

Nickel Oxide: IARC-1 Carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen. TLV-A1 confirmed human carcinogen; NTP-K known to be a human carcinogen.

Nickel Sub sulfide: EPA-A human carcinogen, studies support a causal association between exposure and cancer; IARC-1 carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen. TLV-A1 confirmed human carcinogen; NTP-K known to be a human carcinogen.

☉ **WARNING:** This product contains or produces a chemical known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code §25249.5 et seq.)

VII. Precautions for Safe Handling and Use/Applicable Control Measures

Read and understand the manufacturer's instructions and the precautionary label on this product. See American National Standard Z-49.1, "Safety in Welding and Cutting," published by the American Welding Society, P. O. Box 351040, Miami, FL 33135 and OSHA Publication 2206 (29 C.F.R. 1910), U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 for more detail on many of the following:

Ventilation: Use enough ventilation, local exhaust at the arc, or both, to keep the exposure within legal limits. In the worker's breathing zone and the general area, fumes and gases must be kept below the TLVs and the equivalent exposure must compute to less than one. Train the welder to keep his head out of the fumes.

Respiratory Protection: Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV. Where respiratory protection is necessary, NIOSH approved respiratory protection should be used. The selection of the appropriate respiratory protection (dust respirator, etc.) should be based on the actual or potential airborne contaminants and their concentrations present. However, at least a NIOSH approved type TC-21-C dust mask is recommended.

Eye Protection: Wear helmet or use face shield with filter lens. As a rule of thumb, start with a shade which is too dark to see the weld zone. Then go to the next lighter shade which gives sufficient view of the weld zone. Provide protective screens and flash goggles, if necessary, to shield others. Wear safety glasses or goggles when handling this material to prevent eye contact. Do not wear contact lenses in any environment where dust or fumes are present. Readily available eye baths are recommended in areas where operations may produce fumes and dusts.

Protective Clothing: Wear head, hand, and body protection which help to prevent injury from radiation, sparks and electrical shock. See ANSI Z-49.1. At a minimum, this includes welder's gloves and a protective face shield and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Train the welder not to touch live electrical parts and to insulate himself from work and ground.

Hygienic Work Practices: Avoid contact to eyes, skin, and mucous membranes. Avoid inhalation of vapors. Wash thoroughly after handling and use. Do not smoke, eat, drink, chew gum or tobacco, or apply cosmetics within the working area. Do not carry or store tobacco products, gum, food, drinks or cosmetics into the working area. Otherwise, follow the standards of good industrial hygiene practices.

Procedure for Cleanup of Spills or Leaks: NOT APPLICABLE

Waste Disposal Method: Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with Federal, State and Local regulations.

The opinions expressed in this MSDS are those of qualified experts within **THE ESAB GROUP**. We believe that the information contained herein is current as of the date of this MSDS. Since the use of this information and these opinions and the conditions of use of these products are not within the control of **THE ESAB GROUP**, it is the user's obligation to determine the conditions of safe use of these products.

Effects of chronic (long-term) overexposure to air contaminants may lead to their accumulation in the lungs, a condition which may be seen as dense areas on chest X-rays. The severity of the change is proportional to the length of the exposure. The changes seen are not necessarily associated with symptoms or signs of reduced lung function or disease. In addition, the changes on X-rays may be caused by non-work factors such as smoking, etc. Long term exposure to welding and allied processes gases, dusts and fumes may contribute to pulmonary irritation or pneumoconiosis. Nickel and chromium are considered carcinogenic. Long term overexposure to nickel fumes can also cause pulmonary fibrosis and edema. Overexposure to manganese compounds can affect the central nervous system, symptoms of which are languor, sleepiness, muscular weakness, emotional disturbances, and spastic gait. The effect of manganese on the nervous system is irreversible. Overexposure to copper fumes may lead to copper poisoning, resulting in hemolytic anemia and liver, kidney and spleen damage. Inhalation of too much iron oxide fume over a long time can cause siderosis, sometimes called "iron pigmentation" of the lung, which can be seen on a chest x-ray but causes little or no disability.

Exposure limits for the ingredients are listed in Section II. The ACGIH and the 1989 OSHA TWA for welding fume is 5 mg/m³. At times, the limit for a particular hazardous chemical is reached before the limit for welding fumes. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and excessive concentrations. As noted in Section V, the welding fume is a mixture of many components. Therefore, a statutory computation of the equivalent exposure is required. The equivalent exposure value for the welding fume mixture shall always be less than one. When these products are used as recommended by **THE ESAB GROUP**, and the preventive measures taught in this MSDS are followed, overexposure to hazardous substances will not occur.

Emergency First Aid Measures: In case of emergency, call for medical aid. Employ first aid technique recommended by the Red Cross. **IF BREATHING IS DIFFICULT**, give oxygen and call for a physician. **FOR ELECTRIC SHOCK**, disconnect and turn off the power. If not breathing, begin artificial respiration, preferably mouth-to-mouth. If no detectable pulse, begin Cardio Pulmonary Resuscitation (CPR). Immediately call a physician. **FOR ARC BURN**, apply cold, clean compresses and call a physician.

Eye Contact: Flush with water for at least fifteen minutes to remove all residue. If irritation persists, obtain medical assistance.

Skin Contact: Promptly flush with soap and water to remove all residue. If irritation persists, consult a physician.

Inhalation: Remove to fresh air. If breathing has stopped, perform artificial respiration and obtain medical assistance immediately!

Ingestion: Call a physician or your Poison Control Center IMMEDIATELY! Advise of Section II.

Carcinogenic Assessment (NTP Annual Report, IARC Monographs, Other):

Chromates, alkaline as Cr; Chromic Acid and chromates; and Chromite ore processing (Chromate) as Cr: TLV-A1, confirmed human carcinogen.

Chromium (III) inorganic compounds, as Cr: EPA-D not classified as to human carcinogenicity. IARC-3 unclassifiable as to carcinogenicity in humans. TLV-A4 not classified as a human carcinogen.

Chromium (VI) inorganic compounds, as Cr, water-soluble: EPA-A human carcinogen, studies support a causal association between exposure and cancer; EPA-K known human carcinogen; IARC-1 carcinogenic to humans; TLV-A1 confirmed human carcinogen; NTP-K known to be a human carcinogen.

Chromium (VI) inorganic compounds, as Cr, certain water insoluble: EPA-A human carcinogen, studies support a causal association between exposure and cancer; EPA-K known human carcinogen; IARC-1 carcinogenic to humans; TLV-A1 confirmed human carcinogen; NTP-K known to be a human carcinogen.

Chromium Metal: IARC-3 unclassifiable as to carcinogenicity in humans. TLV-A4 not classified as a human carcinogen.

Molybdenum Soluble Compounds, as Mo: TLV-A3 confirmed animal carcinogen with unknown relevance to humans.

Molybdenum Trioxide: MAK-3B substance for which in vitro tests or animal studies have yielded evidence of carcinogenic effects.

Nickel, Alloys: IARC-2B possibly carcinogenic to humans.

Nickel Compounds: IARC-1 carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen.

Nickel, Elemental: IARC-2B possibly carcinogenic to humans; NTP-K known to be a human carcinogen; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; TLV-A5 not suspected as a human carcinogen on the basis of properly conducted epidemiological studies in humans.

Nickel, Insoluble Compounds, as Ni: NTP-K known to be a human carcinogen; TLV-A1 confirmed human carcinogen; NTP-K known to be a human carcinogen.

Nickel, Soluble Compounds, as Ni: NTP-K known to be a human carcinogen; TLV-A4 not classified as a human carcinogen.

Nickel Carbonate: IARC-1 carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen.

Nickel Dioxide: IARC-1 carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen.

Nickel Hydroxide: IARC-1 carcinogenic to humans; MAK-1 substances that cause cancer in man and can be assumed to make a significant contribution to cancer risk; NTP-K known to be a human carcinogen.

V. Reactivity Data

Stability: Stable (X) Unstable () Polymerization will not occur.

Incompatible products: None currently known.

Hazardous decomposition products: Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the material being worked, the process, procedures, and consumables used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the material being worked (such as paint, plating or galvanizing), the number of welding operations and the volume of the work area, the quality and amount of ventilation, the position of the worker's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning or painting activities). When the materials are consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section II. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the ingredients, plus those from the material being worked and the coatings etc. noted above.

Reasonably expected decomposition products from normal use of these products include a complex of the oxides of the materials listed in Section II, as well as carbon monoxide, carbon dioxide, ozone and nitrogen oxides (refer to "Characterization of Arc Welding Fume" available from the American Welding Society). THE FUME LIMIT FOR CHROMIUM, NICKEL, AND/OR MANGANESE MAY BE REACHED BEFORE THE GENERAL LIMIT FOR WELDING FUMES OF 5 mg/m³ IS REACHED. MONITOR FUMES FOR CHROMIUM, NICKEL, AND MANGANESE. A SIGNIFICANT AMOUNT OF THE CHROMIUM IN THE FUMES CAN BE HEXAVALENT CHROMIUM, WHICH HAS A VERY LOW EXPOSURE LIMIT, 0.005 mg/m³ (5µg/m³). The only way to determine the true identity of the decomposition products is by sampling and analysis. The composition and quantity of the fumes and gases to which a worker may be overexposed can be determined from a sample obtained from inside the welder's helmet, if worn, or in the workers breathing zone. See ANSI/AWS F1.5, "Methods for Sampling and Analyzing Gases from Welding and Allied Processes," and F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes," available from the American Welding Society.

VI. Physical and Health Hazard Data

Electric arc working may create one or more of the following health or physical hazards. Fumes and gases can be dangerous to your health. Electric shock can kill you. Arc rays can injure eyes and burn skin. Noise can damage hearing. In addition, a detailed description of the Health and Physical Hazards and their consequences may be found in ESAB's publications F52-529 "Precautions and Safe Practices for Electric Welding and Cutting" and F2035 "Precautions and Safe Practices for Gas Welding, Cutting and Heating." You may obtain copies from your local supplier or by writing to the address in Section I.

Route of overexposure: The primary route of entry of the decomposition products is by inhalation. Skin contact, eye contact, and ingestion are possible. Absorption by skin contact is unlikely. When these products are used as recommended by **THE ESAB GROUP**, and ventilation maintains exposure to the decomposition products below the limits recommended in this section, overexposure is unlikely.

Effects of acute (short-term) overexposure to the gases, fumes, and dusts may include irritation of the eyes, lungs, nose and throat. Some toxic gases associated with welding may cause pulmonary edema, asphyxiation, and death. Acute overexposure may include signs and symptoms such as watery eyes, nose and throat irritation, headache, dizziness, difficulty in breathing, frequent coughing, or chest pain. The presence of chromium/chromate in fume can cause irritation of nasal membranes and skin. The presence of nickel compounds in fume can cause metallic taste, nausea, tightness of chest, fever, and allergic reaction.

Pre-existing Medical Conditions Aggravated by Overexposure: Individuals with allergies or impaired respiratory function may have symptoms worsened by exposure to welding fumes; however, such reaction cannot be predicted due to the variation in composition and quantity of the decomposition products.

III. Physical Data

As shipped, these products are nonflammable, non-explosive, non-reactive, and non-hazardous.

<u>Physical State:</u>	Solid.
<u>Appearance:</u>	Solid alloyed steel wires.
<u>Odor:</u>	Odorless.
<u>Odor Threshold:</u>	Not applicable.
<u>Specific Gravity:</u>	7.8
<u>Vapor Pressure:</u>	Not determined.
<u>Vapor Density:</u>	Not determined.
<u>Density (g/cc):</u>	7.8
<u>Evaporation Rate:</u>	Not determined.
<u>Percent Volatile by Wt:</u>	Not determined.
<u>Boiling Point:</u>	3000-3500°C.
<u>Freezing Point:</u>	Not determined.
<u>Melting Point:</u>	1515°C (2760°F)
<u>Solubility in Water:</u>	Not determined.
<u>pH:</u>	Not determined.
<u>Thermal Decomposition:</u>	Not determined.
<u>Volatile Organic Compounds (lbs/lb):</u>	Not determined.
<u>Coefficient of Water/Oil Distribution:</u>	Not determined.
<u>Other:</u>	The wire end is restrained and under a spring load.

IV. Fire & Explosion Hazard

Conditions Of Flammability: This product will not burn.

Extinguishing Media: Welding arcs and sparks can ignite combustible and flammable materials. Use the extinguishing media recommended for the burning materials and fire situation. See ANSI Z49.1 "Safety in Welding, Cutting and Allied Processes" and the AWS publication, "Safe Practices", both published by the American Welding Society, P. O. Box 351040, Miami, FL 33135, and NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work" published by the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169, for additional fire prevention and protection information.

Flammable Properties:

<u>Flash Point:</u>	Not applicable.
<u>Flash Point Method:</u>	Not applicable.
<u>Upper Flame Limit (volume % in air):</u>	Not applicable.
<u>Lower Flame Limit (volume % in air):</u>	Not applicable.
<u>Auto Ignition Temperature:</u>	Not applicable.
<u>Hazardous Combustion Products:</u>	When involved in a fire, these products may emit toxic and irritating fumes of the metals, metal oxides, and their compounds.
<u>Explosion Data- Mechanical Impact:</u>	Not applicable.
<u>Explosion Data- Static Discharge:</u>	Not applicable.
<u>Flame Propagation Rate (solids):</u>	Not applicable.
<u>OSHA Flammability Class:</u>	Not applicable.
<u>Unusual Fire and Explosion Hazards:</u>	None anticipated.
<u>Special Fire Fighting Procedures:</u>	Full protective equipment required. Wear self contained breathing apparatus.

II. Hazardous Ingredients

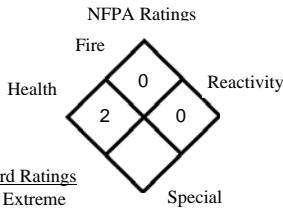
IMPORTANT: This section covers the materials from which this product is manufactured. The fumes and gases produced during normal use of these products are covered in Section V. The term **HAZARDOUS** should be interpreted as a term required and defined by Laws, Statutes, or Regulations, and does not necessarily imply the existence of any hazard when the products are used as directed by **THE ESAB GROUP**.

Material	(CAS No.)	SARA	ACGIH TLV		OSHA - PEL		
			TWA (mg/m ³)		TWA (mg/m ³)	STEL (mg/m ³)	
Chromium (Cr)	(7440-47-3)	*	0.5	(Metal)	1	(Metal)	--
			0.05	(CrVI inorganic compounds as Cr, water soluble)	0.005	(CrVI inorganic compounds as CrVI, water soluble)	--
			0.01	(CrVI inorganic compounds as Cr, water insoluble)	C 0.1	(as CrO ₃)	--
Copper (Cu)	(7440-50-8)	*	0.2	(Fume)	0.1	(Fume)	--
			0.005	(CrVI inorganic compounds as CrVI, water insoluble)	C 0.1	(as CrO ₃)	--
Iron (Fe)	(7439-89-6)		5	(Oxide Fume)	10	(Total Particulate)	--
Manganese (Mn)	(7439-96-5)	*	0.2	(Fume)	1	(Fume)	3
Molybdenum (Mo), Insoluble Compounds as Mo	(7439-98-7)		10	(Inhalable Fraction)	5	(Soluble)	--
			3	(Respirable Fraction)			--
Soluble Compounds as Mo Nickel (Ni)	(7440-02-0)	*	0.5	(Respirable Fraction)			--
			1.5	(Inhalable Fraction, elemental)	0.1	(Soluble)	--
			0.2	(Inhalable insoluble inorganic compounds)			--
Niobium (Nb)	(7440-03-1)		0.1	(Inhalable soluble inorganic compounds)			--
			10	(Nuisance Particulate)	5	(Respirable Dust)	--
Silicon (Si)	(7440-21-3)		10	(Dust)	5	(Respirable)	--

NOTE: In the ingredients table, an asterisk (*) after the CAS number indicates a toxic chemical subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (SARA) and 40 CFR Part 372.

Some of these products may not contain all of the materials listed. For details of composition, refer to the COMPOSITION TABLE in Section I.

In the table above, "C" indicates "Ceiling Limit."



Hazard Ratings
4 = Extreme
3 = High
2 = Moderate
1 = Slight
0 = Insignificant

Material Safety Data Sheet

(Essentially Similar to U.S. Department of Labor Suggested
Form For Hazard Communication Compliance)

I. Product Identification

Product Type - ARCALOY BARE STAINLESS STEEL WELDING ELECTRODES

Manufacturer - THE ESAB GROUP, INC.

Telephone No. - 1-717-637-8911

Website: www.esabna.com

1-800-933-7070

Address - 801 Wilson Avenue, P. O. Box 517
Hanover, PA 17331

Emergency No. - 1-717-637-8911
(CHEMTREC) 1-800-424-9300

Product Description: These Bare Stainless Steel Welding Electrodes are solid continuous metal wires and rods cut to standard lengths.

APPROXIMATE COMPOSITION OF STAINLESS STEEL WELDING ELECTRODES (Wt. %)

Product Trade Name	Mn	Ni	Cr	Cu	Mo	Si	Nb	Fe	AWS* Classification
ARCALOY Ⓢ									
ER308/308H	1.0-2.5	9.0-11.0	19.5-22.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER308/308H
ER308L	1.0-2.5	9.0-11.0	19.5-22.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER308/308L
ER308LSi	1.0-2.5	9.0-11.0	19.5-22.0	<0.75	<0.75	0.65-1.00	--	Bal.	ER308Si/308LSi
ER309	1.0-2.5	12.0-14.0	23.0-25.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER309
ER309L	1.0-2.5	12.0-14.0	23.0-25.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER309/309L
ER309LMo	1.0-2.5	12.0-14.0	23.0-25.0	<0.75	2.0-3.0	0.30-0.65	--	Bal.	ER309Mo/309LMo
ER309LSi	1.0-2.5	12.0-14.0	23.0-25.0	<0.75	<0.75	0.65-1.00	--	Bal.	ER309Si/309LSi
ER310	1.0-2.5	20.0-22.5	25.0-28.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER310
ER312	1.0-2.5	8.0-10.5	28.0-32.0	<0.75	<0.75	0.30-0.65	--	Bal.	ER312
ER316	1.0-2.5	11.0-14.0	18.0-20.0	<0.75	2.0-3.0	0.30-0.65	--	Bal.	ER316
ER316L	1.0-2.5	11.0-14.0	18.0-20.0	<0.75	2.0-3.0	0.30-0.65	--	Bal.	ER316/316L
ER316LSi	1.0-2.5	11.0-14.0	18.0-20.0	<0.75	2.0-3.0	0.65-1.00	--	Bal.	ER316Si/316LSi
ER317L	1.0-2.5	13.0-15.0	18.5-20.5	<0.75	3.0-4.0	0.30-0.65	--	Bal.	ER317/317L
ER320LR	1.5-2.0	32.0-36.0	19.0-21.0	3.0-4.0	2.0-3.0	<0.15	<0.40	Bal.	ER320LR
ER347	1.0-2.5	9.0-11.0	19.0-21.5	<0.75	<0.75	0.30-0.65	<1.0	Bal.	ER347
ER409Nb	<0.8	<0.6	10.5-13.5	<0.75	<0.50	<1.0	<0.75	Bal.	ER409Nb
ER410	<0.6	<0.6	11.5-13.5	<0.75	<0.75	<0.5	--	Bal.	ER410
ER430 LNb	<0.8	<0.5	17.0-19.0	<0.75	<0.75	<0.8	<0.75	Bal.	None

NOTE: Ⓢ See Note in Section VI

* AWS A5.9 Specification

THE ESAB GROUP requests the users of these products to study this Material Safety Data Sheet (MSDS) and the product labels and become fully aware of the product hazards and safety information. To promote the safe use of these products a user should (1) notify and train its employees, agents and contractors concerning the information on this MSDS and any product hazards and safety information, (2) furnish this same information to each of its customers for these products, and (3) request that such customers notify and train their employees and customers, for these products, of the same product hazards and safety information.