**BOMBARDIER**
Toronto (de Havilland)
**PROPRIETARY INFORMATION**

# PPS 23.05

**PRODUCTION PROCESS STANDARD**

# DESIGNATION OF MAGNESIUM ALLOYS

Issue 2
- This standard supersedes PPS 23.05, Issue 1.
- Vertical lines in the left hand margin indicate changes over the previous issue.

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This PPS is effective as of the distribution date specified on the accompanying distribution notice.

Direct any PPS related questions to the PPS Group (416) 375-4365.

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## 1 SCOPE

1.1 This Production Process Standard (PPS) explains the alloy designations, temper designations and material specifications of magnesium alloys.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction and the procedure specified must be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

## 2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

## 3 REFERENCES

3.1 PPS 13.26 - General Subcontractor Provisions.

## 4 ALLOY DESIGNATIONS

4.1 Magnesium alloys are designated by a three part alpha-numeric code as defined by the American Society for Testing and Materials (ASTM).

4.2 The magnesium alloy designation consists of not more than two letters representing the principal alloying elements arranged in order of decreasing percentages, or in alphabetical order if of equal percentages, followed by the respective percentages rounded off to whole numbers and followed by a serial letter to differentiate otherwise identical designations.

4.3 Refer to Table I for a complete breakdown of the magnesium alloy designation system.

**TABLE I - DESIGNATION OF MAGNESIUM ALLOYS**

| FIRST PART | SECOND PART | THIRD PART |
|---|---|---|
| ONE OR TWO LETTERS<br>- Indicating the principal alloying element(s).<br>- Consisting of one or two code letters representing the principal alloying element(s).<br>- Arranged in order of decreasing percentage (or alphabetically if percentages are equal).<br>- Alloy Element Codes:<br>A - Aluminum M - Manganese<br>B - Bismuth N - Nickel<br>C - Copper P - Lead<br>D - Cadmium Q - Silver<br>E - Rare Earth R - Chromium<br>F - Iron S - Silicon<br>H - Thorium T - Tin<br>K - Zirconium Z - Zinc<br>L - Beryllium | ONE OR TWO FIGURES<br>- Indicating the respective amount(s) of the principal alloying element(s).<br>- Consisting of one or two numbers corresponding to the percentage of the principal alloying element(s).<br>- Arranged in same order as the alloying elements in first part.<br>- Signifies the mean of the range (or minimum if only that is specified) rounded off to whole numbers. | ONE LETTER<br>- Differentiate otherwise identical designation.<br>- Consisting of a letter assigned in alphabetical sequence (except I and O) starting with 'A'.<br>- 'A' signifies the first alloy whose composition qualified assignment of a particular basic designation. 'B' and subsequent letters would signify subsequently developed alloys whose compositions differ slightly but do not differ sufficiently to effect a change in the basic designation. |
| For example: **AZ91C**<br>• 'A' represents aluminum, the alloying element in the greatest amount.<br>• 'Z' represents zinc, the alloying element in the second greatest amount.<br>• '9' indicates the rounded mean aluminum percentage, ie. 9%.<br>• '1' indicates the rounded mean zinc percentage, ie. 1%.<br>• 'C' indicates the third alloy developed with the basic AZ91 designation but with a composition slightly different from the first two, ie AZ91A and AZ91B. | | |

## 5 TEMPER DESIGNATIONS

5.1 The temper designation, consisting of an alpha-numeric code, follows the alloy designation, the two being separated by a dash.

5.2 The temper designation indicates the treatment (thermal or otherwise) to which the alloy has been subjected in order to produce specific mechanical properties.

5.3 Temper designations for non-heat treatable magnesium alloys are listed in Table II.

5.4 Temper designations for heat treatable magnesium alloys are listed in Table III.

## 6 MATERIAL SPECIFICATIONS

6.1 Table IV lists the material specifications for the magnesium alloys and product forms used at Bombardier Toronto (de Havilland).

**TABLE II - TEMPER DESIGNATION OF NON-HEAT TREATABLE MAGNESIUM ALLOYS**

| TEMPER DESIGNATION | DEFINITION |
|---|---|
| F | As fabricated - applies to products that acquire some temper from shaping processes not having special control over the amount of strain hardening or thermal treatment. |
| O | Annealed, Re-crystallized (Wrought Products Only) - Softest temper of wrought products. |
| H12 | Strain-hardened to one-quarter-hard temper. |
| H14 | Strain-hardened to half-hard temper. |
| H16 | Strain-hardened to three-quarters-hard temper. |
| H18 | Strain-hardened to full-hard temper. |
| H22 | Strain-hardened and partially annealed to one-quarter-hard temper. |
| H24 | Strain-hardened and partially annealed to half-hard temper. |
| H26 | Strain-hardened and partially annealed to three-quarters-hard temper. |
| H28 | Strain-hardened and partially annealed to full-hard temper. |
| H32 | Strain-hardened to one-quarter-hard temper and then stabilized. |
| H34 | Strain-hardened to half-hard temper, and then stabilized. |
| H36 | Strain-hardened to three quarters-hard temper, and then stabilized. |
| H38 | Strain-hardened to full-hard temper, and then stabilized. |
| H112 | As fabricated to special properties as specified. |

**TABLE III - TEMPER DESIGNATIONS OF HEAT TREATABLE MAGNESIUM ALLOYS**

| TEMPER DESIGNATION | DEFINITION |
|---|---|
| F | As fabricated - applies to products that acquire some temper from shaping processes not having special control over the amount of strain hardening or thermal treatment. |
| O | Annealed, Re-crystallized (Wrought Products Only) - Softest temper of wrought products. |
| W | As quenched condition following solution heat treatment. This condition is unstable and applies only to alloys which spontaneously age at room temperature after solution heat treatment. |
| T1 | Cooled from an elevated temperature shaping process and naturally aged to a substantially stable condition. |
| T2 | Annealed (Cast Products Only) - a type of annealing treatment used to improve ductility and increase stability of castings. |
| T3 | Solution heat treated and then cold worked. |
| T4 | Solution heat treated and naturally aged to a substantially stable condition. |
| T5 | Cooled from an elevated temperature shaping process and then artificially aged. |
| T6 | Solution heat treated and then artificially aged. |
| T7 | Solution heat treated and then stabilized. |
| T8 | Solution heat treated, cold worked, and then artificially aged. |
| T9 | Solution heat treated, artificially aged, and then cold worked. |
| T10 | Cooled from an elevated temperature shaping process, artificially aged, and then cold worked. |

**TABLE IV - MATERIAL SPECIFICATIONS FOR MAGNESIUM ALLOYS**

| MATERIAL SPECIFICATION | ALLOY | MILL PRODUCT FORM |
|---|---|---|
| QQ-M-44 | AZ31B | Sheet and Plate (Rolled) |
| QQ-M-55 | AZ81A | Permanent Mould Castings |
| QQ-M-56 | | Sand Castings |
| QQ-M-55 | AZ91C | Permanent Mould Castings |
| QQ-M-56 | | Sand Castings |