated with determining austenitic grain size relates to how to deal with the typical mill product, i,e, ferritic steels in the softened condition for which the austenitic grain size can not be optically read in the as-supplied condition. Much coverage is given to this subject in Annex 3 of ASTM E 112. A thermal treatment is needed to delineate grain boundaries, and seven candidate procedures from which to choose are detailed. Each involves austenitizing at a temperature suitable for low alloy steels (1500-1700 F). Not stated, though appropriately necessary, is the fact that for higher alloyed steels a higher austenitizing temperature is to be used. For those materials the AMS material specification specifies the heat treatment. Popular examples of this would be AMS6487 for H-11 and AMS6491 for M50. In a sense, this test is a demonstration of capability. When conforming, the result provides confidence to the user that when final (service) heat treatment is properly conducted the specified grain size will be satisfied. (I might add here that to read grain size on a hardened and tempered product does not involve re-austenitizing and that it can be a challenge------but that is another subject.)

Of course, if the product in question is austenitic, the grain size can be directly determined sans any pre-treatment.

In summary, my T vote directed at 3.3.2 of AMS6345D is applicable to the six proposed specifications that present the same requirement. Further, I don't feel that how a grain size requirement is stated in other AMSs warrants serious concern by the commitee. It has been understood by industry for years.

Robert Steffen	AMSE	T	3.3.2

Using aluminum content to "prove" grain size < 5 should be supported by more data than "ASTM has accepted this method". AMS needs to be able to point to a technical report to demonstrate this type of control.

Technical justification also needed to demonstrate why "heat" control is sufficient (e.g., why subsequent thermal processes cannot further deteriorate the GS.

Jacque Bader	AMSE	T	3.3.2

concur with issues raised by other commentors

Roger Sines	AMSE	T	3.3.2

Agree with Steffen, et al, that the grain size premise is not validated.

Shlomo Ramati	AMSE	T	3.3.2

Steffan's concerns are correct as in the previous spec

Deborah Fialkowski	AMSE	T	3.3.2

3.3.2 The current requirements for Grain Size requires the austenitic grain size to be evaluated per ASTM E112, McQuaid-Ehn test. This requirement merely shows the worst case capability of the material as all prior heat treatments performed below 1700F are erased. Therefore the delivered condition of each lot is irrelevant with respect to Grain Size evaluation. The as-delivered condition would be the same or finer than that determined by E112. The requirement currently is not defined as the grain size of the as-delivered product, but rather the capability of the steel in the austenitic phase, which is chemistry dependent.

The use of Aluminum as a grain refiner has been studied and documented for over 60 years. One more recent reference is "Steels: Processing, Structure, and Performance" by George Krauss, ASM International, 2005. Chapter 8 contains over 40 references to other technical publications.

General Commentary: The scope of this specification is for material supplied to the parts manufacturer (whether or not via a steel service center). The material as it leaves the mill is to be normalized "or otherwise heat treated" such and Q&T , (per the condition paragraph 3.2) to meet tensile properties for the parts manufacturer to work with to make the parts and to subsequently heat treat the parts as necessary for the final product condition. The material is to have the capability to achieve a fine grained structure based on the prior austenite grain size achieved when a McQuaid-Ehn test is performed. Any heat treatment in excess of the grain coarsening temperature (generally over 1850F), could result in a coarse grain structure, but such post-material specification processes are beyond the scope and control of this material specification requirements. The current spec as written does not protect the material from any abusive heat treatments that occur after the material is supplied.

Ronald Hahn	AMSE	T	3.3.4

Decarburization shall be by "lot". It is not a heat property.

The other material specs of this series do not specify the location or frequency of testing. The number of samples will be an issue with AMS2370. "Per lot" needs to be added to the other specs in this series.

Testing Frequency in the paragraph titles

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I agree that Decarburization should be per lot and not per heat. It seems inappropriate for the paragraph titles to contain “per Heat” or “per Lot”. AMS 2370 covers the frequency of testing (for Grain Size and for Decarburization) and the definition of the lot per table 2. The material spec should only specify the frequency if it takes exception, when more restrictive, to Table 2 of AMS 2370. If more restrictive, then it seems more appropriate for the frequency of sampling to be in the paragraph and not in the title.

Patrick Nowak	AMSE	I	ALL

APPROVE

See comments in AMS6385 ballot regarding heat vs. lot testing and role of aluminum as a grain refiner.

Sy Sweet	AMSE	I	All

Waive

Sy Sweet	AMSE	I	All

Waive

Ronald Hahn	AMSE	I	Rationale

Remove "condition" from the Rationale as there is not any change there. If the grain size and decarb changes are not accepted, then it is suggested that the specification be held until its due date unless the GA on decarb is accepted.

Remove "condtion" from Rationale

Z hg#Dxj#53#49=7;=73#HGW#5347#e|#**Deborah Fialkowski**

Agreed. There is no change to condition in this spec. However, the "or otherwise heat treated" phrase will permit a quench and temper, which in some cases is required to meet the tensile properties of this specification. Do all permitted heat treatments need to be listed? Should the word "suitably" be added as "or otherwise suitably heat treated".

otherwise heat treated

Z hg#Dxj#53#55=8<=7;#HGW#5347#e|#**Ronald Hahn**

I believe that this is the only spec that carries over the "or otherwise heat treated" from the MIL spec. All the others that were carried over did not have the "or otherwise heat treated" in the MIL spec. and while this is not the location to ballot against the other specs, it should not be added to the other specs just because it is in this one.