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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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## 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 11. Additions may be made as required according to the rules outlined in the Declaration of Accord, printed on page 15, and aluminum hardeners will be deleted when no longer in commercial use (See table of Inactive Aluminum Hardeners).

Some of the registered aluminum hardeners 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" aluminum 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.
H2002	1% Be	2009-07-20	USA	0.20	0.40	0.05	0.02	0.02	0.02	0.02	....	....	Be 0.9-1.2 Mg 0.20 max Zn 0.10 max	0.05	0.15	Rem.
H2003	3% Bi	1975-01-01	USA	0.20	0.20	....	....	....	....	....	....	....	Bi 2.7-3.3	0.03	....	Rem.
H2004	2.5% Be	2009-07-20	USA	0.20	0.40	0.05	0.02	0.02	0.02	....	....	....	Be 2.2-3.0 Mg 0.50 max Zn 0.10 max	0.05	0.15	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	....	....	....	....	....	....	....	Bi 7.5-8.5 Zn 0.10 max	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.
H2018	5% Sr	2009-07-20	USA	0.20	0.30	....	....	....	....	....	....	....	Sr 4.5-5.5 Ba 0.05 max Ca 0.05 max	0.04	0.10	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.
H2020	20% Sr	2009-07-20	USA	0.20	0.30	....	....	....	....	....	....	....	Sr 18.0-22.0 Ba 0.10 max	0.05	0.15	Rem.
H2025	2% Sc	2009-07-20	USA	0.05	0.05	....	....	....	....	....	....	....	Sc 1.8-2.2	0.03	0.10	Rem.
H2030	68% Mg	2009-07-20	USA	0.10	0.15	....	0.10	....	....	....	....	....	Mg 65-71	0.05	0.15	Rem.
H2035	10% Bi	2009-07-20	USA	0.20	0.30	....	....	....	....	....	....	....	Bi 9.0-11.0	0.05	0.20	Rem.

See footnotes on page 5.

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

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The Aluminum Association should be designated as "AA" aluminum 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>	
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	2005-08-18	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.
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.
H2223	1.7% Ti-1.4% B	2009-07-20	USA	0.20	0.30	...	...	...	...	1.3-2.2	1.1-1.7	0.05	...	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.

See footnotes on page 5.

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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>	
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.
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.

See footnotes on page 5.

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

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The Aluminum Association should be designated as "AA" aluminum 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>	
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 5.



## 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 %	000X
0.001 through 0.01 %	0.00X
0.01 through 0.10 %:	
Unalloyed aluminum made by a refining process	0XX
Alloys and unalloyed aluminum not made by a refining process	0.0X
0.10 through 0.55 %	0.XX
(It is customary to express limits 0.30 % through 0.55 % as 0.X0 or 0.X5)	
0.55 through 29.9 %:	0.X, X.X, or XX.X
Over 29.9 %	XX

2. Except for "Aluminum" and "Others", analysis is required 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 % 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.

## 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 <sup>2</sup>	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 <sup>2</sup>	H2500 <sup>2</sup> H2501 <sup>2</sup> H2575 <sup>2</sup>	H2003 <sup>2</sup> H2016 <sup>2</sup> H2035 <sup>2</sup>		H2207 <sup>2</sup>	H2632 <sup>3</sup> H2633 <sup>3</sup>	H2010 <sup>2</sup> H2011 <sup>2</sup> H2030 <sup>2</sup>	H2002 <sup>2</sup> H2004 <sup>2</sup> 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 <sup>1</sup>	
RED			H2231 <sup>2</sup>	H2258 <sup>2</sup>	H2201 <sup>2</sup>	H2025 <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 <sup>1</sup>		
YELLOW					H2202 <sup>2</sup>			H2132 <sup>1</sup> H2148 <sup>1</sup> H2149 <sup>1</sup> H2150 <sup>1</sup> H2154 <sup>1</sup>			
LIGHT BLUE					H2223 <sup>2</sup>		H2007 <sup>1</sup> H2012 <sup>1</sup> H2018 <sup>1</sup> H2019 <sup>1</sup> H2020 <sup>1</sup> H2700 <sup>1</sup>				
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 <sup>1</sup>					
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 <sup>1</sup>								
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 Aluminum Hardener Designation" on the next page.

## COLOR CODE FOR ALUMINUM HARDENERS - Continued

### BY ALUMINUM HARDENER DESIGNATION

H2000	Red/White
H2001	Red/White
H2002	Black/Yellow
H2003	Black/Purple
H2004	Black/Yellow
H2005	Black/Yellow
H2007	Light Blue
H2010	Black/Lt. Blue
H2011	Black/Lt. Blue
H2012	Light Blue
H2016	Black/Purple
H2017	Light Blue/Red/Yellow
H2018	Light Blue
H2019	Light Blue
H2020	Light Blue
H2025	Red/Dark Blue
H2030	Black/Lt. Blue
H2035	Black/Purple
H2132	Yellow
H2148	Yellow
H2149	Yellow
H2150	Yellow
H2154	Yellow
H2201	Green/Red
H2202	Green/Yellow
H2203	Red/Yellow
H2204	Red/Yellow
H2206	Red
H2207	Green/Black
H2209	Red
H2210	Red
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
H2223	Green/Lt. Blue
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

H2600	Dark Blue
H2602	Black/Orange
H2603	Dark Blue
H2605	Black/Orange
H2606	Dark Blue
H2607	Dark Blue
H2610	Black/Orange
H2612	Dark Blue
H2615	Dark Blue
H2632	Black/Dark Blue/Black
H2633	Black/Dark Blue/Black
H2700	Light Blue
H2810	Black
H2811	Black
H2825	Black
H2845	Black
H2875	Black
H2880	Black
H2918	Orange
H2919	Orange
H2920	Orange
H2921	Orange
H2975	Orange

See footnotes on page 5.

## COLOR CODE FOR ALUMINUM HARDENERS - Continued

### BY ALTERNATE DESIGNATION

Beryllium 1%	H2002	Black/Yellow
Beryllium 2.5%	H2004	Black/Yellow
Beryllium 5%	H2005	Black/Yellow
Bismuth 3%	H2003	Black//Purple
Bismuth 8%	H2016	Black//Purple
Bismuth 10%	H2035	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
Magnesium 68%	H2030	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
Scandium 2%	H2025	Red/Dark Blue
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 5%	H2018	Light Blue
Strontium 10%	H2007	Light Blue
Strontium 10%, Silicon 14%	H2700	Light Blue
Strontium 10%, Titanium 1%, Boron 0.2%	H2017	Lt. Blue/Red/Yellow
Strontium 15%	H2019	Light Blue
Strontium 20%	H2020	Light Blue

See footnotes on page 5.

## COLOR CODE FOR ALUMINUM HARDENERS - Continued

### BY ALTERNATE DESIGNATION

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 1.7% Boron 1.4%	H2223	Green/Lt. Blue
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
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 5.

## INACTIVE ALUMINUM HARDENERS

<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 5.

Arlington, VA 22202  
U.S.A.

## 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, registered in accordance with this Recommendation, may be used by any country. For use, see Appendix A, B, C and D.

### 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. Aluminum Hardener 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 aluminum hardener group by major alloying element(s)<sup>(2)(3)</sup> as shown in Table 1. The last two digits indicate the sequential registration of aluminum hardeners beginning with the number H2X00 and have no other significance.

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

	<i>Major Alloying Elements</i>	<i>Designation No.</i>
Aluminum Hardeners  Grouped by Major Added Elements Other Than Aluminum	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.

### FOOTNOTE

- (1) Chemical composition limits and designations conforming to this recommendation may be registered with The Aluminum Association provided
- (a) The aluminum hardener is offered for sale;
- (b) The aluminum hardener contains more aluminum than attributable to impurity and the aluminum serves a useful function other than qualifying the aluminum hardener for inclusion in the system;
- (c) The aluminum hardener must be produced specifically for and regularly used as an alloying material in the production of aluminum and aluminum alloys;
- (d) The complete chemical composition limits are registered; and
- (e) The composition is significantly different from that of any other aluminum 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 Registered Aluminum Hardener</i>	<i>Minimum Arithmetic Changes Need for New Aluminum Hardener Issuance*</i>
Up thru 0.30%	0.10
Over 0.30 thru 1.0%	0.15
Over 1.0 thru 2.0%	0.20
Over 2.0 thru 3.0%	0.30
Over 3.0 thru 4.0%	0.40
Over 4.0 thru 5.0%	0.50
Over 5.0 thru 6.0%	0.70
Over 6.0	1.00

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

- (ii) Addition or deletion of one or more alloying elements with limits having an arithmetic mean of 0.20% or more.
- (iii) Change in limits for impurities for which the difference between arithmetic means (existing and proposed) is at least 0.10%.
- (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 aluminum hardeners are assigned to the 27XX group.
- (4) Standard limits for alloying elements and impurities are expressed in the following sequence: Silicon; Iron; Copper; Manganese; Chromium; Nickel; Titanium; Boron; Vanadium (See Note 1); Other (See Note 2) elements, Each; Other (See Note 2) elements, Total; Aluminum (See Note 3).
- Note 1- Additional specified elements having limits are inserted in alphabetical order by their chemical symbols between Vanadium and Other Elements, Each, or are specified in footnotes.

Note 2- "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 "Others" 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 non-conforming.

Note 3- Aluminum is specified as a remainder for aluminum hardeners.