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This material Safety Data Sheet (SDS) provides information on a specific group of manufactured metal products. Since these metal products share a common physical nature and constituents, the data presented are applicable to all alloys identified. This document was prepared to meet the requirements of OSHA's Hazard Communication Standard, 29 CFR 1910.1200.

Section I - **PRODUCT IDENTIFICATION & COMPANY INFORMATION**

Product name: Various grades of welding consumables carrying various trade names and alloy designations encompassing stainless steel, nickel, cobalt and titanium alloys.
Other/generic names: A list is given in the Appendix.
Product use: Welding consumables, refer to applicable product technical data sheets for information of typical scope of use and application, not all products are suitable for all processes or applications.

Filler Metal - Used for joining and overlaying, using GTAW, GMAW, Plasma and SAW (with suitable flux) welding processes

Flux Cored - Used for joining and overlaying, using GMAW welding processes

Welding Electrode - Used for joining and overlaying, using SMAW welding process

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Section II – **HAZARDS IDENTIFICATION**

Welding consumables are not normally considered hazardous as shipped. Ends and edges can be sharp and gloves should be worn when handling.

POTENTIAL HEALTH HAZARDS

Skin: Although not normally hazardous, some individuals can develop allergic skin reactions to nickel and other metallic ingredients. Ends of wire and edges of strips may be sharp and can cause cuts. During welding and

spraying - Fumes generated may be irritating to the skin. UV radiation produced can cause burns (ray burn). Hot metal can cause burns.

Eyes: As shipped, product does not pose a hazard to the eyes however ends of wire and edges of strip are sharp and can cause cuts. During welding and spraying - Fumes generated can be irritating to the eye. Ends of wire may be sharp and can cause cuts or hot and cause burns. UV radiation produced can cause burns (arc eye).

Inhalation: Fumes generated by welding and spraying processes can be irritating and toxic.

Ingestion: Not a likely route of entry. Metal ingestion can cause toxic effects.

Delayed effects: Inhalation of welding or spraying fumes may cause damage to the lungs and respiratory tract including but not limited to fibrosis of the lung which can reduce lung capacity and produce difficulty breathing. Cobalt and Nickel are animal carcinogens and inhalation of fumes and dusts should be avoided. Prolonged inhalation of Manganese fumes and dusts may cause irreversible damage to the nervous system resulting in Parkinson's Disease-like symptoms (tremors, weakness, paralysis, etc.)

Section III - **COMPOSITION / INGREDIENTS[1]**

IMPORTANT – This section lists hazardous ingredients in the as-shipped products.

INGREDIENT	Max Wt. %	PEL[2]	TLV[3]	CAS#[4]
Aluminum (Al)	6	15	10	7429-90-5
Calcium Carbonate (containing silica)	Note 5	15(5*)	10	1317-65-3
Calcium Fluoride (As F)	Note 5	2.5	2.5	7789-75-5
Calcium Silicate	Note 5	15(5*)	None	13983-17-0
Chromium (Cr) (metal)	33	1	0.5	7440-47-3
Cobalt (Co)	66	0.1	0.02	7440-48-4
Copper (Cu)	34	1	1	7440-50-8
Feldspar (containing silica)	Note 5	10**	2(Total Dust)	68476-25-5
Hydroxyethyl Cellulose	Note 5	None	None	9004-62-0
Iron (Fe)	99	None	None	7439-89-6
Iron Oxide	Dust or fume	10	5	1309-37-1
Lithium Silicate	Note 5	None	None	12627-14-4

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Manganese (Mn)	16	C5	0 .2	7439-96-5
Magnesium Carbonate	Note 5	15(5)	10	546-93-0
Magnesium Fluoride (As F)	Note 5	2.5	2.5	7783-40-6
Manganese Oxide	Note 5	C5	5	1344-43-0
Molybdenum (Mo)	30	15	10	7439-98-7
Nickel (Ni)	99	1	1.5*	7440-02-0
Niobium (Nb)	6	15	10	03/01/7440
Potassium Bichromate	Note 5	C0.1	0.05	7778-50-9
Potassium Hydroxide	Note 5	C2	C2	1310-58-3
Potassium Silicate	Note 5	None	None	1312-76-1
Silicon	4	15(5*)	10	7440-21-3
Sodium Aluminum Fluoride (As F)	Note 5	2.5	2.5	13775-53-6
Sodium Silicate	Note 5	C2 (As NaOH)	C2 (As NaOH)	1344-09-8
Titanium (Ti)	90	None	None	7440-32-7
Titanium Dioxide	Dust or fume	15(5*)	10	13463-67-7
Tungsten (W)	5	5(STEL-10)	5	7440-33-7
Vanadium (V)	4	C0.5	0.05	7440-62-2

Nuisance particulates as respirable dust at 5mg/m3 (*Respirable Fraction)(**Crystalline Silica) (C = Ceiling Limit) (STEL – Short Term Exposure Limit)
1 - Composition of HAZARDOUS INGREDIENTS (as defined by OSHA – 29CFR1910.1200 and PA TITLE 34) – 1% or greater by weight, except 0.01% or greater for nickel and chromium.
2 - OSHA Permissible Exposure Limits (mg/m3)
3 - Threshold Limit Value (mg/m3), American Conference of Governmental Industrial Hygienist (ACGIH)
Both PEL and TLV are 8 hour Time Weighed Averages (TWA), unless designated as C (ceiling limits)
4 - Chemical Abstract Services Number
5 - Not an alloying element, >1% possibly present in electrode coating

Section IV – **FIRST AID MEASURES**

Skin: Wash skin with soap and water to remove any metallic particles. If a rash or burn develops, seek medical attention.
Eyes: Flush particles from eyes with clean water for at least 15 minutes. If irritation persists or burn develops, seek medical attention.
Inhalation: Remove from exposure. If respiratory irritation persists, seek medical attention.
Ingestion: If metallic particles are swallowed, seek medical assistance.
Advice to physician: Treat symptomatically

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Section V – **FIRE FIGHTING MEASURES**

As shipped, these products are nonflammable and non-explosive. However, welding arcs and sparks can ignite combustibles, and can initiate fires and explosions. Be sure you read and understand American National Standard Institute standard ANSI Z49.1 "Safety in Welding and Cutting" and National Fire Protection Association standard 51B for fire prevention in "Cutting and Welding Processes" before using these products.

Extinguishing
N/A
Unusual Fire and Explosive Hazards
N/A
Special Fire Fighting Procedures
N/A

Media Flash Point (Method Used)
N/A
Flammable Limit
N/A

Section VI – **ACCIDENTAL RELEASE MEASURES**

In solid form this material poses no special clean-up problems. If this material is in powder or dust form, notify safety personnel, isolate the area and deny entry. Do not sweep. Clean-up should be conducted with a vacuum system utilizing a high efficiency particulate air (HEPA) filtration system. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air and water. Cleanup personnel should protect against exposure. Properly label all materials collected in waste container. Follow applicable emergency response regulations, such as OSHA (29CFR 1910.120).

Section VII – **HANDLING AND STORAGE**

HANDLING PRECAUTIONS - Dust and welding fume should be moved or transported to minimize spill or release potential.
STORAGE PRECAUTIONS - In solid form this material poses no special problems. To ensure performance of the product, store in a warm, dry environment away from incompatibles (Section 10).

Section VIII – **EXPOSURE CONTROLS/PERSONAL PROTECTION**

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ENGINEERING CONTROLS - Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during welding) below the exposure limits cited in Section 2.
VENTILATION - Use enough ventilation (local exhaust at the arc) to keep fumes and gases from the worker's breathing zone and the general area. Train welders to keep their heads out of the welding plume. If the fumes are removed by filtration or some other means and the air/gas stream is put back into the room, gases and fumes may build up to toxic or asphyxiation levels. Gas build-up should be monitored and if excessive should be removed or reduced to safe levels by some supplementary system and/or reduced by general ventilation.
RESPIRATORY PROTECTION - Use NIOSH approved respirators as specified by an industrial hygienist or qualified safety professional. Lung function tests are recommended for users of negative pressure devices. Use a fume respirator or an air supplied respirator where local exhaust or general ventilation does not keep exposure below the exposure limits for air contamination. Remember - the shielding gases used with the GMAW and GTAW processes can displace breathing air and cause asphyxiation in confined work spaces or unventilated areas.
SKIN PROTECTION - Wear hand, head, and body protection which help to prevent injury from radiation, sparks, and electric shock. Refer to ANSI Z49.1 for more information. At a minimum this includes dry welder's gloves and a protective face shield and may include arm protectors, aprons, hats, and shoulder protectors as well as dark, substantial clothing.
EYE PROTECTION - Arcs produce ultraviolet and infrared radiation. Use a welder's helmet or a face shield and wear safety glasses under the welder's helmet or face shield. As a rule, start with a lens shade that is too dark to see the weld zone. Then go to a lighter shade (a lower number shade) which gives sufficient view of the weld zone. Do not go below the minimum recommended in ANSI standard Z49.1.
ELECTRIC SHOCK - Welders should be trained to avoid electric shock by maintaining a dry work area, insulating themselves from the workpiece and ground, and not touching live electrical parts.
RECOMMENDED MONITORING PROCEDURES - The welding fumes of most of these welding products contain certain ingredients which either may, or will, reach their PEL TLV ®, or other occupational exposure limit before reaching the TLV ®-TWA of 5 mg/m3 for respirable particulate not otherwise specified (NOS).

Monitoring the welding fume for these ingredients is recommended. Monitoring for respirable particulate (NOC) is also recommended for all products. Seek professional advice from an industrial hygienist or qualified safety professional for recommended monitoring procedures.

Section IX – **PHYSICAL AND CHEMICAL PROPERTIES**

MELTING POINT: >2100°F <2600°F

VAPOR DENSITY (AIR=1): Not Applicable

SUBLIMES @: Not Applicable

SPECIFIC GRAVITY: (H2O=1) 7-9

BOILING POINT: Not Applicable

pH: Not Applicable

EVAPORATION RATE: Not Applicable

SOLUBILITY IN WATER: None

VAPOR PRESSURE (mmHg): Not Applicable

% VOLATILES BY VOLUME: None

APPEARANCE AND COLOR: The bare wire welding and thermal spray products are produced as straight lengths and coiled wires. The SMAW electrodes are produced as metal core rods coated with a flux.

Section X – **STABILITY AND REACTIVITY**

General: This product is intended for normal welding purposes.
Stability: Stable under normal conditions.
Reactivity: May react in contact with strong acids to release gaseous acid decomposition products. Fume is produced during welding. Expected fume constituents include oxides of metal as iron, manganese, nickel and chromium. Expected gaseous products would include
carbon oxides, nitrogen oxides and ozone. Contamination, dirt, surface protections, paint or primer on the base material can affect the composition of the fumes.

Section XI – **TOXICOLOGICAL INFORMATION**

Nickel and cobalt are classified as Category 3 carcinogens. The exposure route of concern is inhalation.
As shipped, these complex alloys in massive form have no known toxicological properties other than causing allergic reactions in individuals sensitive to the

metal(s) contained in the alloys. However, dust from flux or user-generated dusts and fumes may on contact with the skin or eyes produce mechanical irritation. Chronic exposures coupled with sweat could cause dermatitis (skin) or conjunctivitis (eyes).

Excessive inhalation of dust or user-generated fumes from welding or metal spraying may, depending on the specific features of the process used, pose a long-term health hazard. The International Agency for Research on Cancer (IARC) has concluded that welding fumes are possibly carcinogenic to humans. The ingredients of fumes and gases generated in welding, metals spraying and grinding will depend on the base metal and the details of the specific process being used. Ingredients may include metals, metal oxides, chromates, fluorides, carbon monoxide, ozone, and oxides of nitrogen. Phosgene can be produced if chlorinated solvent vapors are present in user operations.

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Chromium - The International Agency for Research on Cancer (IARC) considers hexavalent chromium to be a carcinogen (lung, nasal) but does not have adequate evidence for chromium metal and trivalent chromium. Fumes have been associated with lung fibrosis.

Iron - Prolonged inhalation of iron oxide fumes can lead to siderosis, which presents as a benign pneumoconiosis.

Molybdenum - Repeated inhalation of fumes has caused kidney damage, respiratory irritation and liver damage in animals.

Nickel - Nickel metal is “reasonably anticipated to be a human carcinogen” (National Toxicology Program’s 10th Report). IARC states that nickel metal is possibly carcinogenic to humans. Epidemiological studies of workers exposed to nickel powders, dusts and fumes in the nickel alloy and stainless steel producing industries do not indicate a significant respiratory cancer hazard. Inhalation of nickel powder produced malignant tumors in rodent studies. Single intratracheal installations of nickel powder at levels close to the LD50 have caused malignancies in hamsters. Nickel can cause skin sensitization in susceptible individuals through prolonged contact with skin.

Section XII – **ECOLOGICAL INFORMATION**

As a solid metal object, Filler Metal products are not considered toxic to aquatic species.

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Flux (being of mineral constituents) from flux coated electrodes, flux cored wire and flux may degrade over time.

Section XIII – **DISPOSAL CONSIDERATIONS**

Unused consumable wastes are normally collected to recover metal values. Dispose of fume, flux and weld grinding residues from the work area, or from filters, in accordance with local, state and federal regulations. Refer to this SDS for information on the possible contents of the collected fumes and other materials.

Section XIV – **TRANSPORT INFORMATION**

No international regulations or restrictions are applicable.

SHIPPING NAME -	Not Applicable
IDENTIFICATION NUMBER -	Not Applicable
HAZARD CLASS -	Not Applicable
LABEL(S) REQUIRED -	Not Applicable

Section XV – **REGULATORY INFORMATION**

Alloys containing less than 1% of nickel or cobalt are not classified as "dangerous for supply". Alloys containing more than 1% of either metal are classified as the metals themselves. However, in recognition of their essentially non-hazardous nature, these alloys in the massive form are not required to be labeled as hazardous.

Section XVI – **OTHER INFORMATION**

Current Issue Date: January 31, 2017 **Previous Issue Date:** May 2015
Changes: Reviewed no changes
Previous Changes: N/A

This SDS was prepared by Rolled Alloys technical personnel to be in compliance with OSHA's Hazard Communication Standard, 29 CFR 1910.1200 and is provided in good faith based upon the experience and knowledge of the

company. Rolled Alloys does not manufacture welding consumables, but causes products to be made under their label by internationally known and recognized producers. In addition, Rolled Alloys distributes products of these companies and has relied, in part, on information contained in SDS documents provided by these manufacturers. Users should make their own assessment of workplace risks as required by other health and safety legislation. As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any material described herein. Information contained herein is believed to be true and accurate, but all statements or suggestions are made without warranty, expressed or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable Federal, State, and local laws and regulations remain the responsibility of the user.

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APPENDIX

This listing of weld consumables represents the common or trade name of the materials commonly supplied by Rolled Alloys. Rolled Alloys may, from time to time, supply similar alloys that are not included on this list. The composition of these other materials will fall within the compositions ranges shown in Section II of the SDS.

NICKEL ALLOYS

RA718 AMS5832	RA625 AMS5837	RA625 ERNiCrMo-3
RA112 ENiCrMo-3	RA82 ERNiCr-3	RA182 ENiCrFe-3
Hastelloy® X AMS5798	Hastelloy® W AMS5786	C263 AMS5966
WASPALOY™ AMS5828	René 41® 5 AMS800	

COBALT ALLOYS

L605 (Haynes 25) AMS5796	RA188 AMS5801	694 (CM64)
T-800	MAR M-918 AMS5814	

STAINLESS/HEAT RESISTING

RA347 AMS5680	17-4PH AMS5825	Jethete AMS5823
309	310	RA333® N06333
RA333-70-16 W86333	RA330-04 N08334	RA330-04-15 W88334
RA330-80-15 W88338	RA330-80-16 W88338	RA 253 MA® S30815
RA 602 CA™ N06025	RA320LR-15 E320LR	RA320LR ER320LR-15
RA2209 ER2209	Zeron®100 ER2594	

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