# Importance of Accurate Specification Conversions

- Many technical data packages (TDPs) need updating to convert canceled or obsolete specifications to current specifications
- Contracts are often unnecessarily delayed by as much as one year due to inaccurate specifications
- Suppliers no longer support old specs
- Conversion to modern specs is difficult

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# Ensure These Designations are Updated

- Alloy Number
  - Commercial alloy designations can change
- Casting Inspection Class and Radiographic Grade
  - Critical for determining nondestructive testing (NDT) requirements for inspection frequency and radiographic soundness
- Mechanical Properties Class
  - Determines mechanical property and test coupon requirements

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# Verify Alloy Designation

## Cast aluminum example:

- Commercial designation was 220
- Current Aluminum Association designation is 520

Reference:
https://www.faa.gov/aircraft/air_cert/design_approvals/csta/publications/media/formerdesignations.pdf

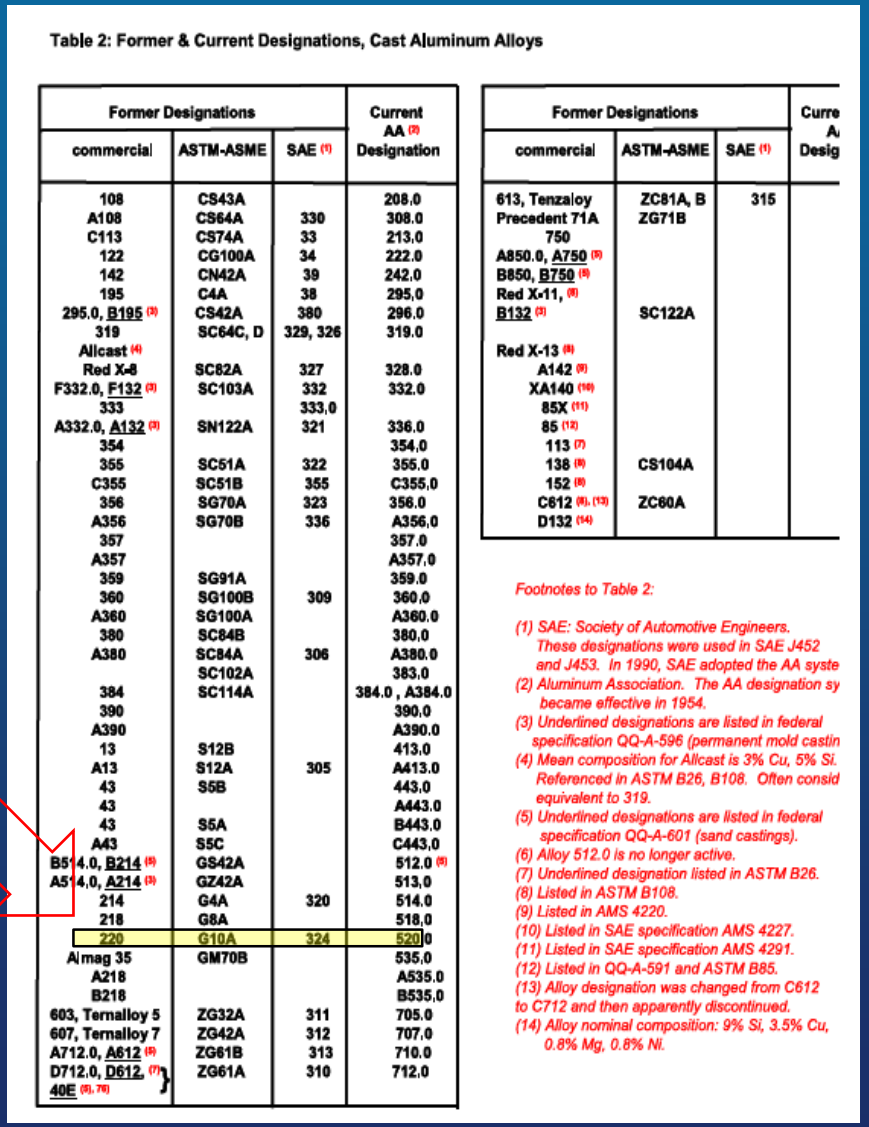

Table 2: Former & Current Designations, Cast Aluminum Alloys

| Former Designations | | | Current AA [2] Designation |
|---|---|---|---|
| commercial | ASTM-ASME | SAE [1] | |
| 108 | CS43A | | 208.0 |
| A108 | CS64A | 330 | 308.0 |
| C113 | CS74A | 33 | 213.0 |
| 122 | CG100A | 34 | 222.0 |
| 142 | CN42A | 39 | 242.0 |
| 195 | C4A | 38 | 295.0 |
| 295.0, B195 [3] | CS42A | 380 | 296.0 |
| 319 | SC64C, D | 329, 326 | 319.0 |
| Alcast [4] | | | |
| Red X-8 | SC82A | 327 | 328.0 |
| F332.0, F132 [3] | SC103A | 332 | 332.0 |
| 333 | | 333.0 | |
| A332.0, A132 [3] | SN122A | 321 | 336.0 |
| 354 | | | 354.0 |
| 355 | SC51A | 322 | 355.0 |
| C355 | SC51B | 355 | C355.0 |
| 356 | SG70A | 323 | 356.0 |
| A356 | SG70B | 336 | A356.0 |
| 357 | | | 357.0 |
| A357 | | | A357.0 |
| 359 | SG91A | | 359.0 |
| 360 | SG100B | 309 | 360.0 |
| A360 | SG100A | | A360.0 |
| 380 | SC84B | | 380.0 |
| A380 | SC84A | 306 | A380.0 |
| | SC102A | | 383.0 |
| 384 | SC114A | | 384.0 , A384.0 |
| 390 | | | 390.0 |
| A390 | | | A390.0 |
| 13 | S12B | | 413.0 |
| A13 | S12A | 305 | A413.0 |
| 43 | S5B | | 443.0 |
| 43 | | | A443.0 |
| 43 | S5A | | B443.0 |
| A43 | S5C | | C443.0 |
| B514.0, B214 [5] | GS42A | | 512.0 [6] |
| A514.0, A214 [3] | GZ42A | | 513.0 |
| 214 | G4A | 320 | 514.0 |
| 218 | G8A | | 518.0 |
| 220 | G10A | 324 | 520.0 |
| Almag 35 | GM70B | | 535.0 |
| A218 | | | A535.0 |
| B218 | | | B535.0 |
| 603, Ternalloy 5 | ZG32A | 311 | 705.0 |
| 607, Ternalloy 7 | ZG42A | 312 | 707.0 |
| A712.0, A612 [8] | ZG61B | 313 | 710.0 |
| D712.0, D612 [7] | ZG61A | 310 | 712.0 |
| 40E [9], [10] | | | |

| Former Designations | | | Curre A Desig |
|---|---|---|---|
| commercial | ASTM-ASME | SAE [1] | |
| 613, Tenzaloy | ZC81A, B | 315 | |
| Precedent 71A | ZG71B | | |
| 750 | | | |
| A850.0, A750 [5] | | | |
| B850, B750 [5] | | | |
| Red X-11, [8] | | | |
| B132 [3] | SC122A | | |
| Red X-13 [8] | | | |
| A142 [9] | | | |
| XA140 [10] | | | |
| 85X [11] | | | |
| 85 [12] | | | |
| 113 [7] | | | |
| 138 [8] | CS104A | | |
| 152 [8] | | | |
| C612 [6], [13] | ZC60A | | |
| D132 [14] | | | |

*Footnotes to Table 2:*

*(1) SAE: Society of Automotive Engineers. These designations were used in SAE J452 and J453. In 1990, SAE adopted the AA syste*
*(2) Aluminum Association. The AA designation sy became effective in 1954.*
*(3) Underlined designations are listed in federal specification QQ-A-596 (permanent mold castin*
*(4) Mean composition for Alcast is 3% Cu, 5% Si. Referenced in ASTM B26, B108. Often consid equivalent to 319.*
*(5) Underlined designations are listed in federal specification QQ-A-601 (sand castings).*
*(6) Alloy 512.0 is no longer active.*
*(7) Underlined designation listed in ASTM B26.*
*(8) Listed in ASTM B108.*
*(9) Listed in AMS 4220.*
*(10) Listed in SAE specification AMS 4227.*
*(11) Listed in SAE specification AMS 4291.*
*(12) Listed in QQ-A-591 and ASTM B85.*
*(13) Alloy designation was changed from C612 to C712 and then apparently discontinued.*
*(14) Alloy nominal composition: 9% Si, 3.5% Cu, 0.8% Mg, 0.8% Ni.*

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# Incorrect Specification Conversion QQ-A-596 to ASTM B686

- Obsolete spec QQ-A-596 specifies the same alloy and temper as ASTM B686, but is NOT specific for soundness/NDT
- ASTM B686 allows soundness/NDT choice between 4 classes and 4 grades, as well as mechanical properties class specification
- Incorrect conversion causes unnecessary over-specification which drives costs up

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# Impact of Incorrect Conversion QQ-A-596 to ASTM B686

- Too severe of a soundness requirement may cause part producibility to be impractical or uneconomical

- For example, specifying Class 1, Grade A requires a part to have **NO discernable radiographic discontinuities**, and that **every casting must be x-rayed 100% (all over)**

*Refer to ASTM B686 paragraph 4.1.2 Note 1 and ASTM B686 paragraph 15.1.4.1 "Class 1 Castings – Each shall be completely examined."*

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# Correct Specification Conversion QQ-A-596 to ASTM B108/108M

- Same alloy, temper, tests, and properties
- Incorrect change to ASTM B686 caused alloy change from 356-T6 to A356-T6, no x-ray to Class 2 / Grade B, and higher mechanical property requirements
- If increased requirements are necessary, they should be explained
- Requiring tighter chemistry, x-ray, and test bar properties increased costs and delayed contract delivery by one year

# Casting Note Tips

- QQ specs often convert closely to ASTM
- ASTM typically have multiple alloys and testing requirements
- MIL specs often convert directly to SAE / AMS
- SAE / AMS have single alloy and temper designations
- Critical application parts often use SAE / AMS
- MIL-C-6021H converts closely to SAE / AMS 2175
- MIL-C-6021G has different class and grade designations and requires special attention when updating

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# MIL-C-6021G to AMS 2175
## *Class Changes are Confusing*

| MIL-C-6021G | converts to | AMS 2175 |
|---|---|---|
| • Class 1A | | • Class 1 |
| • Class 1B | | • Class 2 |
| • Class 2A | | • Class 3 |
| • Class 2B | | • Class 4 |

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# Considerations for Conversion of MIL-A-21180 to AMS-A-21180

- Very similar (almost identical) specs
- Used for high-strength and critical applications
- Mostly used for aircraft parts
- Provides critical and non-critical requirements
- AMS-A-21180 references modern versions of NDT, for example, it uses AMS 2175 in place of obsolete MIL-C-6021

***Correct conversions of NDT class and grade are essential!***

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# Modern AMS Specs for AMS-A-21180 Conversion

| AMS-A-21180 | AMS |
|---|---|
| A201-T7 | 4229 & 4242 |
| 354 | N/A |
| C355-T6 | 4215 |
| A356-T6 | 4218 |
| A357-T6 | 4218, 4289, 4241, 4249 |
| E357* | 4288 |

* Not in original MIL-A-21180

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# Recommendations

TDPs should:

- Call out alloy designations and temper (strength) designations accurately and completely including alloy, class, and grade
- Cross-reference old (former) alloy designations to current designations (e.g. 220 is now 520) so that there is no question which alloy is required
- Provide current specifications that are still active (not cancelled)
- Not over-specify requirements when specs are converted