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Scope:	Specification for Re-melt Unalloyed Aluminium Sows/Ingots & Aluminium Alloy Hardeners.		
Keywords:	Area: Purchasing Foundry (General) External Supplier/Subcontractor	Process: Goods Receiving Charge/Melt	Quality Description: Purchasing Inspection & Testing (Receiving)

THIS DOCUMENT IS LEVEL 4 OF THE COMPANY'S APPROVED QUALITY SYSTEM. ITS CONTENTS ARE MANDATORY. REQUESTS FOR CHANGE SHALL BE MADE ON A CHANGE CONTROL FORM OBTAINABLE FROM YOUR SUPERVISOR. THE TABLES, LISTS, INDEXES OR FORMS ARE ATTACHED TO THE LEADING PAGES.

1. Authorisation.

Process Owners:

Foundry Technical Manager
 Foundry Team Manager
 Quality Manager

2. Purpose

- 2.1 Provide a specification for purchasing and verification of all incoming aluminium for remelt purposes.
- 2.1 To ensure material can be produced within the specification limits required by Arconic Manufacturing (GB) Ltd Products Group.

3. Who is Responsible?

- 3.1 It is the responsibility of the Remelt Resource Manager, to order material to this database.
- 3.2 It is the responsibility of incoming inspection to ensure deliveries conform to this database.
- 3.3 It is the responsibility of all suppliers to supply material that conforms to this specification.

4. Other relevant documents.

- 4.1 Level 2
 - QM-PU-01 - Purchase of Goods & Services.
 - QM-RM-01 - Remelting Process Scrap.
- 4.2 Level 4
 - DB-TQ-050 - List of approved suppliers of critical items.
 - WI-TQ-009 - Supplier Approval and Monitoring.

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5. Amendments

<u>Date</u>	<u>Issue</u>	<u>Reason</u>
20.02.68	3	
17.12.75	4	Specification revised & updated
01.09.76	5	CR5 included
07.02.77	6	CR7 Mg & Zn included
08.09.77	7	50/50 SP Cu for use in 7475 included.
16.04.81	8	FRS included & Cr maxfor NC20 added.
28.06.82	9	Spec.for Pure Aluminium included.
20.02.86	10	Lithium max. of 0.0002% added.C120 inc.
31.03.89	11	Issued in new S.M.P. form.
13.10.89	12	Include 9% min for Mn in MN10.
09.10.91	13	Update to include colour code change. This new format/numbered practice replaces C110 which should be destroyed.
17.11.92	14	Incorrect specification Page 8 - 99.85% Cu A1 Grade.
14.01.93	15	Change in specification requirements as per meeting with LSM on 08.01.93.
09.06.93	16	Change in ingot supplier identification system.
06.12.93	17	Inclusion of rod grain refiner into hardener spec. WI and correction of error in mag. concentration of beryllium hardener.
21.06.94	18	Al 99.5 is included as a result of audit PC 9402.
24.06.96	19	To prevent excessive pick-up of Li from ingot.
19.07.96	20	Add composition of 5Ti 1B hardener.
17.07.97	21	To add MAG50. To add sodium levels to 99.50, 99.70 and 99.92% Al grades. To add Lithium level to 99.50 Al grade after Russian Aluminium bought by group with unconfirmed analysis. To remove SR20 and replace with SR30. To remove CR4.
18.05.98	22	To relax limits on Iron & Silicon to allow lower purity based metal in hardener production.
16.09.98	23	Rationalisation of hardener specs within BAL Group. 6%Zr, 12%Si and MN10A added to ACL. Main element ranges tightened throughout.
20.11.98	24	Additional hardeners MAG 95 - 95% Mg Hardener, CAAL 10% Calcium Waffle, TICAL 315 ROD.
11.10.99	25	Change 3.1 from Purchasing Manager to Remelt Resource Manager. CAR Audit QA9812. Add Zirconium grain refiner. Add Lithium. Addition of ALTAB Hardeners.
20.02.01	26	New hardener Mg-Al-Mn. Change to Zr specification in accordance with process capability. To define maximum limits for trace elements.
22.08.01	27	Bring 99.92% Alum Spec in line with AA192A Spec, apart from Na which is 0.002% max.
15.10.02	28	Update to new format. Fe was reduced from 0.20% max to 0.15% max at request of BASE. This lower level restricts supply and is not necessary for Kitts Green products.
14.04.03	29	Al grade 99.96% min added. Selenium max of 0.0500added to MN10, MN10A and MN80 hardeners.

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28-06.04 16.08.07 18.02.09 07.05.10 29.02.12 15.03.12 24.07.12 24.10.12 09.12.13 27.06.14 31.10.14 26.02.15 24.03.15 09.05.18 24.04.23	30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	Re-ordered alpha numerically. Grain refiner spec. composition amended, grain size and specific supplier specifications included. Relaxed Zr limits on Zr5. New Titanium hardener. 85% Manganese hardener added. Note re cleanliness added. Paragraph re Beryllium Hardener removed on page 6. Remove MRA 40% Copper, MAG 50, MAG 95, Mg-Al-Mn, MN10A, MN80, ALTAB, 12% Silicon, ZR6, SR20%, TICAL, V5. Amend Tygem to read Titanium Tablet, 5Ti 0.2B grain refinement rod to have grain size of 160 microns. Salts based process specified for ZR5 Change to Prime compositions to comply with commercial grades. Introduction of a specification for Copper. Information for suppliers as per AS9100 requirements Modification to grain refiner rod targets in line with Alcoa specs – MS 1-2251 STi 1b, MS 1-2207 STi 0.2B, MS 1-224 3Ti 13 CR80 F89 & Mn85 Min. Target & max added. Change min% vanadium to 9.0% to align with Alcoa alloying materials specifications. Note 11 for Suppliers and Receiving Inspection. Addition of “regulatory authorities” to comply with AS9100 Change to CAAL 10% Calcium Waffle. Add Ty-gem specification (88% min Ti). Added P0303 specification. Notes on chemical analysis (rare earth elements) and WI-TQ-009 to relevant documents list. Increase Na limit of all prime grades from 20 to 40 ppm max. Added 99.67 (P1320) grade alum as a specific concession. sections 13 and 14 added also M Lapunovs added to external distribution list. reduce upper acceptance limit from 160 to 140 or less for 5Ti,0.2B grain refining rod. (pg14)
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6 Distribution List

Internal

72, 67, 29, 14, 43, 62, 56, 101

External

M Lapunovs, European Metal Group to ensure that link to Arconic Direct site is updated

All approved critical suppliers categories 0A, 1B, 1Bi, 1E

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Notes for Suppliers and Receiving Inspection

1. The chemical composition shall comply with the limits appended.
2. An analytical release certificate shall be provided for each furnace melt and each melt shall be clearly identified.
3. Analytical checks shall be carried out at the discretion of the Foundry Technical Manager.
4. A bundle of ingots shall only contain the product of 1 melt.
5. Each ingot in a bundle shall be identified with its own colour code except where stated in this practice.
6. The ingots are to be held in a properly organised store area and every precaution taken to prevent mixing and contamination.
7. Remelt sows and ingots shall be stacked with base uppermost to reduce the risk of water seeping into sumps.
8. All unalloyed aluminium sows/ingots and alloy hardeners shall be clean and free of corrosion.
9. The supplier shall notify Alcoa Flat Rolled Products – Kitts Green of any non-conforming product and must only ship such product if formal approval is granted.
10. The supplier shall notify Alcoa Flat Rolled Products – Kitts Green of any changes in the product or process which may affect the quality or performance of the product being supplied.
11. Periodic surveys of the supplier's Quality Management System, product(s) and/or process(es) may be undertaken by authorised representatives of Alcoa Flat Rolled products, its customers and/or regulatory authorities, who will require access to the applicable areas of all the supplier's premises at all reasonable times.
12. It is expected that suppliers will retain records relating to the manufacturing of the product in the event of any quality issue arising from use of the product. Records shall be maintained for a minimum of 5 years.
13. The supplier shall establish and maintain a process to ensure that the supplier, its employees and contractors are aware of:
 - a. Their contribution to product or service conformity;
 - b. The importance of ethical behaviour;
 - c. Their contribution to product safety; (Product safety is the state in which a product is able to perform to its designed or intended purpose without causing unacceptable risk or harm to persons or damage to property)
14. Suppliers will have systems in place to prevent the shipment of counterfeit / misrepresented parts or material to Arconic Manufacturing (GB) Ltd. Including the training of appropriate

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persons in the awareness and prevention of counterfeit parts.

Aluminium Ingot

Grade 99.50

AL Grade (Max.Limits Wt%)(1)	P1535A
Iron	0.35
Silicon	0.15
Zinc	0.03
Vanadium	0.02 [^]
Gallium	0.04
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.03
Others Total	0.10

Grade 99.70

AL Grade (Max.Limits Wt%)(1)	P1020A
Iron	0.20
Silicon	0.10
Zinc	0.03
Vanadium	0.02 [^]
Gallium	0.04
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.03
Others Total	0.10

Grade 99.84

AL Grade (Max.Limits Wt%) (1)	P0610A
Iron	0.10
Silicon	0.06
Zinc	0.03
Vanadium	0.02
Gallium	0.04
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.02
Others Total	0.05

Grade 99.90

AL Grade (Max.Limits Wt%)(1)	P0406A
Iron	0.06
Silicon	0.04
Zinc	0.03
Vanadium	0.02
Gallium	0.03
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.02
Others Total	0.04

Grade 99.92

AL Grade (Max.Limits Wt%) (1)	P0404A
Iron	0.04
Silicon	0.04
Zinc	0.03
Vanadium	0.01
Gallium	0.03
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.01
Others Total	0.03

Grade 99.94

AL Grade (Max.Limits Wt%) (1)	P0303A
Iron	0.03
Silicon	0.03
Zinc	0.02
Vanadium	0.01
Gallium	0.02
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.01
Others Total	0.02

Grade 99.96

AL Grade (Max.Limits Wt%) (1)	P0202A
Iron	0.02
Silicon	0.02
Zinc	0.02
Vanadium	0.01
Gallium	0.02
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.01
Others Total	0.02

Note1 Metal falling outside the limits must be made the subject of a concession.

(* Kitts Green Specific Requirement)

([^]Levels up to 0.03 are acceptable, but restrictions will apply on the amounts used in the charge make up)

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NB Aluminium Grades 99.50 (P1535A), 99.70 (P1020A), 99.84 (P0610A), 99.90 (P0406A), 99.92 (P0404A), 99.94 (P0303A) and 99.96 (P0202A) represent the standard grades purchased by Kitts Green. When a particular grade is unavailable it may be substituted by a grade of higher purity. The substitution must meet or exceed the requirements of the standard grade it replaces.

99.67 (P1320 grade) is not normally purchased by Kitts Green, but can be accepted on concession. The individual lot chemistries shall be checked before material arrives on site, and if the actual analysis of any specific batch is found to not meet the requirements of 99.70 grade, (see above), then this batch shall be segregated, identified specifically on Keystone, and consumed only in suitable alloys.

Grade 99.67

AL Grade (Max.Limits Wt%)	P1320A
Iron	0.20
Silicon	0.13
Zinc	0.03
Copper	0.04
Vanadium	0.05
Gallium	0.04
Sodium	0.004*
Lithium	0.0002*
Cd + Pb + Hg	<0.010
Aluminium	Rest
Others Each	0.03
Others Total	0.10

Chemical Analysis

Raw materials used in Kitts Green remelt operations are tested annually to ensure the quality of supply (see WI-TQ-009). Materials shall be tested against the relevant purchasing specifications, (detailed in this document), to ensure that the materials are as described and that the supplied analysis is consistent. In addition, materials will also be checked for the following heavy, toxic and rare earth elements;

Arsenic (Ac), Molybdenum (Mo), Cadmium (Cd), Mercury (Hg), Beryllium (Be), Lithium (Li), Lead (Pb), Cerium (Ce), Neodymium (Nd), Uranium (U), Praseodymium (Pr) and Lanthanum (La).

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Aluminium Alloy Hardeners

CAAL 10% Calcium Waffle (Colour code - Nil)

	<u>Min %</u>	<u>Max %</u>
Calcium	9.0	11.00
Iron	-	0.20
Silicon	-	0.10
Lithium	-	0.0002
Magnesium	-	0.20
Others		
Each	-	0.05
Total	-	0.15
Aluminium the remainder		

CR5 - 5% Chromium Hardener (Colour code - Green/Yellow)

	<u>Min %</u>	<u>Max %</u>
Chromium	5.0	5.5
Copper	-	0.05
Iron	-	0.15
Magnesium	-	0.05
Manganese	-	0.05
Silicon	-	0.10
Zinc	-	0.05
Titanium	-	0.05
Nickel	-	0.05
Lead	-	0.05
Bismuth	-	0.05
Lithium	-	0.0002
Others		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

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CR20 - 20% Chromium Hardener (Colour code - Purple)

	<u>Min%</u>	<u>Max%</u>
Copper	-	0.10
Iron	-	0.55
Magnesium	-	0.05
Manganese	-	0.05
Silicon	-	0.30
Zinc	-	0.05
Titanium	-	0.05
Chromium	20.0	22.0
Lithium	-	0.0002
Others		
Each	-	0.05
Total	-	0.15
Aluminium the remainder		

CR80 ALTAB Hardener (Colour code - Blue)


	<u>Min%</u>	<u>Target%</u>	<u>Max%</u>
Cr	79	80	81
Aluminium the remainder			

Copper Pure (Cu-CATH-1 or equal)

	<u>Min %</u>	<u>Max %</u>
Copper	99.9	-
Bale Weight not to exceed 25kg		

50/50 Super Purity Copper Hardener (Colour code - Red/White)

	<u>Min %</u>	<u>Max %</u>
Copper	50.0	52.0
Iron	-	0.08
Magnesium	-	0.10
Manganese	-	0.10
Silicon	-	0.07
Nickel	-	0.05
Titanium	-	0.05
Zinc	-	0.05
Lead	-	0.05
Bismuth	-	0.05
Lithium	-	0.0002
Others		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

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FR4 - 4% Iron Hardener (Colour code - Black/White)

	<u>Min %</u>	<u>Max %</u>
Iron	4.0	4.5
Copper	-	0.20
Magnesium	-	0.20
Manganese	-	0.20
Silicon	-	0.30
Nickel	-	0.10
Titanium	-	0.10
Zinc	-	0.10
Lead	-	0.10
Bismuth	-	0.10
Lithium		0.0002
Others		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

FR80 ALTAB Hardener (Colour code - Green)

	<u>Min%</u>	<u>Target%</u>	<u>Max%</u>
Fe	79	80	81
Aluminium the remainder			

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Lithium Metal

Chemistry

	<u>Min %</u>	<u>Max %</u>
Sodium	-	<120 ppm
Potassium	-	<100 ppm
Calcium	-	<120 ppm
Iron	-	<10 ppm
Chlorine	-	<50 ppm
Nitrogen	-	<300 ppm
Others each	-	<100 ppm
Others max	-	<1300 ppm

Lithium (balance by difference)

Size:

Weight	1kg		
Dimensions	100mm dia.	250mm length	

Packaging

Dry packed in Argon sealed individually in 1kg units.

NB

- Alternative size/weight ingots to be agreed by production.
- No wax/paraffin packaging acceptable.

Pure Magnesium (99.8% min) (Colour code - Nil)

	<u>Min%</u>	<u>Max %</u>
Copper	-	0.02
Lead	-	0.01
Manganese	-	0.10
Nickel	-	0.001
Tin	-	0.01
Others	-	0.05

Magnesium the remainder. Purchased to specification ASTM B92.998OA.

Ingots to be free of corrosion.

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MN10 - 10% Manganese Hardener (Colour code - Brown/Black)

	<u>Min %</u>	<u>Max %</u>
Manganese	10.0	11.0
Copper	-	0.10
Iron	-	0.40
Magnesium	-	0.25
Silicon	-	0.40
Nickel	-	0.10
Zinc	-	0.20
Lead	-	0.10
Bismuth	-	0.10
Titanium	-	0.20
Lithium	-	0.0002
Selenium	-	0.0500
Others		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

MN85 ALTAB Hardener (Colour code – Silver)

	<u>Min%</u>	<u>Target%</u>	<u>Max%</u>
Mn	84	85	86
Selenium	-		0.0500
Aluminium the remainder			

NC20 - 20% Nickel Hardener (Colour code - Blue/Red)

	<u>Min %</u>	<u>Max %</u>
Nickel	20.0	22.0
Copper	-	0.50
Iron	-	0.50
Magnesium	-	0.25
Manganese	-	0.25
Silicon	-	0.25
Zinc	-	0.10
Lead	-	0.10
Bismuth	-	0.10
Titanium	-	0.10
Chromium	-	0.10
Lithium	-	0.0002
Others		
Each		0.03
Total		0.15
Aluminium the remainder		

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SR30 - 30% Silicon Hardener (Colour code - Yellow/Blue)

	<u>Min %</u>	<u>Max %</u>
Silicon	30.0	32.0
Copper	-	0.20
Iron	-	0.40
Magnesium	-	0.20
Manganese	-	0.20
Nickel	-	0.10
Zinc	-	0.10
Lead	-	0.10
Bismuth	-	0.10
Titanium	-	0.10
Lithium	-	0.0002
Others		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

TR6 -6% Titanium Hardener (Colour Code - Blue/Green)

	<u>Min %</u>	<u>Max %</u>
Titanium	6.0	6.5
Iron	-	0.3
Silicon	-	0.1
Vanadium	-	0.3
Bismuth	-	0.004
Lithium	-	0.0002
Others		
Each	-	0.05
Total	-	0.15
Aluminium the remainder		

Titanium Tablet (Colour code – none)

	<u>Min%</u>	<u>Max%</u>
Titanium	92.0	98.0

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Ty-Gem Titanium Tablet (Colour code – Red)

	<u>Min%</u>	<u>Max%</u>
Titanium	>88.0	
Silicon	-	0.3
Iron	-	1.0
Chromium	-	0.3
Nickel	-	0.3
Molybdenum	-	0.3
Tin	-	0.3
Vanadium	-	3.0
Zirconium	-	0.3
Lead + Cadmium + Mercury	-	<0.010
Beryllium	-	0.0001
Lithium	-	0.0002
Moisture	-	0.05
<i>Others</i>		
Each	-	0.03
Total	-	0.10

5Ti 1.0B grain refining rod (Colour code - green)

	<u>Min %</u>	<u>Target%</u>	<u>Max %</u>
Titanium	4.8	5.0	5.2
Boron	0.8	1.2	1.2
Iron	-		0.30
Silicon	-		0.20
Vanadium	-		0.01
Lead + Cadmium	-		<0.01
Beryllium	-		0.0001
<i>Others</i>			
Each	-		0.03
Total	-		0.10
Aluminium the remainder			

Ability to achieve grain size of 140 micron or less in one min. using the standard AA TP 1 test.
 Specific detailed supply specification to be agreed with each approved supplier.

5Ti 0.2B grain refining rod (Colour code - green/black)

	<u>Min %</u>	<u>Target%</u>	<u>Max %</u>
Titanium	4.8	5.0	5.2
Boron	0.17	0.20	0.23
Iron	-		0.30
Silicon	-		0.20
Vanadium	-		0.15
Lead + Cadmium	-		<0.01
Beryllium	-		0.0001
<i>Others</i>			
Each	-		0.03
Total	-		0.10
Aluminium the remainder			

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| Ability to achieve grain size of 140 micron or less in one min. using the standard AA TP 1 test. |
 Specific detailed supply specification to be agreed with each approved supplier.

3Ti 1.0B grain refining rod (Colour code - green/brown)

	<u>Min %</u>	<u>Target %</u>	<u>Max %</u>
Titanium	2.8	3.1	3.4
Boron	0.7	0.9	1.1
Iron	-	-	0.30
Silicon	-	-	0.20
Vanadium	-	-	0.15
Lead + Cadmium	-	-	<0.010
Beryllium	-	-	0.0001
<i>Others</i>			
Each	-	-	0.03
Total	-	-	0.10
Aluminium the remainder			

Ability to achieve grain size of 140 micron or less in one min. using the standard AA TP 1 test.
 Specific detailed supply specification to be agreed with each approved supplier.

V10-10% Vanadium Hardener (Colour code - Purple/White)

	<u>Min %</u>	<u>Max %</u>
Vanadium	9.0	11.0
Copper	-	0.20
Iron	-	0.40
Magnesium	-	0.25
Manganese	-	0.25
Silicon	-	0.40
Zinc	-	0.20
Titanium	-	0.20
Nickel	-	0.10
Lead	-	0.10
Bismuth	-	0.10
Lithium	-	0.0002
<i>Others</i>		
Each	-	0.03
Total	-	0.15
Aluminium the remainder		

Pure Zinc (99.95% min.) (Colour code - Nil)

	<u>Min %</u>	<u>Max %</u>
Cadmium	-	0.02)
Iron	-	0.01)
Lead	-	0.03)-Max total of 0.05%
Tin	-	0.001)

Zinc the remainder. Purchased to specification BS3436 Zn 2(99.95%).

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ZR5 - 5% Zirconium Hardener (Colour code - Yellow/Red)

	<u>Min %</u>	<u>Max %</u>
Zirconium -	4.8	5.4
Copper	-	0.20
Iron	-	0.20
Magnesium	-	0.25
Manganese	-	0.25
Silicon	-	0.40
Zinc	-	0.20
Titanium	-	0.20
Nickel	-	0.10
Lead	-	0.10
Bismuth	-	0.10
Lithium	-	0.0002
Others		
Each	-	0.03
Total	-	0.15

Aluminium the remainder
 Manufactured using a salts based process.

Zygem Zirconium Tablets (Colour code - Blue)

	<u>Min %</u>	<u>Max %</u>
Zirconium	92.00	100.00
Titanium	-	3.50
Vanadium	-	0.10
Silicon	-	0.20
Chromium	-	0.10
Nickel	-	0.30
Iron	-	0.50
Lead	-	0.01
Tin	-	0.15
Others		
Each	-	0.03
Total	-	0.15

Aluminium the remainder