Aluminium Alloy
ALUMEC 89 Hot Rolled PLATE

SPECIFICATIONS

Commercial	7000 Series

Alumec 89 is a high strength aluminium alloy supplied in the form of hot rolled, heat treated plate. It undergoes a special cold stretching operation for maximum stress relieving.
Thanks to its high strength and good stability, Alumec 89 has become widely used in the tooling industry.
Delivery condition: heat treated to 146–180 Brinell.
Alumec 89 has the following characteristics which make it suitable for many types of tools especially plastics moulds:
Excellent machinability - High cutting speeds, reduced machining time, lower tooling costs, quicker deliveries.
Low weight - The low weight, which is approximately 1/3 of the weight of steel, allows easier and more convenient tool handling. Low inertia makes it possible to speed up closing and opening of moulds.
High thermal conductivity - Cycle times are reduced and less complicated cooling systems may be used.
Good stability - A special stress relieving operation guarantees minimal deformation during and after machining.
Good corrosion resistance - Good resistance against all commonly used plastics materials.
Suitable for surface treatments - Alumec 89 can be hard anodized, hard chromium or nickel plated for increased hardness, wear resistance and corrosion resistance.
Full manufacturer's information and MSDS Datasheet are attached.

TEMPER TYPES

Heat treated to 146–180 Brinell.

SUPPLIED FORMS

- Plate

GENERIC PHYSICAL PROPERTIES

Property	Value
Density	2.83 g/cm³
Thermal Conductivity	165 W/m.K

MECHANICAL PROPERTIES

Property	Value
Hardness Brinell	146-180 HB

CONTACT

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REVISION HISTORY

Datasheet Updated	18 December 2017

DISCLAIMER

This Data is indicative only and as such is not to be relied upon in place of the full specification. In particular, mechanical property requirements vary widely with temper, product and product dimensions. All information is based on our present knowledge and is given in good faith. No liability will be accepted by the Company in respect of any action taken by any third party in reliance thereon.

Please note that the 'Datasheet Update' date shown above is no guarantee of accuracy or whether the datasheet is up to date.

The information provided in this datasheet has been drawn from various recognised sources, including EN Standards, recognised industry references (printed & online) and manufacturers' data. No guarantee is given that the information is from the latest issue of those sources or about the accuracy of those sources.

Material supplied by the Company may vary significantly from this data, but will conform to all relevant and applicable standards.

As the products detailed may be used for a wide variety of purposes and as the Company has no control over their use; the Company specifically excludes all conditions or warranties expressed or implied by statute or otherwise as to dimensions, properties and/or fitness for any particular purpose, whether expressed or implied.

Advice given by the Company to any third party is given for that party's assistance only and without liability on the part of the Company. All transactions are subject to the Company's current Conditions of Sale. The extent of the Company's liabilities to any customer is clearly set out in those Conditions; a copy of which is available on request.

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General

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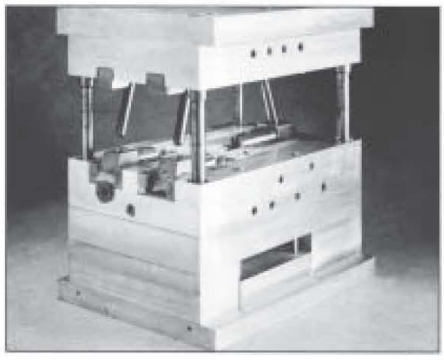
- **Excellent machinability**
  High cutting speeds, reduced machining time, lower tooling costs, quicker deliveries.
- **Low weight**
  The low weight, which is approximately 1/3 of the weight of steel, allows easier and more convenient tool handling. Low inertia makes it possible to speed up closing and opening of moulds.
- **High thermal conductivity**
  Cycle times are reduced and less complicated cooling systems may be used.
- **Good stability**
  A special stress relieving operation guarantees minimal deformation during and after machining.
- **Good corrosion resistance**
  Good resistance against all commonly used plastics materials.
- **Suitable for surface treatments**
  Alumec 89 can be hard anodized, hard chromium or nickel plated for increased hardness, wear resistance and corrosion resistance.



Alumec 89 tool.

Application areas

The properties and characteristics which Alumec 89 offers make it an ideal material for prototype tools and for moulding short and medium length production runs which are not subjected to high pressures or abrasive plastics.

Considerably shorter tool making times, lower tooling costs and shorter cycle times give valuable savings both for the tool maker and the tool user when using Alumec 89.

Application areas	Tooling category			
	Proto-types	Short runs	Medium runs	Long runs
Blow moulding	X	X	X	X
Vacuum forming	X	X	X	X
Foam moulding	X	X	X	(X)
RIM-moulding	X	X	X	(X)
Injection moulding of thermoplastics	X	X	(X)	
Rubber moulding	X	X		
Holders and support plates, jigs and fixtures				

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Properties

Physical data

Values at room temperature unless stated otherwise.

Density	kg/m³ lbs/in³	2 830 0.102
Modulus of elasticity	N/mm² psi	71 500 10.3 x 10⁶
Coefficient of thermal expansion per °C from 20°C to 100°C per °F (68–212°F)		 23 x 10⁻⁶ 12.8 x 10⁻⁶
Thermal conductivity	W/m °C Btu in/ft²h °F	165 1 144
Specific heat capacity	J/kg °C Btu/lb °F	890 0.20

Tensile strength

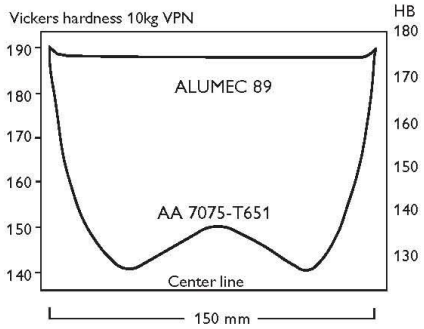
Tensile strength values, which for most practical purposes can be compared to compression strength values, should be regarded as typical.

Values at room temperature for different plate thicknesses.

	Tensile strength N/mm²	Yield strength N/mm²
Plate (thickness), mm		
> 10– 50	590	550
> 50–100	570	520
>100–150	550	500
>150–200	535	485
>200–300	430	365
Round bar Ø, mm		
40	680	630
100	680	620
200	670	610

Note that the plate is tested in the transverse direction and the round bar in the length direction.

HARDNESS DISTRIBUTION
THROUGH THE PLATE CROSS SECTION



Machining

General

A major advantage when machining aluminium alloys is the possibility of using high cutting speeds. The reason is the low cutting force needed compared with steel and brass. Because of the excellent combination of mechanical and physical properties in Alumec 89 the maximum cutting speed possible is very high, when suitable cutting tools are used. When using high speed milling machines, cutting speeds exceeding 3 500 m/min. (11 500 ft./min.) has been used with good results.

Cutting tool – design and material

Although aluminium alloys give low cutting forces, it is necessary to use high quality cutting tools. In order to achieve the highest possible cutting speed the use of cemented carbide tools, especially during turning and end milling, is ideal.

The same cutting tools normally used for steel can also be used for machining of Alumec 89. However, for good production economy, tools with large positive angles should be used. The flute should have a large chip space and be polished to prevent chips clogging the cutter.

When sawing Alumec 89, a coarse tooth saw blade is recommended.

Cooling/lubrication

The purpose of cutting fluid is to cool the work piece and to lubricate the cutting tool. Because of the high cutting speeds possible when machining Alumec 89, cooling is important, although the heat conductivity of Alumec 89 is very high. Good lubrication is of special importance during deep hole drilling, as there is a prolonged contact between chips and tool.

Cutting fluids recommended for steel may sometimes discolor the aluminium surface, if PH values are high. Most manufacturers of cutting fluid have universal fluids suitable for both steel and aluminum.

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Cutting data recommendations

The cutting data below are to be considered as guiding values which must be adapted to existing local conditions. Further information is given in the technical report "Cutting data recommendations".

Turning

	Rough turning with carbide	Fine turning with carbide	Fine turning with PCD[1]	Turning with high speed steel
Cutting speed (v_c) m/min f.p.m.	600–1200 1980–3960	1200–2500 3960–8250	600–1500 1980–4950	250–300 825–990
Feed (f) mm/r i.p.r.	0.3–1.0 0.012–0.04	–0.3 –0.012	–0.3 –0.012	–0.3 –0.012
Depth of cut (a_p) mm inch	2–6 0.08–0.24	0.5–2 0.02–0.08	0.5–3 0.02–0.12	0.5–3 0.02–0.12
Carbide designation ISO	K20	K10	–	–

[1] Polycrystallin diamond.

MILLING

FACE AND SQUARE SHOULDER FACE MILLING

	Rough milling with carbide	Fine milling with carbide	Fine milling with PCD[1]	Milling with high speed steel
Cutting speed (v_c) m/min f.p.m.	600–1000 1980–3300	1000–3000 3300–9900	800–4000 2650–13200	250–400 825–1320
Feed (f_z) mm/tooth in/tooth	0.2–0.6 0.008–0.024	0.1–0.2 0.004–0.008	0.05–0.2 0.002–0.008	–0.4 –0.016
Depth of cut (a_p) mm inch	2–8 0.08–0.32	–2 –0.08	–2 –0.08	–8 –0.32
Carbide designation ISO	K20	K10	–	–

[1] Polycrystallin diamond.

END MILLING

	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (v_c) m/min f.p.m.	300–500 990–1650	300–500 990–1650	120–250 400–825
Feed (f_z) mm/tooth inch/tooth	0.03–0.20[1] 0.001–0.008[1]	0.08–0.20[1] 0.003–0.008[1]	0.05–0.35[1] 0.002–0.014[1]
Carbide designation ISO	–	K20	–

[1] Depending on the radial depth of cut and cutter diameter

Drilling

HIGH SPEED STEEL TWIST DRILL[1]

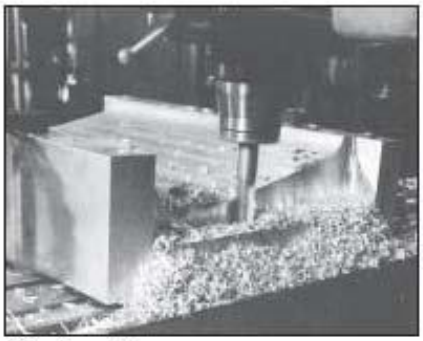
Drill diameter mm	Drill diameter inch	Cutting speed (v_c) m/min	Cutting speed (v_c) f.p.m.	Feed (f) mm/r	Feed (f) i.p.r.
– 5	–3/16	50–70	165–230	0.08–0.20	0.003–0.008
5–10	3/16–3/8	50–70	165–230	0.20–0.30	0.008–0.012
10–15	3/8–5/8	50–70	165–230	0.30–0.35	0.012–0.014
15–20	5/8–3/4	50–70	165–230	0.35–0.40	0.014–0.016

[1] Point angel 118° helix angle 16–30°

CARBIDE DRILL

	Indexable insert	Solid carbide	Carbide tip[1]
Depth of cut (v_c) m/min f.p.m.	200–400 660–1320	200–300 660–994	150–250 495–825
Feed (f) mm/r i.p.r.	0.05–0.25[2] 0.002–0.01[2]	0.10–0.30[2] 0.004–0.012[2]	0.15–0.35[2] 0.006–0.014[2]

[1] Drill with replaceable or brazed carbide tip
[2] Depending on drill diameter



Milling Alumec 89.

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Grinding

A general grinding wheel recommendation is given below. For grinding of Alumec 89 use silicon carbide abrasive. Cutting oil is recommended as grinding fluid.

Type of grinding	Wheel recommendation
Face grinding straight wheel	C 46 H V
Face grinding segments	C 24 G V
Cylindrical grinding	C 60 J V
Internal grinding	C 46 H V
Profile grinding	C 100 L V

Electrical Discharge Machining (EDM)

Machine settings are similar to those used for steel but may need more power to stabilize. Metal re-moval rates are 3 to 4 times that of steel necessitating good flushing to avoid arcing.

Copper electrodes give best results and show less wear. Roughing electrodes are rarely required.

Polishing guidelines

General

Maintain a clean work(environment and ensure that the work(piece is flushed with an appropriate industrial solvent to prevent accumulation of polishing debris.

Use large tools wherever possible to prevent high levels of localized pressure leading to surface degradation.

Renew grinding paper frequently and change direction of grinding between grades. When work(ing towards a mirror finish use copious quantities of lubricant such as a light oil.

See separate leaflet "Polishing of Tool Steel" for detailed information on polishing.

Techniques

Both mechanical and manual techniques may be used. When seek(ing a mirror finish the use of power tools should be avoided.

Media

Carborundum paper should be used for grinding starting with grades 300 through to 800. When seek(ing a mirror finish, continue with 1200 grade paper and if necessary followed with 6 micron/3 micron diamond paste.

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Photo-etching

Alumec 89 is perfecat for photo-etching thanks to its homogeneous structure.

Surface treatment

Hard anodising

Alumec 89 can be hard anodised for higher wear resistance, giving a surface hardness equivalent to about 65 HRC in steel. Usual coating thickness is 20–50 µm. Anodising is used to a limited degree in mould cavities due to the difference in expansion of the surface layer relative to the underlying aluminium. This can lead to hairline cracking, spoiling the surface appearance of mouldings. This surface is usually acceptable on non-moulding tool parts, such as slides, wear guides, leader pins and bushes, ejector pins, etc.

Note: The anodising will cause dimensional changes in the workpiece, and allowance should, therefore, be made. Increase in dimension is about 50% of the oxide layer thickness. The oxide layer may be impregnated with PTFE to reduce adhesion of the plastic.

Hard Chrome Plating

Hardness levels up to and equivalent to 80 HRC are possible using processes which have been developed for aluminium alloys. Plated layer thickness is typically 0.1–0.2 mm (0.004" to 0.008").

Chemical Nickel Plating

Hardness levels equivalent to 50 HRC are possible. Plated layer thickness is typically 0.03–0.1 mm (0.001"–0.004") whilst adhesion and corrosion resistance are generally superior to a chrome plated finish.

Repair welding

Alumec 89 may be repair welded using either Metal Inert Gas (MIG) or Tungsten Inert Gas (TIG) pro-cesses, though TIG is not recommended for large scale repairs.

General guidelines

EQUIPMENT

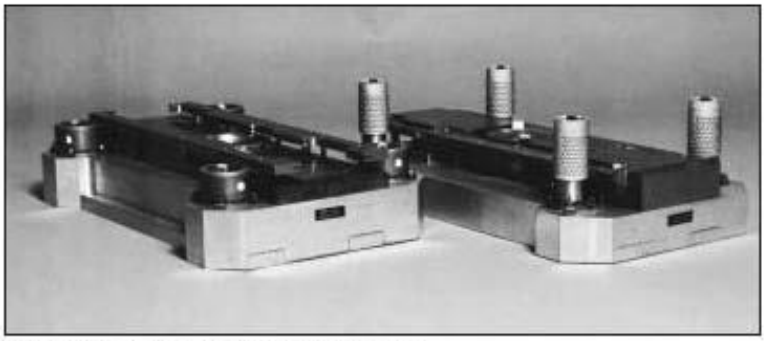
400 Amps rating, Wire Feed Motor 7.5–10 m/min (25–33 f.p.m.) (compared to 3.7 m/min [12 f.p.m.] for steel).

WELDING WIRE

AA5356 (Al 5 % Mg), AA5556A (Al 5.2 % Mg) or AA5087 (Al 4.5 % MgMnZr).
MIG 1.6 mm (0.063 in.) diameter. TIG 2.4–3.2 mm (0,095–0,126 in.).

PRE-WELD PREPARATION

Vertical faces should be machined to an angle and surfaces to be welded, degreased. Oxide layer must then be removed using rotary wire brushing and welding carried out within eight hours.



Alumec 89 is ideal for high-strength, lightweight die-sets.

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PRE-HEATING

Pre-heat to 50–130°C (120–270°F) to offset the chilling effect and high thermal conductivity of Alumec 89. Maximum metal temperature during welding should not exceed 200°C (390°F) in order to avoid cracking after welding.

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DURBIN METAL INDUSTRIES

MATERIAL SAFETY INFORMATION SHEET
ALUMEC - EU

Release date: 2014-08-19
Review date: 2016-04-21

SECTION 1: Identification of the substance/mixture and company/undertaking

1.1 Product designation

Wrought aluminum products, 7xxx Series alloys.

1.2 Identified uses of the substance/mixture

Various fabricated aluminium parts and products.

1.3 Further information on the company/undertaking

Uddeholms AB

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Sweden

Telephone number: +46 563 170 00
Fax number: +46 563 174 61
Internet: www.uddeholm.com

Contact: Eva-Lill Bergenfur
E-Mail: eva-lill.bergenfur@uddeholm.com

SECTION 2: Hazards Identification

2.1 Classification of the substance/mixture

Complete composition is provided in Section 3 and may include some components classified as nonhazardous.

2.1.1 Health hazards

The health effects listed below are not likely to occur unless processing of this product generates dusts or fumes. The following statements summarize the health effects generally expected in cases of overexposures. User specific situations should be assessed by qualified individual.

Eyes	Dust and fumes from processing: Can cause irritation.
Skin	Contact with residual oil/oil coating: Can cause irritation. Prolonged or repeated skin contact may cause irritation. Dust and fumes from processing: Can cause irritation. Prolonged or repeated skin contact may cause sensitization and allergic contact dermatitis.
Inhalation	Health effects from mechanical processing (e.g., cutting, grinding): Can cause Dust: Can cause irritation of the upper respiratory tract. Chronic overexposures: Can cause scarring of the lungs (pulmonary fibrosis), damage to the heart muscle

UDDEHOLM

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	(cardiomyopathy), reduction in the number of red blood cells (anemia), skin abnormalities (pigmentation changes), central nervous system damage, secondary Parkinson's disease and reproductive harm. Additional health effects from elevated temperature processing (e.g., welding, melting): Dust and fumes: Can cause irritation of the respiratory tract. Acute overexposures: Can cause metal fume fever (nausea, chills, fever, shortness of breath and malaise), reduced ability of the blood to carry oxygen (methemoglobin) and the accumulation of fluid in the lungs (pulmonary edema). Chronic overexposures: Can cause asthma, benign lung disease (siderosis) and lung cancer.
Carcinogenicity	Dust from mechanical processing: Can present a cancer hazard. Dust and fumes from welding or elevated temperature processing: Can present a cancer hazard.
Reproduction	Dust from mechanical processing: Can present a reproductive hazard. Dust and fumes from welding or elevated temperature processing: Can present a cancer hazard.

2.1.2 Physical hazards

Not classified for physical hazards.

2.1.3 Environmental hazards

Not classified for environmental hazards.

2.2 Labeling

The product is not classified as hazardous and does not therefor require any labeling.

2.3 Other hazards

Not available.

SECTION 3: Composition/information on ingredients

3.2 Contents/mixtures

Substance	Identification	Concentration (%)
Aluminum	CAS 7429-90-5	> 84
Zinc	CAS 7440-66-6	< 12
Magnesium	CAS 7439-95-42	< 3,7
Copper	CAS 7440-50-8	< 3,3
Cobalt *	CAS 7440-48-4	< 2
Manganese	CAS 7439-96-5	< 1,5
Iron	CAS 7439-89-6	< 1,4
Silicon	CAS 7440-21-3	< 1,2
Chromium	CAS 7440-47-3	< 0,4
Nickel **	CAS 7440-02-0	0 – 0,2
Lead (*)	CAS 7439-92-1	< 0,05

Additional information:

* - Alloys 7064 and 7090.
** - Alloys 7093 and C7093
(*) – Present as impurity. While lead is not intentionally added to this mixture, it could potentially enter through the recycle stream.

SECTION 4: First aid measures

4.1 Description of first aid measures

First aid procedures:

Eye contact — Dust and fumes from processing: Rinse eyes with plenty of water or saline for at least 15 minutes. Consult a physician.

Skin contact — Dust and fume from processing or contact with lubricant/residual oil: wash with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Inhalation — Dust and fumes from processing: Remove to fresh air. Check for clear airway, breathing and presence of pulse. Provide cardiopulmonary resuscitation for persons without pulse or respirations. Consult with a physician.

4.2 Most important symptoms and effects, both acute and delayed

Dust and fumes from processing this material can aggravate conditions such as asthma, chronic lung disease, secondary Parkinson's disease and skin rashes.

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4.3 Any immediate medical attention and special treatment needed

Not available.

SECTION 5: Firefighting measures

5.1 Extinguishing media

USE class D extinguishing agents on fines, dust or molten metal of this substance. Use coarse water spray on chips and turnings.

DO NOT USE halogenate extinguishing agents on small chips/fines.
DO NOT USE water in fighting fires around molten metal.
These fire extinguishing agents will react with the burning metal!

5.2 Special hazards arising from the substance or mixture

May be a potential hazard under the following conditions:

- Dust clouds may be explosive. Even a minor dust cloud can explode violently. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions.
- Chips, fines and dust in contact with water can generate flammable/explosive hydrogen gas. These gases could present an explosion hazard in confined or poorly ventilated spaces.
- Dust and fines in contact with certain metal oxides (e.g., rust, copper oxide). A thermite reaction, with considerable heat generations, can be initiated by a weak ignition source.
- Molten metal in contact with water/moisture or certain metal oxides (e.g., rust, copper oxide). Moisture entrapped by molten metal can be explosive. Contact of molten aluminum with certain metal oxides can initiate a thermite reaction. Finely divided metals (e.g., powders or wire) may have enough surface oxide to produce thermite reactions/explosions.

5.3 Advice for firefighters

Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

In solid form this material causes no special clean-up problems. Wear appropriate protective equipment and clothing during cleaning of debris or dust of the product.

6.2 Environmental precautions

Avoid release to the environment. In the event of a spill or accidental release, the competent authorities need to be notified in accordance with all applicable regulations. Prevent further leakage or spillage if it can be done safely. Keep out of sewers, watercourses or on the ground and in the aquatic environment.

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6.3 Methods and materials for containment and cleaning

Collect scrap for recycling.
If molten: Contain the flow using sand or salt flux as a dam. All tooling (e.g., shovels or hand tools) and containers which come in contact with molten metal must be preheated or specially coated, rust free and approved for such use. Allow the spill to cool before remelting as scrap.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

If processing of this product generates dust or if extremely fine particulate is generated, obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin F-1 and National Fire Protection Association (NFPA) brochures listed in section 16.

7.2 Conditions for safe storage, including any pollution

Keep material dry. Avoid generating dust. Avoid contact with sharp edges or heated metal. Hot and cold aluminum are not visually different. Hot aluminum does not necessarily glow red.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

8.1.1 Occupational exposure limit values (Sweden)

Compounds	Type of limit	Value (mg/m³)	Form
Aluminum (CAS 7429-90-5)	NGV	2	Respirable dust
		5	Total dust
Zinc (CAS 7440-66-6)	-	-	Not applicable
Magnesium (CAS 7439-95-4)	-	-	Not applicable
Copper (CAS- 7440-50-8)	NGV	0.2	Respirable dust
		1	Total dust
Cobalt (CAS- 7440-48-4)	NGV	0.02	Total dust
Manganese (7439-96-5)	NGV	0.1	Respirable dust
		0.2	Total dust
Iron (CAS 7439-89-6)	-	-	Not applicable
Silicon (CAS 7440-21-3)	-	-	Not applicable
Chromium (CAS 7440-47-3)	NGV	0.5	Total dust
Nickel (CAS- 7440-02-0)	NGV	0.5	Total dust
Lead (CAS 7439-92-1)	NGV	0.05	Respirable dust
		0.1	Total dust

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Note:
In accordance with the CLP Regulation, steels containing more than 10% nickel should be classified as Specific Target Organ Toxicity Repeated Exposure 1 (STOT RE1) and steels containing 1 to 10% nickel should be classified as Specific Target Organ Toxicity Repeated Exposure 2 (STOT RE 2). Steels containing more than 1% nickel should be classified as Carcinogen Category 2.

8.1.2 Biological limits values

No biological exposure limits has been detected for the constituents.

8.1.3 Recommended monitoring procedures

Wet methods:
Machine Use is normally carried out with a flow of lubricating liquid/coolant, which helps to reduce airborne particles. However, by driving the machine with coolant containing small divided particles in suspension, may cause the concentration increases to such a point where the particles can become airborne during use. Some processes such as sanding and grinding may require a complete covered containment and local exhaust ventilation. Prevent coolant spill on floor areas, external structures or operators' clothing. Use a coolant filtering system to remove particles from the cooling liquid.

Work practies:
Develop working process and procedures to prevent particles that come in contact with workers' skin, hair or personal clothing. If the working practices and / or procedures are not effective enough to control exposure and prevent airborne or visual particles from being stored on skin, hair or clothing, provide appropriate when washing / cleaning facilities. Written procedures should describe the plant's requirements for protective clothing and personal hygiene. These requirements for clothing and personal hygiene helps prevent the spread of the particles to areas that are not used for production or that they comply with the staff home. Never use compressed air to clean work clothes or other surfaces.

Housekeeping:
Use vacuum or wet cleaning methods for removing particles from surfaces. Be certain to de-energize the electrical system before beginning wet cleaning. Use a vacuum cleaner with a HEPA filter. Do not use compressed air, brushes, or regular vacuum cleaner to remove particles from the surfaces, as this may lead to increased exposure to airborne particles. Follow the manufacturer's instructions when performing maintenance on the vacuum cleaner with a HEPA filter used for cleaning hazardous materials.

8.1.4 Exposure guidelines

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

8.2 Exposure Controls

General

Personnel who handle and work with molten should utilize primary protective clothing like polycarbonate face shields, fire resistant tapper's jackets, neck shades (snoods), leggings, spats and similar equipment to prevent burn injuries. In addition to primary protection, secondary, secondary or day-to-day work clothing that is fire resistant and sheds metal splash is recommended for use

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	with molten metal. Synthetic materials should never be worn even as secondary clothing (undergarments). Minimize breathing oil vapors and mist. Remove oil contaminated clothes; lauder or dry-clean before reuse. Remove oil contaminated shoes and thoroughly clean and dry before reuse. Cleanse skin thoroughly after contact, before breaks and meals, and at the end of the work period. Oil coating is readily removed from skin with waterless hand cleaners followed by a thorough washing with soap and water.
Eye/face protection	Wear safety glasses with side shields.
Skin protection	Wear impervious gloves to avoid repeated or prolonged skin contact with residual oils and to avoid any skin injury.
Respiratory protection	Dust and fumes from processing: Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if considerations exceed the limits listed in Section 8.Suggested respiratory protection: P95, P100 for lead.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid
Colour	Silver
Odour	Odorless
pH-value	Not applicable
Flammability	Not applicable
Solubility in water	Insoluble
Density	2,7 – 2,9 g/cm3 (0,098 – 0,105 lb/in3)
Melting point	476,7 – 657,2 °C (890 – 1215 °F)

9.2 Other information

No further information applicable.

SECTION 10: Stability and reactivity

10.1 Reactivity

There is no risk for reactivity.

10.2 Chemical stability

Stable under normal conditions of use, storage and transportation as shipped.

10.3 Possibility for hazardous reactions

Hazardous polymerization of this product will not occur.

10.4 Conditions to avoid

Avoid dust formation. Contact with water. Contact with acids. Contact with alkalis.

10.5 Incompatible materials

Water, strong acids, alkalies and oxidizing agents.

10.6 Hazardous decomposition products

Not available.

SECTION 11: Toxicological information

11.1 Information on toxicological effects associated with the ingredients

Aluminum	Dust and fumes has low health risk by inhalation. Generally considered to be biologically inert (milling, cutting, grinding).
Copper	Dust and mists can cause irritation of the eyes, mucous membranes, skin and respiratory tract. Chronic overexposures can cause reduction in the number of red blood cells (anaemia), skin abnormalities (pigmentation changes) and hair dislocation.
Cobalt	Can cause irritation of eyes, skin and respiratory tract. Skin contact can cause allergic reactions. Acute and chronic overexposures can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis) and damage to the heart muscle (cardiomyopathy). Listed as possibly carcinogenic to humans by IARC (Group 2B).
Manganese	Chronic overexposure of dust or fumes can cause inflammation of the lung tissues, scarring of the lunges (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproduction harm in males.
Silicon	Chronic overexposure of inert dusts can cause chronic bronchitis and narrowing of airways.
Chromium	Dust and fumes can cause irritation of eyes, skin and respiratory tract. Metallic chromium and trivalent chromium is not classifiable as to their carcinogenicity to humans by IARC.

Nickel	Dust and fumes can cause irritation of eyes, skin and respiratory tract. Eye contact can cause inflammation of the eyes and eyelids (conjunctivitis). Skin contact can cause sensitization and allergic contact dermatitis. Chronic overexposures can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma and scarring of the lungs (pulmonary fibrosis). Reviewed and not recommended for listing by NTP. Listed as possibly carcinogenic to humans by IARC (Group 2B).
Lead	Can cause irritation of eyes and upper respiratory tract. Acute overexposures can cause nausea and muscle cramps. Chronic weakness in the extremities (peripheral neuropathy), abdominal cramps, gastrointestinal tract effects, kidney damage, liver damage, central nervous system damage, damage to the blood forming organs, blood cell damage and reproductive harm. Can cause reduced fertility and fatal toxicity in pregnant women. Listed as “reasonably anticipated to be a human carcinogen” by the NTP. Listed as possibly carcinogenic to humans by IARC (Group 2B).

Some products are supplied with an oil coating or have a residual oil from the manufacturing process. Oil can cause irritation of skin. Prolonged or repeated skin contact can cause dermatitis.

11.2 Health effects associated with compounds formed during processing.

The following effects could be expected if welded, remelted or otherwise processed at elevated temperatures.

Aluminum oxide	Low health risk by inhalation. Generally considered to be biologically inert.
Zinc oxide fume	Can cause irritation of respiratory tract. Acute overexposures can cause metal fume fever (nausea, fever, chills shortness of breath and malaise).
Magnesium oxide fume	Can cause irritation of the eyes and respiratory tract. Acute exposure can cause metal fume fever (nausea, fever, chills shortness of breath and malaise).
Copper fume	Can cause irritation of the eyes, mucous membranes, and respiratory tract. Acute overexposure cam cause, metal fume fever (nausea, fever, chills shortness of breath and malaise).
Cobalt compounds	Can cause irritation of eyes, skin and respiratory tract. Acute overexposures can cause allergic reactions. Acute and chronic overexposures can cause respiratory sensitization, asthma, kidney damage and damage to the heart muscle (cardiomyopathy). Listed as possibly carcinogenic to humans by IARC (Group 2B).
Manganese oxide fumes	Can cause irritation of the eyes, skin and respiratory tract. Acute overexposures can cause metal fume fever (nausea, fever, chills shortness of breath and malaise).

Iron oxide	Chronic overexposures can cause benign lung disease (siderosis). Ingestion can cause irritation of the gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis) and liver damage.
Silica, amorphous	Acute overexposure can cause dryness of eyes, nose and upper respiratory tract.
Chromium (III)compounds	Can cause irritation of eye, skin and respiratory tract. (Not classified as carcinogenic to humans by IARC).
Chromium (VI)compounds	Can cause irritation of eye, skin and respiratory tract. Skin contact can cause irritant dermatitis, allergic reactions and skin ulcers. Chronic overexposures can cause perforation of the nasal septum, respiratory sensitization, asthma, the accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer and cancer or the gastrointestinal tract. Listed as "Known to be human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1).
Nickel compounds	Associated with lung cancer, cancer of the vocal cords and nasal cancer. Listed as "Known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1).
Lead (inorganic compounds)	Listed as "reasonably anticipated to be a human carcinogen" by the NTP. Listed as probably carcinogenic to humans by IARC (Group 2A).

If the products are heated well above ambitient temperatures or machines, oil vapor or mist may be generated. Oil vapor or mist can cause irritation of respiratory tract. Acute overexposures can cause bronchitis, headache, central nervous system effects (nausea, dizziness and loss of coordination) and drowsiness (narcosis).

Welding, plasma arc cutting, and arc spray metalizing can generate ozone.
Ozone can cause irritation of eyes, nose and upper respiratory tract. Acute overexposure can cause shortness of breath, tightness of chest, headache, cough, nausea and narrowing of airways. Effects are reversible on cessation of exposure. Acute overexposure of high concentrations can cause respiratory distress, respiratory tract damage, bleeding and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed up to 1-2 hours.

Additional information: Studies (inhalation) with experimental animals have found genetic damage, reproductive harm, blood cell damage, lung damage and death.

Welding fumes are listed as possibly carcinogenic to humans by IARC (Group 2B).

Additional information: In one study, occupational asthma was associated with exposures to fumes from aluminium welding.

Plasma arc cutting of aluminium can generate oxides of nitrogen. Oxides of nitrogen (NO and NO2) can cause irritation of eyes, skin and respiratory tract. Acute overexposures can cause reduced ability of the blood to carry oxygen (methaemoglobin). Can cause cough, shortness of breath, accumulation of fluid in the lungs (pulmonary edema) and death. Effects can be delayed up to 2-3 weeks.

Chronic overexposure of nitrogen dioxide (NO_2) can cause scarring of the lungs (pulmonary fibrosis).

SECTION 12: Ecological information

12.1 Persistence and degradability

Not available.

12.2 Bioaccumulative potential

Not available.

12.3 Mobility in soil

Not relevant because of the form of the product.

12.4 Results of PBT and vPvBB assessment

Not available.

12.5 Other adverse effects

Not available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Reuse or recycle material whenever possible. If reuse or recycling is not possible, disposal must be made according to local or governmental regulations.

13.2 Requirements for remelting of scrap material or ingot

Molten metal and water can be an explosive combination. The risk is greatest when there is sufficient molten metal to entrap or seal off the water. Water and other forms of contamination on or contained on scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

13.3 Dross handling

Small amounts of beryllium (<0,0002% or <2 ppm) can be present in aluminum alloys either from naturally occurring beryllium in aluminum ore or as a alloying element in the aluminum recycling stream. This beryllium does not present a health hazard during processing (grinding, cutting or welding of aluminum products. However, beryllium may concentrate in the dross formed when aluminum scrap is remelted. Therefore, the potential for exposures to beryllium when handling dross must be considered. Control of airborne dust levels would be critical in reducing or eliminating this potential.

SECTION 14: Transport information

14.1 ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road).
Not regulated.

14.2 RID (Regulations concerning the International Carriage of Dangerous Goods).
Not regulated.

14.3 ADN (The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways).
Not regulated.

14.4 IATA (International Air Transport Association).
Not regulated.

14.5 IMDG (International Maritime Dangerous Goods Code)
Not regulated.

14.6 Special precautions

Not regulated.

14.7 Transport in bulk according to Annex III of MARPOL 73/78 and the IBC Code
Not regulated.

14.8 General shipping information
When "Not regulated", enter the proper freight classification, MSDS Number and Product Name onto the shipping paperwork.

SECTION 15: Regulatory information

15.1 Regulations / legislation for the substance or mixture Safety, health and environment

15.1.1 EU Regulations

Regulation (EC) no.1005/2009 on substances that deplete the ozone layer. Annex II with amendments.
Not listed.

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Regulation (EC) no.850/2004 on persistent organic pollutants.
Annex I.
Not listed.

Regulation (EC) no.689/2008 concerning the export and import of dangerous chemicals.
Annex I, Part 1.
Not listed

Regulation (EC) no. 689/2008 concerning the export and import of dangerous chemicals.
Annex I, Part 2.
Not listed

Regulation (EC) no. 689/2008 concerning the export and import of dangerous chemicals.
Annex I, Part 3.
Not listed

Regulation (EC) no. 689/2008 concerning the export and import of dangerous chemicals.
Annex V.
Not listed.

Regulation (EC) no. 166/2006
Annex II Register of releases and transfers of pollutants.
Copper (CAS 7440-50-8).
Chromium (CAS 7440-47-3).
Lead (CAS 7439-92-1).

Regulation (EC) no. 1907/2006 REACH Article 59 (10) list of candidates in the form in which it is currently published in the ECHA.
Not listed.

15.1.2 Authorizations

Regulation (EC) no. 1907/2006 REACH Annex XIV substance for which a permit is required.
Not listed.

Regulation (EC) no. 1907/2006 REACH Annex XVII Restrictions on the marketing and use of certain dangerous substances as amended.
Not listed.

15.1.3 Restrictions on use

Regulation (EC) no. 1907/2006 Annex XVII Substances whose use and placing on the market has been limited.
Nickel (CAS- 7440-02-0).

Directive 2004/37 / EC on protection of workers from risks related to exposure to carcinogens and mutagens at work.

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Copper (CAS- 7440-50-8).
Chromium (CAS 7440-47-3).

Directive 92/85 / EEC: measures to improve safety and health at work of pregnant workers who have recently given birth or are breastfeeding.
Not listed.

15.1.4 Other EU regulations

Directive 2012/18 / EC, if measures to prevent and limit the danger of major accidents involving dangerous substances.
Not listed.

Directive 98/24 / EC concerning protection of the health and safety risks related to chemical reactions in the work.
Not listed.

Directive 94/33 / EC on protection of minors in the workplace.
Cobalt (CAS 7440-48-4).

15.1.5 National regulations

Not Listed.

15.2 Chemical safety assessment

No assessment of the chemical safety have been implemented.

SECTION 16: Other information

16.1 Other information

The information in this Safety Data Sheet was written based on the best knowledge and experience currently available.

16.2 Responsible for SDS

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16.3 Prepared by

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16.4 Change History

2016-04-21 New Safety Data Sheet because of changes in company profile.