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REGISTRATION RECORD SERIES  
GRAY SHEETS

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**International Designations  
and  
Chemical Composition Limits  
for  
Aluminum Hardeners**

*(North American and International Registration Record)*



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**With Support for On-line Access From:**  
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## FOREWORD

Listed herein are designations and chemical composition limits for aluminum hardeners registered in accordance with the *Recommendation – International Designation System for Aluminum Hardeners*, which is printed on page 10. Additions may be made as required according to the rules outlined in the Declaration of Accord, printed on page 13, and hardeners will be deleted when no longer in commercial use (See table of Inactive Hardener Alloys).

Some of the registered alloys may be the subject of a patent or patent application and their listing herein is not to be construed in any way as the granting of a license under such patent rights.

The following organizations are signatories to the Declaration of Accord on the Recommendation:

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# REGISTERED CHEMICAL COMPOSITION LIMITS <sup>1,2</sup>

**Only composition limits which are identical to those listed herein or are registered with  
The Aluminum Association should be designated as "AA" hardeners.**

	Designation		Date Registered	Registered By	Si	Fe	Cu	Mn	Cr	Ni	Ti	B	V		Others <sup>4</sup>		Al
	Registered	Alternate													Each	Total <sup>3</sup>	
	H2000	20% Ca	1990-11-05	USA	0.20	0.30	....	....	....	....	....	....	0.05	Ca 18.0-22.0	0.03	0.10	Rem.
**	H2001	10% Ca	2005-08-18	EAA	0.30	0.30	....	....	....	....	....	0.01	....	Ca 9.0-11.0 Zn 0.04 max Pb 0.02 max Sn 0.02 max	0.04	0.10	Rem.
	H2003	3% Bi	1975-01-01	USA	0.20	0.20	....	....	....	....	....	....	....	Bi 2.7-3.3	0.03	....	Rem.
	H2005	5% Be	1977-02-10	USA	0.20	0.40	0.05	0.02	0.02	0.02	0.02	....	....	Be 4.5-6.0 Mg 0.50 max Zn 0.10 max	0.05	0.15	Rem.
	H2007	10% Sr	1982-04-13	USA	0.20	0.30	....	....	....	....	....	....	....	Sr 9.0-11.0 Mg 0.05 max Ba 0.10 max Ca 0.03 max P 0.01 max	0.05	0.15	Rem.
	H2010	25% Mg	1983-08-02	USA	0.10	0.15	....	....	....	....	....	....	....	Mg 23.0-27.0	0.03	0.10	Rem.
	H2011	50% Mg	1983-08-02	USA	0.10	0.15	....	....	....	....	....	....	....	Mg 48-52	0.03	0.10	Rem.
	H2012	3.5% Sr	1983-08-02	USA	0.20	0.30	....	....	....	....	....	....	....	Sr 3.2-3.8 Ca 0.03 max P 0.01 max	0.03	0.10	Rem.
	H2016	8% Bi	1984-07-12	USA	0.20	0.30	....	....	....	....	....	....	....	Zn 0.10 max Bi 7.5-8.5	0.05	0.20	Rem.
	H2017	10%Sr-1%Ti-0.2%B	1986-02-21	USA	0.20	0.30	....	....	....	....	0.9-1.2	0.15-0.25	....	Sr 9.0-11.0 Ca 0.02 max	0.05	0.15	Rem.
**	H2019	15% Sr	2001-07-18	USA	0.20	0.30	...	...	...	...	...	...	...	Sr 14.0-16.0 P 0.01 max Ba 0.10 max Ca 0.05 max	0.05	0.15	Rem.
	H2132	32% Cu	1975-01-01	USA	0.20	0.30	32-34	....	....	....	....	....	....	....	0.05	0.15	Rem.
**	H2148	50% Cu	2005-08-18	EAA	0.30	0.30	47-53	....	....	....	....	0.01	....	Zn 0.05 max Pb 0.02 max Sn 0.02 max	0.04	0.10	Rem.
**	H2149	50% Cu	2008-08-18	EAA	0.50	0.7	47-53	0.40	0.10	0.20	0.10	....	....	Mg 0.50 max Zn 0.20 max	0.05	0.15	Rem.
	H2150	50% Cu	1989-01-30	USA	0.10	0.15	48-52	....	....	....	....	....	....	....	0.05	0.15	Rem.
	H2154	54% Cu	1975-01-01	USA	0.10	0.10	51-57	....	....	....	....	....	....	....	0.05	....	Rem.
	H2201	5% Ti-0.1% B	1975-01-01	USA	0.30	0.35	....	....	....	....	4.5-5.5	0.10-0.20	0.25	....	0.03	0.10	Rem.
	H2202	5% Ti-0.6% B	1975-01-01	USA	0.20	0.30	....	....	....	....	4.5-5.5	0.50-0.7	0.20	....	0.03	0.10	Rem.
	H2203	3% B	1975-01-01	USA	0.20	0.30	....	....	....	....	....	2.5-3.5	....	K 1.0 max Na 0.50 max	0.03	0.10	Rem.
	H2204	4% B	1975-01-01	USA	0.20	0.30	....	....	....	....	....	3.5-4.5	....	K 1.0 max Na 0.50 max	0.03	0.10	Rem.

See footnotes on page 4.

# REGISTERED CHEMICAL COMPOSITION LIMITS 1, 2

**Only composition limits which are identical to those listed herein or are registered with  
The Aluminum Association should be designated as "AA" hardeners.**

	Designation		Date Registered	Registered By	Si	Fe	Cu	Mn	Cr	Ni	Ti	B	V	Others <sup>4</sup>		Al	
	Registered	Alternate												Each	Total <sup>3</sup>		
	H2206	6% Ti	1975-01-01	USA	0.30	0.35	....	....	....	....	5.5-6.5	0.004	0.30	....	0.03	0.10	Rem.
**	H2207	5% Ti-0.2% B	1977-01-19	USA	0.30	0.35	....	....	....	....	4.5-5.5	0.15-0.25	0.25	....	0.03	0.10	Rem.
	H2209	10% Ti	2005-08-18	EAA	0.30	0.7	0.20	0.45	0.10	0.20	9.0-11.0	....	0.50	Mg 0.50 max Zn 0.20 max	0.05	0.15	Rem.
	H2210	10% Ti	1975-01-01	USA	0.30	0.35	....	....	....	0.05	9.0-11.0	0.004	0.50	....	0.03	0.10	Rem.
	H2211	10% Ti-1% B	1977-01-19	USA	0.30	0.35	....	....	....	0.05	9.0-11.0	0.9-1.5	0.50	....	0.03	0.15	Rem.
	H2213	10% Ti-0.4% B	1983-12-28	USA	0.20	0.30	....	....	....	....	9.0-11.0	0.30-0.50	0.10	....	0.03	0.10	Rem.
	H2214	3%Ti-1% B	1984-12-06	USA	0.20	0.30	....	....	....	....	2.8-3.4	0.7-1.1	0.05	....	0.03	0.10	Rem.
	H2217	5% B	1986-05-19	USA	0.20	0.30	....	....	....	....	0.05	4.5-5.5	....	K 1.0 max Na 0.50 max	0.03	0.10	Rem.
	H2218	6% Ti-0.4% B	1987-09-28	USA	0.20	0.30	....	....	....	....	5.5-6.5	0.30-0.50	0.15	....	0.03	0.10	Rem.
	H2219	3% Ti-0.4% B	1987-09-28	USA	0.20	0.30	....	....	....	....	2.7-3.3	0.30-0.50	0.15	....	0.03	0.10	Rem.
**	H2220	3% Ti-0.2% B	1987-09-28	USA	0.20	0.30	....	....	....	....	2.7-3.3	0.15-0.25	0.15	....	0.03	0.10	Rem.
	H2221	10% B	2001-05-10	USA	0.25	0.30	....	....	....	....	...	9.0-11.0	....	K 1.0 max Na 0.50 max	0.03	0.10	Rem.
**	H2222	8% B	2001-07-18	USA	0.25	0.30	....	....	....	....	0.05	7.5-9.0	....	K 1.0 max Na 0.50 max	0.03	0.10	Rem.
	H2231	3% Ti-0.15% C	1997-02-27	USA	0.30	1.5	....	....	....	....	2.6-3.4	0.004	0.30	C 0.08-0.22	0.03	0.10	Rem.
	H2252	5% Ti-1% B	1996-10-08	USA	0.20	0.30	....	....	....	....	4.5-5.5	0.8-1.2	0.20	....	0.03	0.10	Rem.
	H2258	5% Ti-0.18% C	1999-05-20	USA	0.30	0.35	....	....	....	....	4.5-5.5	0.005	0.30	C 0.13-0.23	0.03	0.10	Rem.
	H2264	6% Ti-0.04% C	1996-03-12	USA	0.20	0.35	....	....	....	....	5.5-6.5	0.004	0.05	C 0.03-0.05	0.03	0.10	Rem.
	H2302	36% Si	1983-08-02	USA	34-39	0.50	....	....	....	....	0.07	0.01	0.06	P 0.01 max	0.05	0.15	Rem.
**	H2312	12% Si	1975-01-01	USA	11.0-13.0	0.35	0.10	....	....	....	....	....	....	....	0.05	0.15	Rem.
	H2320	20% Si	2005-08-18	EAA	18.0-22.0	0.30	....	....	....	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max Ca 0.06 max	0.04	0.10	Rem.
**	H2321	20% Si	2005-08-18	EAA	18.0-22.0	0.7	0.20	0.40	0.10	0.20	0.10	....	....	Mg 0.50 max Ca 0.06 max	0.05	0.15	Rem.
	H2350	50% Si	1975-01-01	USA	47-54	0.50	....	....	....	....	0.07	0.01	0.06	....	0.05	....	Rem.
**	H2410	10% Mn	2005-08-18	EAA	0.30	0.30	....	9.0-11.0	....	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max	0.04	0.10	Rem.
**	H2411	10% Mn	2005-08-18	EAA	0.50	0.7	0.20	9.0-11.0	0.10	0.20	0.10	....	....	Mg 0.50 max Zn 0.20 max	0.05	0.15	Rem.
	H2425	25% Mn	1975-01-01	USA	0.20	0.25	....	24.0-26.0	....	....	....	....	....	....	0.03	0.15	Rem.
	H2461	61% Mn	1975-01-01	USA	0.15	0.25	....	58-64	....	....	....	....	....	....	0.03	0.10	Rem.
	H2475	75% Mn	1975-01-01	USA	0.10	0.20	....	74-76	0.10	....	....	....	....	....	0.05	0.15	Rem.
	H2485	85% Mn	1995-01-04	USA	0.10	0.20	....	84-86	0.10	....	....	....	....	....	0.05	0.15	Rem.
	H2500	10% Ni	1975-01-01	USA	0.15	0.20	....	....	....	9.0-11.0	....	....	....	....	0.03	0.10	Rem.
	H2501	20% Ni	1983-08-02	USA	0.15	0.20	....	....	....	18.0-22.0	....	....	....	....	0.03	0.10	Rem.
	H2575	75% Ni	1975-10-10	USA	....	0.10	....	....	0.05	74-76	....	....	....	Co 0.10 max	0.05	0.15	Rem.
	H2600	10% Zr	1983-08-02	USA	0.20	0.25	....	....	....	....	0.05	....	....	Zr 9.0-11.0	0.03	0.15	Rem.
	H2602	2.5% V	1977-01-19	USA	0.20	0.25	....	....	....	....	0.03	0.01	2.0-3.0	....	0.03	0.10	Rem.
	H2603	3% Zr	1977-02-07	USA	0.20	0.25	....	....	....	....	0.05	....	....	Zr 2.7-3.3	0.03	0.10	Rem.

See footnotes on page 4.

# REGISTERED CHEMICAL COMPOSITION LIMITS 1, 2

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The Aluminum Association should be designated as "AA" hardeners.**

	Designation		Date Registered	Registered By	Si	Fe	Cu	Mn	Cr	Ni	Ti	B	V		Others <sup>2</sup>		Al
	Registered	Alternate													Each	Total <sup>3</sup>	
	H2605	5% V	1977-01-19	USA	0.20	0.25	....	....	....	....	0.03	0.01	4.5-5.5	....	0.03	0.10	Rem.
**	H2606	6% Zr	1975-01-01	USA	0.20	0.25	....	....	....	....	0.05	....	....	Zr 5.5-6.5	0.03	0.10	Rem.
	H2607	5% Zr	2005-08-18	EAA	0.30	0.30	....	....	....	....	....	0.01	....	Zr 4.5-5.5 Ca 0.010 max Na 0.005 max Pb 0.010 max Sn 0.010 max Zn 0.04 max	0.04	0.10	Rem.
**	H2610	10% V	2005-08-18	EAA	0.30	0.30	....	....	....	....	....	0.01	9.0-11.0	Pb 0.02 max Sn 0.02 max Zn 0.04 max	0.04	0.10	Rem.
**	H2612	10% Zr	2005-08-18	EAA	0.30	0.45	0.20	....	....	0.20	0.20	....	....	Zr 9.0-11.0 Sn 0.20	0.05	0.15	Rem.
	H2615	15% Zr	1986-02-21	USA	0.35	0.35	....	....	....	....	....	....	....	Zr 13.5-16.0	0.05	0.15	Rem.
	H2632	3% Zr-2% V	1975-01-01	USA	0.20	0.25	....	....	....	....	....	....	1.8-2.2	Zr 2.7-3.3	0.03	0.10	Rem.
**	H2633	6% Zr - 4% V	2001-05-10	USA	0.35	0.35	...	...	...	...	...	...	3.5-4.5	Zr 5.5-6.5	0.05	0.15	Rem.
	H2700	10% Sr-14% Si	1977-02-10	USA	12.0-16.0	1.5	0.05	0.10	0.05	0.05	0.10	....	0.05	Sr 9.0-11.0 Ba 0.50 max Ca 0.50 max P 0.01 max Zr 0.10 max	0.05	0.15	Rem.
**	H2810	10% Fe	2005-08-18	EAA	0.30	9.0-11.0	....	....	....	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max	0.04	0.10	Rem.
**	H2811	10% Fe	2005-08-18	EAA	0.50	9.0-11.0	0.20	0.40	0.10	0.20	0.10	....	....	Mg 0.50 max Zn 0.20 max	0.05	0.15	Rem.
	H2825	25% Fe	1975-01-01	USA	0.30	23.0-27.0	0.05	0.20	....	....	....	....	....	....	0.05	....	Rem.
**	H2845	45% Fe	2005-08-18	EAA	0.30	43-47	....	0.30	....	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max C 0.10 max	0.04	0.10	Rem.
	H2875	75% Fe	1975-10-10	USA	....	74-76	0.15	0.25	0.10	0.10	....	....	....	....	0.05	0.15	Rem.
	H2880	80% Fe	1994-03-31	USA	....	79-81	0.15	0.30	0.10	0.10	....	....	....	....	0.05	0.15	Rem.
**	H2918	10% Cr	2005-08-18	EAA	0.30	0.30	....	....	9.0-11.0	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max	0.04	0.10	Rem.
**	H2919	20% Cr	2005-08-18	EAA	0.30	0.30	....	....	18.0-22.0	....	....	0.01	....	Pb 0.02 max Sn 0.02 max Zn 0.04 max	0.04	0.10	Rem.
	H2920	20% Cr	1975-01-01	USA	0.30	0.55	0.10	....	19.0-21.0	....	....	....	....	....	0.05	0.15	Rem.
**	H2921	20% Cr	2005-08-18	EAA	0.50	0.7	0.20	0.40	18.0-22.0	0.20	0.10	....	....	Mg 0.50 max Zn 0.20 max	0.05	0.15	Rem.
	H2975	75% Cr	1975-10-10	USA	0.30	0.50	....	0.10	74-76	....	....	....	....	....	0.05	0.15	Rem.

See footnotes on page 4.

# FOOTNOTES

1. Composition in weight percent maximum unless shown as a range or a minimum.

Standard limits for alloying elements and impurities are expressed to the following places:

Less than 0.001 percent .....	0.000X
0.001 through 0.01 percent .....	0.00X
0.01 through 0.10 percent:	
Unalloyed aluminum made by	
a refining process .....	0.0XX
Alloys and unalloyed aluminum	
not made by a refining process .....	0.0X
0.10 through 0.55 percent .....	0.XX
(It is customary to express limits	
0.30 percent through 0.55 percent	
as 0.X0 or 0.X5)	
0.55 through 29.9 percent:.....	0.X, X.X, or XX.X
Over 29.9 percent.....	XX

2. Except for "Aluminum" and "Others", analysis normally is made for elements for which specific limits are shown. For purposes of determining conformance to these limits, an observed value or calculated value obtained from analysis is rounded off to the nearest unit in the last right hand place of figures used in expressing the specified limit, based on ASTM Standard Practice E29, as follows:

When the figure next beyond the last figure or place to be retained is less than 5, the figure in the last place retained should be kept unchanged.

When the figure next beyond the last figure or place to be retained is greater than 5, the figures in the last place should be increased by 1.

When the figure next beyond the last figure or place to be retained is 5 and

- a. there are no figures or only zeroes beyond this 5, if the figure in the last place to be retained is odd, it should be increased by 1; if even, it should be kept unchanged;
  - b. if the 5 next beyond the figure in the last place to be retained is followed by any figures other than zero, the figure in the last place retained should be increased by 1 whether odd or even.
3. The sum of those "Others" metallic elements 0.010 percent or more each, expressed to the second decimal before determining the sum.
  4. "Others" includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the registration or specification. However, such analysis is not required and may not cover all metallic "Other" elements. Should any analysis by the producer or the purchaser establish that an "Others" element exceeds the limit of "Each" or that the aggregate of several "Others" elements exceeds the limit of "Total", the material shall be considered nonconforming.

- + Designation registered since previous issue.
- \* Composition limits revised since previous issue.
- \*\* Revision since the January 2000 publication of the North American Registration Record including changes in color codes in accordance with the new color code scheme.



## COLOR CODE FOR ALUMINUM HARDENERS\*

	ORANGE	GRAY	PURPLE	BROWN	GREEN	DARK BLUE	LIGHT BLUE	YELLOW	RED	BLACK	WHITE
WHITE					H2211 <sup>2</sup>				H2000 <sup>2</sup> H2001 <sup>2</sup> H2264	H2302 <sup>2</sup> H2312 <sup>2</sup> H2320 <sup>2</sup> H2321 <sup>2</sup> H2350 <sup>2</sup>	
BLACK	H2602 <sup>2</sup> H2605 <sup>2</sup> H2610	H2500 <sup>2</sup> H2501 <sup>2</sup> H2575 <sup>2</sup>	H2003 <sup>2</sup> H2016		H2207 <sup>2</sup>	H2632 <sup>3</sup> H2633	H2010 <sup>2</sup> H2011	H2005 <sup>2</sup>		H2810 <sup>1</sup> H2811 <sup>1</sup> H2825 <sup>1</sup> H2845 <sup>1</sup> H2875 <sup>1</sup> H2880	
RED			H2231 <sup>2</sup>	H2258 <sup>2</sup>	H2201 <sup>2</sup>		H2017 <sup>3</sup>	H2203 <sup>2</sup> H2204 <sup>2</sup> H2217 <sup>2</sup> H2221 <sup>2</sup> H2222 <sup>2</sup>	H2206 <sup>1</sup> H2209 <sup>1</sup> H2210		
YELLOW					H2202 <sup>2</sup>			H2132 <sup>1</sup> H2148 <sup>1</sup> H2149 <sup>1</sup> H2150 <sup>1</sup> H2154			
LIGHT BLUE							H2007 <sup>1</sup> H2012 <sup>1</sup> H2019 <sup>1</sup> H2700				
DARK BLUE					H2213 <sup>2</sup>	H2600 <sup>1</sup> H2603 <sup>1</sup> H2606 <sup>1</sup> H2607 <sup>1</sup> H2612 <sup>1</sup> H2615					
GREEN	H2218 <sup>2</sup>	H2219 <sup>2</sup>	H2220 <sup>2</sup>	H2214 <sup>2</sup>	H2252 <sup>1</sup>						
BROWN											
PURPLE			H2410 <sup>1</sup> H2411 <sup>1</sup> H2425 <sup>1</sup> H2461 <sup>1</sup> H2475 <sup>1</sup> H2485								
GRAY											
ORANGE	H2918 <sup>1</sup> H2919 <sup>1</sup> H2920 <sup>1</sup> H2921 <sup>1</sup> H2975 <sup>1</sup>										

1. One stripe - single color      For example: Yellow for 2132
2. Two stripes - Different colors      For example: Black/Light Blue for H2010.
3. Three stripes - Various colors      For example: Light Blue/Red/Yellow for H2017

\* For specific color codes by designation, see table "Color Code by Hardener Designation" on the next page.

# COLOR CODE FOR ALUMINUM HARDENERS - Continued

## BY HARDENER DESIGNATION

**	H2000	Red/White	**	H2600	Dark Blue
**	H2001	Red/White	**	H2602	Black/Orange
**	H2003	Black/Purple	**	H2603	Dark Blue
**	H2005	Black/Yellow	**	H2605	Black/Orange
**	H2007	Light Blue	**	H2606	Dark Blue
**	H2010	Black/Lt. Blue	**	H2607	Dark Blue
**	H2011	Black/Lt. Blue	**	H2610	Black/Orange
**	H2012	Light Blue	**	H2612	Dark Blue
**	H2016	Black/Purple	**	H2615	Dark Blue
**	H2017	Light Blue/Red/Yellow	**	H2632	Black/Dark Blue/Black
**	H2019	Light Blue	**	H2633	Black/Dark Blue/Black
**			**		
**	H2132	Yellow	**	H2700	Light Blue
**	H2148	Yellow	**		
**	H2149	Yellow	**	H2810	Black
**	H2150	Yellow	**	H2811	Black
**	H2154	Yellow	**	H2825	Black
**			**	H2845	Black
**	H2201	Green/Red	**	H2875	Black
**	H2202	Green/Yellow	**	H2880	Black
**	H2203	Red/Yellow	**		
**	H2204	Red/Yellow	**	H2918	Orange
**	H2206	Red	**	H2919	Orange
**	H2207	Green/Black	**	H2920	Orange
**	H2209	Red	**	H2921	Orange
**	H2210	Red	**	H2975	Orange
**	H2211	Green/White			
**	H2213	Green/Dark Blue			
**	H2214	Green/Brown			
**	H2217	Red/Yellow			
**	H2218	Green/Orange			
**	H2219	Green/Gray			
**	H2220	Green/Purple			
**	H2221	Red/Yellow			
**	H2222	Red /Yellow			
**	H2231	Red/Purple			
**	H2252	Green			
**	H2258	Red/Brown			
**	H2264	Red/White			
**					
**	H2302	Black/White			
**	H2312	Black/White			
**	H2320	Black/White			
**	H2321	Black/White			
**	H2350	Black/White			
**					
**	H2410	Purple			
**	H2411	Purple			
**	H2425	Purple			
**	H2461	Purple			
**	H2475	Purple			
**	H2485	Purple			
**					
**	H2500	Black/Gray			
**	H2501	Black/Gray			
**	H2575	Black/Gray			

See footnotes on page 4.

## COLOR CODE FOR ALUMINUM HARDENERS - Continued

### BY ALTERNATE DESIGNATION

**	Beryllium 5%	H2005	Black/Yellow
**	Bismuth 3%	H2003	Black//Purple
**	Bismuth 8%	H2016	Black//Purple
**	Boron 3%	H2203	Red/Yellow
**	Boron 4%	H2204	Red/Yellow
**	Boron 5%	H2217	Red/Yellow
**	Boron 8%	H2222	Red/Yellow
**	Boron 10%	H2221	Red/Yellow
**	Calcium 10%	H2001	Red/White
**	Calcium 20%	H2000	Red/White
**	Chromium 10%	H2918	Orange
**	Chromium 20%	H2919	Orange
**	Chromium 20%	H2920	Orange
**	Chromium 20%	H2921	Orange
**	Chromium 75 %	H2975	Orange
**	Copper 32%	H2132	Yellow
**	Copper 50%	H2148	Yellow
**	Copper 50%	H2149	Yellow
**	Copper 50%	H2150	Yellow
**	Copper 54%	H2154	Yellow
**	Iron 10%	H2810	Black
**	Iron 10%	H2811	Black
**	Iron 25%	H2825	Black
**	Iron 45%	H2845	Black
**	Iron 75 %	H2875	Black
**	Iron 80 %	H2880	Black
**	Magnesium 25%	H2010	Black/Lt. Blue
**	Magnesium 50%	H2011	Black/Lt. Blue
**	Manganese 10%	H2410	Purple
**	Manganese 10%	H2411	Purple
**	Manganese 25%	H2425	Purple
**	Manganese 61%	H2461	Purple
**	Manganese 75%	H2475	Purple
**	Manganese 85 %	H2485	Purple
**	Nickel 10%	H2500	Black/Gray
**	Nickel 20%	H2501	Black/Gray
**	Nickel 75 %	H2575	Black/Gray
**	Silicon 12 %	H2302	Black/White
**	Silicon 20%	H2320	Black/White
**	Silicon 20%	H2321	Black/White
**	Silicon 36%	H2312	Black/White
**	Silicon 50%	H2350	Black//White
**	Strontium 3.5%	H2012	Light Blue
**	Strontium 10%	H2007	Light Blue
**	Strontium 10%, Silicon 14%	H2700	Light Blue
**	Strontium 10%, Titanium 1%, Boron 0.2%	H2017	Light Blue/Red/Yellow
**	Strontium 15%	H2019	Light Blue
**	Titanium 6%	H2206	Red
**	Titanium 10%	H2209	Red
**	Titanium 10%	H2210	Red
**	Titanium 3%, Carbon 0.15%	H2231	Red/Purple
**	Titanium 5%, Carbon 0.18%	H2258	Red/Brown
**	Titanium 6%, Carbon 0.04%	H2264	Red/White
**	Titanium 3%, Boron 0.2%	H2220	Green/Purple
**	Titanium 3%, Boron 0.4%	H2219	Green/Gray
**	Titanium 3%, Boron 1%	H2214	Green/Brown
**	Titanium 5%, Boron 0.1%	H2201	Green/Red
**	Titanium 5%, Boron 0.2%	H2207	Green/Black

See footnotes on page 4.

## COLOR CODE FOR ALUMINUM HARDENERS - Continued

### BY ALTERNATE DESIGNATION

	Titanium 5%, Boron 0.6%	H2202	Green/Yellow
	Titanium 5%, Boron 1%	H2252	Green
	Titanium 6%, Boron 0.4%	H2218	Green/Orange
	Titanium 10%, Boron 0.4 %	H2213	Green/ Dark Blue
	Titanium 10%, Boron 1%	H2211	Green/White
**	Vanadium 2.5%	H2602	Black/Orange
**	Vanadium 5%	H2605	Black/Orange
**	Vanadium 10%	H2610	Black/Orange
	Zirconium 3%	H2603	Dark Blue
**	Zirconium 5%	H2607	Dark Blue
**	Zirconium 6%	H2606	Dark Blue
**	Zirconium 10%	H2600	Dark Blue
**	Zirconium 10%	H2612	Dark Blue
**	Zirconium 15%	H2615	Dark Blue
**	Zirconium 3%, Vanadium 2%	H2632	Black/Dark Blue/Black
**	Zirconium 6%, Vanadium 4%	H2633	Black/Dark Blue/Black

See footnotes on page 4.

**INACTIVE  
HARDENER  
ALLOYS**

<u>DESIGNATION</u>	<u>DATE RECLASSIFIED</u>
H2006	1989-06-28
H2008	1986-07-08
H2009	1990-11-05
H2013	1986-07-08
** H2014	2003-09-25
H2015	1986-07-08
H2115	1989-06-28
H2118	1989-06-28
** H2120	2003-09-25
H2140	1989-06-28
H2205	1986-07-08
H2208	1986-07-08
† H2209	1986-07-08
H2212	1998-12-01
H2215	1989-06-28
** H2216	2000-03-08
H2251	1999-10-24
H2300	1989-06-28
H2301	1986-07-08
** H2307	2003-09-25
† H2320	1989-06-28
H2351	1986-07-08
H2401	1994-03-31
H2403	1986-07-08
H2405	1986-07-08
H2407	1986-07-08
H2410	1989-06-28
H2420	1986-07-08
H2430	1986-07-08
H2510	1986-07-08
H2550	1986-07-08
H2801	1986-07-08
H2804	1986-07-08
H2810	1986-07-08
** H2820	2003-09-25
H2900	1986-07-08
H2910	1989-06-28

† Designation Reassigned

See footnotes on page 4.

**RECOMMENDATION  
 INTERNATIONAL DESIGNATION SYSTEM  
 FOR ALUMINUM HARDENERS**

This Recommendation is based on the numerical designation system for aluminum hardeners which was adopted in the U.S.A. in 1973, and which became its national standard in 1975. Designations in accordance with this Recommendation may be used by any country, but there is no obligation to use them. For use, see Appendix A, B and C.

TABLE 1  
*Designations for Hardener Alloy Groups<sup>(4)</sup>*

1. Scope

1.1 This recommendation describes a system for designating aluminum hardeners used primarily for the addition of alloying or grain refining elements or modifiers to aluminum alloy melts.

2. Alloy Designation System<sup>(1)</sup>

2.1 This system consists of four digit numerical designations prefixed by the letter H. The first two digits identify the hardener alloy group by major alloying element<sup>(2)(3)</sup> as shown in Table 1. The last two digits indicate the sequential registration of hardener alloys beginning with the number H2X00 and have no other significance.

Hardener Alloys Grouped by Major Added Elements Other Than Aluminum	}	<table border="0"> <tr> <th style="text-align: left;"><i>Major Alloying Elements</i></th> <th style="text-align: left;"><i>Designation No.</i></th> </tr> <tr> <td>Other Elements <sup>(a)</sup></td> <td>H20XX</td> </tr> <tr> <td>Cu</td> <td>H21XX</td> </tr> <tr> <td>Ti, B</td> <td>H22XX</td> </tr> <tr> <td>Si</td> <td>H23XX</td> </tr> <tr> <td>Mn</td> <td>H24XX</td> </tr> <tr> <td>Ni</td> <td>H25XX</td> </tr> <tr> <td>Zr, V</td> <td>H26XX</td> </tr> <tr> <td>Two or more elements, each over 9.5%</td> <td>H27XX</td> </tr> <tr> <td>Fe</td> <td>H28XX</td> </tr> <tr> <td>Cr</td> <td>H29XX</td> </tr> </table>	<i>Major Alloying Elements</i>	<i>Designation No.</i>	Other Elements <sup>(a)</sup>	H20XX	Cu	H21XX	Ti, B	H22XX	Si	H23XX	Mn	H24XX	Ni	H25XX	Zr, V	H26XX	Two or more elements, each over 9.5%	H27XX	Fe	H28XX	Cr	H29XX
<i>Major Alloying Elements</i>	<i>Designation No.</i>																							
Other Elements <sup>(a)</sup>	H20XX																							
Cu	H21XX																							
Ti, B	H22XX																							
Si	H23XX																							
Mn	H24XX																							
Ni	H25XX																							
Zr, V	H26XX																							
Two or more elements, each over 9.5%	H27XX																							
Fe	H28XX																							
Cr	H29XX																							

(a) Major elements other than those listed.

**FOOTNOTES**

(1) Chemical composition limits and designations conforming to this recommendation may be registered with The Aluminum Association provided (a) the hardener is offered for sale; (b) the complete chemical composition limits are registered; (c) the composition is significantly different from that of any other hardeners for which a numerical designation already has been assigned, where "significant" is defined as:

(i) A change of the following amounts or more in arithmetic mean of the limits for each individual alloying element:

<i>Arithmetic Mean of Limits for Alloying Elements in Original Alloy</i>	<i>Minimum Arithmetic Changes Need for New Alloy Issuance*</i>
--------------------------------------------------------------------------	----------------------------------------------------------------

Up thru 0.30 percent	0.10
Over 0.30 thru 1.0 percent	0.15
Over 1.0 thru 2.0 percent	0.20
Over 2.0 thru 3.0 percent	0.30
Over 3.0 thru 4.0 percent	0.40
Over 4.0 thru 5.0 percent	0.50
Over 5.0 thru 6.0 percent	0.70
Over 6.0	1.00

\*Lesser amounts are considered too small to issue new alloy designation.

(ii) Addition or deletion of one or more alloying elements with limits having an arithmetic mean of 0.20 percent or more.  
 (iii) Change in limits for impurities for which the difference between arithmetic means (existing and proposed) is at least 0.10 percent.

(d) The hardener contains more aluminum than attributable to impurity and the aluminum serves a useful function other than qualifying the hardener for inclusion in the system; and (e) the hardener must be produced specifically for and regularly used as an alloying material in the production of aluminum and aluminum alloys.

(2) For codification purposes an alloying element is any element which is intentionally added.

(3) A major element is that element other than aluminum having the greatest nominal concentration. Should two or more major elements have equal nominal concentrations, that element appearing first in the element limit sequence shall be used to determine designation grouping. When nominal concentration of two or more elements are each greater than 9.5%, such alloys are assigned to the 27XX group.

(4) Standard limits for alloying elements and impurities are arranged in the following sequence: Silicon; Iron; Copper; Manganese; Chromium; Nickel; Titanium; Boron; Vanadium; Additional specified elements in alphabetical order of their chemical symbols; Other elements, Each; Other elements, Total; Aluminum (remainder).

## APPENDIX A

### USE OF DESIGNATIONS

- A.1 All countries using designations in accordance with this Recommendation should use the same numerical designation for aluminum hardeners having identical or closely similar chemical composition limits. They should register the limits and the designations used with all other countries using these designations.
- A.2 A new numerical designation should be assigned only for aluminum hardeners having chemical composition limits significantly different from other aluminum hardeners for which designations have previously been assigned.
- A.3 Designations should be allotted in the following order of precedence:
  - A.3.1 The registered designation should be used if composition limits are identical to those previously registered by another country.
  - A.3.2 A new numerical designation should be assigned only for a significantly different composition not meeting the requirements of A.3.1. In this case, a number must be assigned which has not been used and which will not be assigned by any other country using numerical designations conforming to this Recommendation.
- A.4 Any new numerical designation should have an accompanying color code assignment, based on the color code scheme defined in Appendix C.

## APPENDIX B

### GUIDELINES FOR DETERMINING COMPLIANCE WITH DECLARATION OF ACCORD, ITEM 1.a., "SALE OF ALLOY" AND "COMMERCIAL QUANTITY"

#### B.1 Sale of Alloy

Sale of an alloy shall have been made to external users/customers (i.e., internal use and/or transfer of an alloy within a company does not meet the stated criteria).

#### B.2 Commercial Quantity

- B.2.1 The alloy material and grain refiner has undergone bona fide mill production and is NOT a "laboratory" scale volume used for evaluations or experimental purposes.
- B.2.2 The alloy material and grain refiner is cast and fabricated in standard production facilities and is NOT a one-time production.
- B.2.3 There is an expected and ongoing commercial demand and/or need for the alloy material and grain refiner.
- B.2.4 The alloy material and grain refiner must be purchased and sold in a standard business context, which indicates that the alloy is actually "sold" and not "given away" for uses such as promotional evaluations.

## APPENDIX C

### COLOR SCHEME FOR DETERMINING COLOR CODES FOR ALUMINUM HARDENERS

All countries using designations in accordance with the Recommendation should use the color scheme outlined below in determining color codes for new registrations.

- C. 1 High Volume products such as iron, manganese, and chromium in the form of master alloys and compacted products (briquettes)
- Manganese waffle - One Purple Stripe
  - Iron waffle - One Black Stripe
  - Chromium waffle – One Orange Stripe
  - Other high volume products- One stripe indicates the Alloy Family.
  - Bags- The bag shall be printed in the assigned color while both the hardener designation and the alternate designation (Iron 20% for example) shall be printed on the bag.
- C. 2 High Volume products with exceptions:
- Strontium products – all have one light blue stripe except 10 Sr-1Ti- 0.2 B. See the Table below for the color code of this product.
  - Zirconium products- all have one dark blue stripe with the exceptions of 3 Zr-2 V and 6 Zr-4 V Waffle which are one black stripe, one dark blue stripe and one black stripe.
- C. 3 Medium Volume/Low Volume hardeners are coded with 2 stripes, the first stripe is black and the second stripe indicates the alloy family
- C. 4 Performance Products are coded with 2 stripes, the first stripe is red and the second stripe indicates the alloy family.
- C. 5 Grain Refiner products
- Titanium Boron products are coded with 2 stripes, the first stripe is green and the second stripe is variable.
  - Titanium Carbon products are coded with 2 stripes, the first stripe is red and the second stripe is variable.

Alloy Family	Category	Color Code
Fe	High Volume	Black
Mn	High Volume	Purple
Cr	High Volume	Orange
Cu	High Volume	Yellow
Ti	High Volume	Red
Sr	High Volume	Light Blue
Zr	High Volume	Dark Blue
Mg	Medium/Low Volume	Black - Light Blue
Ni	Medium/Low Volume	Black - Gray
Si	Medium/Low Volume	Black - White
V	Medium/Low Volume	Black - Orange
Be	Medium/Low Volume	Black - Yellow
Bi	Medium/Low Volume	Black - Purple
Pb	Medium/Low Volume	Black - Green
B	Performance	Red-Yellow
Ca	Performance	Red-White
Zr - V	Exceptions	Black - Dark Blue - Black
Sr - Ti -B	Exception	Light Blue – Red - Yellow
Sr - Si	Exception	Light Blue
Ti - B	Grain Refiners	Green – Other Color
Ti - C	Grain Refiners	Red – Other Color



## DECLARATION OF ACCORD ON AN INTERNATIONAL DESIGNATION SYSTEM FOR ALUMINUM HARDENERS

It is agreed by the parties hereto that the following rules will apply in assigning aluminum hardener designations in accordance with the recommendation dated 2001 September 20 and Revised July 2006 for an International Designation System for Aluminum Hardeners:

1. To be eligible for registration:
  - a) The hardener must be offered for sale currently and shall have been supplied in the previous twelve months, in both cases in commercial quantities;
  - b) The complete chemical composition limits must be registered and the former designation, if any, should be shown;
  - c) The composition must be different from that of any hardener for which a numerical designation has already been assigned;
  - d) The hardener must contain more aluminum than attributable to impurity and the aluminum must serve a useful function other than qualifying the hardener for inclusion in the system;
  - e) The hardener must be specifically produced for and regularly used as an alloying material in the production of aluminum and aluminum alloys.
2. All requests for international registrations must be submitted to The Aluminum Association by a signatory of the Declaration of Accord. The signatory, in carrying out this function, will endeavor to restrict registrations to those required for international, regional or national standards or standards of equivalent importance in the commercial field. In view of its historic usage of these designations, more latitude is ceded to The Aluminum Association in this regard.
3. It will be the duty of each signatory to inform all other signatories of proposed composition limits or proposed changes in limits. Number assignments will be made by The Aluminum Association when negotiations on composition limits are complete among all signatories to the Declaration of Accord.
4. No designation or chemical composition limits will become final until at least 60 days after announcement to all participating organizations. During this 60-day period, all questions and objections regarding the designation or chemical composition limits must be submitted; or an extension of the period must be requested. Technical objections must be substantially resolved prior to final registration.
5. Only the organization that registered the designation may make a change in chemical composition limits for the alloy, and when a change is proposed, all participating organizations must be notified and given 60 days to comment.
6. After the 60-day period, the registering organization shall confirm the registered designation and the composition limits to each participating organization.
7. This Declaration of Accord may be executed in several counterparts and all so executed shall constitute one agreement.

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**Organization**

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**Representative**

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**Address**

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**Date**

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**Signature**

## DÉCLARATION D'ACCORD SUR UN SYSTÈME DE DÉSIGNATION INTERNATIONALE POUR LES DURCISSEURS D'ALUMINIUM

Il est convenu par les participants que les règles suivantes s'appliqueront pour la désignations de durcisseurs d'aluminium en concordance avec la recommandation datée du 2001 September 20 révisée en Juiet 2006 pour un Système de désignation internationale pour les durcisseurs d'aluminium.

1. Pour être admis à l'enregistrement:
  - a) Le durcisseur doit être alors offert en vente et avoir été fourni au cours des douze derniers mois, en quantités commerciales dans les deux cas;
  - b) Les limites de composition chimique complètes doivent être enregistrées et la désignation précédente, s'il y a lieu, doit paraître;
  - c) La composition doit différer de celle de tout durcisseur pour lequel une désignation numérique a déjà été assignée;
  - d) Le durcisseur doit contenir plus d'aluminium qu'attribuable à l'impureté et l'aluminium doit avoir une utilité autre que la qualification du durcisseur pour inclusion dans le système.
  - e) Le durcisseur doit être produit spécifiquement pour, et doit être utilisé régulièrement comme un matériau d'alliage dans la production d'aluminium et d'alliages d'aluminium.
2. Tout demand d'enregistrement international doit être soumise à l'Aluminum Association par un signataire de la Déclaration d'Accord. Ledit signataire, dans l'exercice de cette fonction, s'appliquera à limiter les enregistrements à ceux requis pour les normes internationales, régionales ou nationales, ou autres normes d'importance équivalente dans le secteur commercial. Compte tenu de l'utilisation historique de ces désignations, l'Aluminum Association dispose à cet égard d'une assez grande latitude.
3. Il appartiendra à chaque signataire d'informer les organisations correspondantes de tous les pays participants des limites de composition proposées ou des changements proposés de ces limites. Les attributions de numéros seront effectuées par l'Aluminum Association dès l'achèvement des négociations sur les limites de composition par tous les signataires de la Déclaration d'Accord.
4. Aucune désignation ou limites de composition chimique ne sera définitive avant au moins 60 jours à compter de la date où l'information a été communiquée à toutes les organisations participantes. Durant ces 60 jours, toute question ou objection concernant cette désignation ou les limites de composition chimique devra être soumise; sinon, une prolongation de la période devra être demandée. Toute objection technique doit être résolue de façon substantielle avant l'enregistrement final.
5. Seule l'organisation qui a enregistré la désignation peut effectuer un changement dans les limites de composition chimique de l'alliage; lorsqu'un changement est proposé toute les organisations participantes doivent en être avisées et doivent présenter leurs remarques dans un délai de 60 jours.
6. Après la période de 60 jours l'organisation enregistrante confirmera la désignation enregistrée et les limites de composition à chaque organisation participante.
7. Cette Déclaration d'Accord pourra être reproduite en plusieurs exemplaires tout en constituant un seul agrément.

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**Organization**

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**Representative**

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**Address**

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**Date**

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**Signature**

## NOTES

## **OTHER ALUMINUM ASSOCIATION REGISTRATION RECORDS AND REFERENCES**

- **REGISTRATION RECORD OF INTERNATIONAL DESIGNATIONS AND CHEMICAL COMPOSITION LIMITS FOR UNALLOYED ALUMINUM** (Gold Sheets).
- **REGISTRATION RECORD OF INTERNATIONAL ALLOY DESIGNATIONS AND CHEMICAL COMPOSITION LIMITS FOR WROUGHT ALUMINUM AND WROUGHT ALUMINUM ALLOYS** (Teal Sheets). Contains a complete list of all registered designations for wrought alloys including those produced in North America.
- **REGISTRATION RECORD OF ALUMINUM ASSOCIATION ALLOY DESIGNATIONS AND CHEMICAL COMPOSITION LIMITS FOR ALUMINUM ALLOYS IN THE FORM OF CASTINGS AND INGOT** (Pink Sheets).
- **TEMPERS FOR ALUMINUM AND ALUMINUM ALLOY PRODUCTS** (Yellow Sheets).
- **TEMPERS FOR ALUMINUM AND ALUMINUM ALLOY PRODUCTS—METRIC EDITION** (Tan Sheets).
- **COMPONENTS OF CLAD ALUMINUM ALLOY PRODUCTS** (Lt. Green Sheets).

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