



Material Safety Data Sheet

(Meets U.S. Department of Labor Suggested
Criteria For Hazard Communication Compliance)

I. Product Identification

Product Type - ESAB OXWELD, SPOOLARC, GLOBAL & TIGROD SOLID STEEL WELDING ELECTRODES AND RODS

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 **Emergency No.** - 1-717-637-8911
Hanover, PA 17331 (CHEMTREC) 1-800-424-9300

Product Description: These steel welding electrodes are solid continuous metal wires and rods cut to standard lengths.

Process Description: Submerged Arc Welding (SAW) uses an arc or multiple arcs between a bare metal electrode or electrodes and the weld pool. The arc and molten metal are shielded by a blanket of granular flux on the workpiece. The process uses filler metal from the electrode and sometimes from supplemental sources (welding rod, flux, metal granules, etc.). The extreme heat from the welding arc creates hazardous fumes and gases that emanate from the base plate, the flux, the filler metal and the electrode.

Gas Metal Arc Welding (GMAW) uses an arc between a continuous metal electrode and the weld pool. The arc and molten metal are shielded by an externally supplied gas. The extreme heat from the welding arc creates hazardous fumes and gases that emanate from the base plate, shielding gases, and the electrode.

Gas Tungsten Arc Welding (GTAW) uses an arc between a tungsten (non-consumable) electrode and the weld pool. The heat from the welding arc creates hazardous fumes and gases that emanate from the base plate, the filler metal (rods), the shielding gases and the electrode. GTAW has the lowest fuming rate of the open arc welding processes.

II. Product Composition and Information On The Ingredients

APPROXIMATE COMPOSITION OF SOLID ELECTRODES (Wt. %)

See Hazardous Ingredients Table for common name of the symbol for the elements.

Product Trade Name	C	Mn	Si	Cu	Mo	Cr	Ni	Ti	Al	Zr	V	Fe	AWS Classification
Oxweld:													
1HT ①	<0.5	1-2	<0.5	--	--	--	--	--	--	--	--	Bal.	A5.2, R60
7 ①	<0.5	<0.5	<0.1	<0.5	--	--	--	--	--	--	--	Bal.	A5.2, R45
32CMS ③	<0.5	1-2	0.5	--	--	<0.5	--	--	--	--	--	Bal.	A5.2, R65
MW ⑤	<0.5	1-2	<1	--	0.1	<1	--	--	--	--	<0.1	Bal.	NONE
Spoolarc:													
29S ①	<0.5	1-2	0.5	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EM13K; A5.18, ER70S-3
36 ①	<0.5	2	<0.1	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EH14; A5.25, EH14-EW
40 ①	<0.5	2	<0.1	<0.5	0.5	--	--	--	--	--	--	Bal.	A5.23, EA3
40A ①	<0.5	<1	<0.1	<0.5	0.5	--	--	--	--	--	--	Bal.	A5.23, EA1
40B ①	<0.5	1-2	<0.1	<0.5	0.5	--	--	--	--	--	--	Bal.	A5.23, EA2
44 ⑤	<0.5	2	<0.1	<0.5	0.5	--	<1	--	--	--	--	Bal.	A5.23, EF2
53 ①	<0.5	1-2	<0.5	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EH12K
65 ①	<0.5	1-2	0.5	<0.5	--	--	--	<0.1	<0.1	<0.1	--	Bal.	A5.18, ER70S-2
66 ①	<0.5	1-2	0.5	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EM13K; A5.18, ER70S-3
71 ①	<0.5	<1.5	<1	<0.5	--	--	--	<0.2	--	--	--	Bal.	A5.23, EM14K
75 ①	<0.5	<1.5	<1	<0.5	--	--	<1.2	--	--	--	--	Bal.	A5.23, EN1K; A5.28, E80S-Ni1

APPROXIMATE COMPOSITION OF SOLID ELECTRODES (Wt. %)

See Hazardous Ingredients Table for common name of the symbol for the elements.

(Continued)

Product Trade Name	C	Mn	Si	Cu	Mo	Cr	Ni	Ti	Al	Zr	V	Fe	AWS Classification
80 ①	<0.5	0.5	<0.1	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EL12; A5.23, EL12
81 ①	<0.5	1	<0.5	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EM12K; A5.23, EM12K
82 ①	<0.5	1-2	0.5	<0.5	--	--	--	--	--	--	--	Bal.	A5.17, EM13K; A5.18, ER70S-3
83 ①	<0.5	1-2	<1	<0.5	0.5	--	--	--	--	--	--	Bal.	A5.23, EA3K; A5.28, ER80S-D2
85 ①	<0.5	1-2	<1	<0.5	--	--	--	--	--	--	--	Bal.	A5.18, ER70S-4
86 ①	<0.5	1-2	<1	<0.5	--	--	--	--	--	--	--	Bal.	A5.18, ER70S-6
87HP ①	<0.5	1-2	<1	<0.5	--	--	--	--	--	--	--	Bal.	A5.18, ER70S-7
95 ③	<0.5	1-2	<0.5	<0.5	<0.5	0.1	1-2	<0.1	--	--	--	Bal.	A5.23, EM2; A5.28, ER100S-1
100 ③	<0.5	2	0.1	<0.5	0.5	<0.5	2-3	--	--	--	--	Bal.	A5.23, EF5
120 ③	<0.5	1-2	<0.5	<0.5	0.5	<0.5	2-3	<0.1	--	--	--	Bal.	A5.23, EM4; A5.28, ER120S-1
140 ③	<0.5	1-2	<0.5	<0.5	<1	<1	2-3	<0.1	--	--	--	Bal.	NONE
551 ③	<0.5	<1	0.5	<0.5	1	<1	--	--	--	--	--	Bal.	A5.23, EB5
ARC 100 ③	<0.5	1-2	<0.5	<0.5	<1	--	2-3	<0.1	--	--	--	Bal.	NONE
Easy Grind ①	<0.5	1-2	0.5	<0.5	--	--	--	--	--	--	--	Bal.	NONE
ENi4 ③	<0.5	<1	<0.5	<0.5	<0.5	--	1-2	--	--	--	--	Bal.	A5.23, ENi4
HI-84 ①	<0.5	1-2	<1	<0.5	0.5	--	--	<0.1	--	--	--	Bal.	A5.28, ER80S-D2
Spoolarc:													
U515 ③	<0.5	<1	<0.5	<0.5	<1	1-2	--	--	--	--	--	Bal.	A5.23, EB2
U521 ③	<0.5	<1	<0.5	<0.5	1	2-3	--	--	--	--	--	Bal.	A5.23, EB3
WS ③	<0.5	0.5	<0.5	<1	--	<1	<1	--	--	--	--	Bal.	A5.23, EW; A5.28, ER80S-G
XTi ①	<0.5	1-2	<1	<0.5	--	--	--	<0.1	--	--	--	Bal.	A5.18, ER70S-G
Global:													
MIG-3 ①	<0.5	<1.5	<1	<0.5	--	--	--	--	--	--	--	Bal.	A5.18, ER70S-3
MIG-6 ①	<0.5	1-2	<1.2	<0.5	--	--	--	--	--	--	--	Bal.	A5.18, ER70S-6
Tigrod:													
ER80S-B2 ③	<0.5	<1	<1	<0.5	<1	1-2	<1	--	--	--	--	Bal.	A5.28, ER80S-B2
ER90S-B3 ③	<0.5	<1	<1	<0.5	<1.5	2-3	<1	--	--	--	--	Bal.	A5.28, ER90S-B3
ER80S-B6 ③	<0.5	<1	<1	<0.5	<1	4-6	<1	--	--	--	--	Bal.	A5.28, ER80S-B6
ER80S-B8 ③	<0.5	<1	<1	<0.5	<1.5	8-10.5	<0.5	--	--	--	--	Bal.	A5.28, ER80S-B8
ER90S-B9 ③	<0.5	<1	<1	<0.5	<1.5	8-10	<1	--	--	--	<0.5	Bal.	A5.28, ER90S-B9
Autorod													
ER90S-B9 ③	<0.5	<1	<1	<0.5	<1.5	8-10	<1	--	--	--	<0.5	Bal.	A5.23, EB9; A5.28, ER90S-B9
Other:													
Arcaloy B9 ③	<0.5	<1.5	<0.5	--	1	8-10	<1	--	--	--	<0.5	Bal.	A5.23, EB9; A5.28, ER90S-B9
ESAB 80S-B6	<0.5	<1	<1	<0.5	<1	4-6	<1	--	--	--	--	Bal.	A5.23, EB6

① See Section XV heading State-Right-to-Know for corresponding CA product warning.

③ See Section XV heading State-Right-to-Know for corresponding CA product warning.

Hazardous Ingredients

IMPORTANT: This section covers the materials from which these products are manufactured. The term **HAZARDOUS** should be interpreted as a term required and defined by Laws, Statutes, or Regulations. Under the OSHA Hazard Communication Standard, these products are considered hazardous.

WHMIS Classification: Class D, Division 2, Subdivision A

Material	(CAS No.)	SARA	ACGIH TLV		OSHA - PEL		
			TWA (mg/m ³)		TWA (mg/m ³)	STEL (mg/m ³)	
Aluminum (Al)	(7429-90-5)	*	5	(Welding Fume)	5	(Respirable Fraction)	--
Carbon (C)	(7440-44-0)		3.5	(Carbon Black)	3.5	(Carbon Black)	--
Chromium (Cr)	(7440-47-3)	*	0.5	(Metal)	0.5	(Metal)	--
			0.05	(CrVI inorganic compounds as Cr, water soluble)	C 0.1	(as Chromate)	
			0.01	(CrVI inorganic compounds as Cr, water insoluble)			
Copper (Cu)	(7440-50-8)	*	0.2	(Fume)	0.1	(Fume)	--
Iron (Fe)	(7439-89-6)		Not listed		Not listed		--
Iron Oxide (FeO)	(1345-25-1)		Not listed		Not listed		
Iron Oxide (FeO)	(1309-37-1)		5 as Fe	(dusts and fume)	10	(fume)	
Manganese (Mn)	(7439-96-5)	*	0.2	(Fume)			5
Molybdenum (Mo), Insoluble Compounds as Mo	(7439-98-7)		10	(Inhalable Fraction)	Not listed		--
Soluble Compounds as Mo			3	(Respirable Fraction)	Not listed		
Nickel (Ni)	(7440-02-0)	*	0.5	(Respirable Fraction)	5		
			1.5	(Inhalable Fraction, elemental)	0.1	(Soluble)	--
			0.2	(Inhalable insoluble inorganic compounds)			
			0.1	(Inhalable soluble inorganic compounds)			
Silicon (Si)	(7440-21-3)		10	(Dust)	5	(Respirable)	--
Titanium (Ti)	(7440-32-6)		10	(TiO ₂)	5	(TiO ₂ - Respirable)	--
Vanadium (V)	(7440-62-2)	*	Not listed		Not listed		--
Vanadium Pentoxide, as V ₂ O ₅	(1314-62-1)		0.05	(Respirable Fume as V ₂ O ₅)	C 0.1	(fume)	--
Zirconium (Zr)	(7440-67-7)		5	(as Zr)	10	(STEL)	5 (as Zr)

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 preceding this Table.

In the table above, when "C" appears with an exposure number, the "C" indicates a "Ceiling Limit"; the number is the concentration that should not be exceeded during any part of the working exposure.

OSHA on Oct. 4, 2004, issued a Fact sheet of proposed standards for occupational exposure to Hexavalent Chromium that include the following: PEL 1 µg/m³; Action Level 0.5 µg/m³; Exposure Monitoring- an initial test and further testing pending outcome of initial PEL; Establish Regulated Areas where Cr(VI) exposure greater than PEL; REQUIRES ENGINEERING AND WORK PRACTICE CONTROLS if an employee is exposed above the PEL for 30 or more days during a continuous period of 12 months. Consult OSHA FACT SHEET on Hexavalent Chromium.

This section covers some of the additional hazardous ingredients that may be generated by the SAW, GMAW, and GTAW processes. See Section V.

	ACGIH TLV	OSHA PEL
Ozone	0.1 ppm (ceiling)	0.1 ppm
Nitric oxide	25 ppm	25 ppm
Nitrogen dioxide	3, 5ppm (STEL)	5 ppm (ceiling)
Welding fumes	5 mg/m ³	---
Carbon monoxide	25 ppm	50 ppm
Hydrogen Fluoride	0.5 ppm, 2 (ceiling)	3 ppm
Phosgene gas	0.1 ppm	0.1 ppm

III. Hazards Identification

SPOOLARC, OXWELD, GLOBAL, TIGROD, AUTOROD AND ARCALOY SOLID CONTINUOUS WIRE AND CUT-TO-LENGTH ROD PRODUCTS:

Overview: As shipped, these products are not flammable, combustible, or explosive. They pose little or no hazard to humans. When consumed during **SAW, GMAW, and GTAW hot work**, the processes pose very severe health and physical hazards.

PHYSICAL HAZARDS- SKIN AND EYE CONTACT:

The continuous solid wire products are coiled. Beware of uncoiling wire when cutting wire from the spool/coil. Wear safety glasses and gloves. Firmly grip remaining strand. Stand to the side.

FIRE & EXPLOSION HAZARD:

Flammable/Explosive: NO (X) YES ()

Under what conditions: Only the packaging for this product will burn.

Fire Hazard: When involved in a fire, these products may emit toxic and irritating fumes of the metals, metal oxides and their compounds.

HEALTH HAZARDS: SKIN CONTACT:

The continuous solid wires and rods have residual wire drawing aids and wire feed assist residue. Avoid direct and prolonged skin contact.

SUBMERGED ARC WELDING, GAS METAL ARC WELDING, AND GAS TUNGSTEN ARC WELDING PROCESSES:

Health Hazards: Inhalation/Ingestion of Fumes and Gases; Skin and Eye Contact with Fume, Gases, and Residue.

The SAW, GMAW, and GTAW processes use electrical circuits that sustain a welding arc between the electrode and the base plate. The welding arc converts the electrical energy into a localized, concentrated heat source. The tremendously high temperatures of the arc cause the welding continuous wire and rod Electrode (or Filler Metal, when used as such) to decompose. Electric arc working may create one or more of the following health hazards. Fumes and gases can be dangerous to your health. Noise can damage hearing. 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.

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). Vapors of chlorinated hydrocarbon solvents will decompose in the presence of heat and ultraviolet radiation and form highly toxic phosgene gas. 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 and nitrogen oxides (refer to "Characterization of Arc Welding Fume" available from the American Welding Society). THE TLV FOR MANGANESE, CHROMIUM AND NICKEL WILL BE REACHED BEFORE THE GENERAL LIMIT FOR WELDING FUMES OF 5 mg/m³ IS REACHED. MEASURE THE FUME FOR MANGANESE, CHROMIUM AND NICKEL. 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 ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes," available from the American Welding Society.

Cancer: Nickel and Chromium compounds are carcinogenic to humans; welding fume not otherwise classified may be carcinogenic; vanadium oxide is not classified as a human carcinogen.

Process Physical Hazards: SKIN AND EYE CONTACT, LETHAL ELECTRIC SHOCK, ARC RADIATION

Electric arc working may create one or more of the following physical hazards. Electric shock can kill you. Arc rays can injure eyes and burn skin. Heat rays from arc or hot metal can injure eyes. Innocent contact with hot base plate/weld and recently extinguished wire electrode can cause severe skin burns. Weld spatter, ejected metal droplets from the arc-weld pool region can cause skin burns and pose a fire hazard to the surroundings. Slag removal from the weld and reclaim of the flux can create airborne particles and dusts (consult the MSDS for the submerged arc flux). See AWS "Safety and Health Fact Sheet No. X". Series available at no cost at: www.aws.org (www.aws.org/technical/facts/index.html).

IV. First Aid Measures

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. Use a nonconducting material to pull victim away from contact with live parts or wires. 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, rinsing till clean. Get medical attention for irritation or burns.
- 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.

V. Fire-Fighting Measures

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:

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

VI. Accidental Release Measures

- Personal Precaution:** Wear safety glasses and gloves. Gather the loose strands of wire.
- Environmental Impact:** Not known. Prevent product and process waste from contaminating surrounding environment.
- Method For Cleaning Up:** Place waste in containers for recovery or disposal.

VII. Handling and Storage

Storage Precaution: No unusual methods are required. Keep product contained and retain all warning and identity labels. Preferred storage is a sheltered warm area with temperature and humidity control to prevent high humidity and "going through the dew point".

Handling Precaution: 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:

Exposure to Fumes and Gases: Keep the exposure within legal limits. In the worker's breathing zone and the general area, the fumes and gases must be kept below the TLVs and the *equivalent exposure* must compute to less than one. Keep exposure as low as possible.

Confined Spaces: Test confined space atmosphere for (1) suitable oxygen content, (2) no combustibles or reactives, (3) no toxins. Continuously ventilate and monitor confined spaces to ensure that fumes and gases do not exceed safe exposure limits.

Special Precaution: Use industrial hygiene monitoring equipment to ensure that exposure does not exceed threshold limit values.

Eye Protection: Wear helmet or use face shield with filter lens according to ANSI Z87.1. Provide protective screens and flash goggles, if necessary, to shield others. Wear safety glasses with UV protective side shields or goggles. Wear contact lenses in combination with safety eyewear, except where the contact lenses create a likelihood of injury from intense heat, highly particulate atmosphere, or where their use is prohibited.

Protective Clothing: Wear head, hand and body protection that help to prevent injury from radiation, sparks and electrical shock. Wear flame resistant ear plugs to keep sparks out of ears. See ANSI Z-49.1.

Avoid Fire and Explosion: Remove any combustible material from the work area; if relocation is not possible, protect with a cover of fire-resistant material. Sparks can travel horizontally throughout an area within a 10 meter radius.

Protect Against Noise: Reduce the intensity of the sound; the TLV for noise is 85 dBA for an eight hour duration. Wear approved ear plugs or ear muffs.

Protect Against Electric Shock: Do not touch live electrical parts. Wear dry, insulating gloves (in good condition) and clothing. Insulate yourself from the workpiece and ground (wear rubber soled shoes, stand on dry insulating mat or platform). Do not dip the electrode holder (gun) in water to cool it; do not lay it on a conductive surface or the work surface.

Heart Pacemakers: Warn wearers of heart pacemakers or other electronic equipment vital to life that the welding operation may impede the function of the device. Consult a physician and the manufacturer of the device.

VIII. Exposure Controls/Personal Protection

ENGINEERING CONTROLS:

Ventilation: Clean air for welding operations is provided by ventilation systems. Ventilation systems consist of local exhaust and general ventilation supply. The most efficient method of contaminant control in the occupied zone of the welding shop, particularly in the breathing zone of the welder, is local exhaust which captures the contaminants at or near their source. Consult AWSF3.2M/F3.2 "Ventilation Guide for Weld Fume" published by the American Welding Society, P. O. Box 351040, Miami, FL 33135, for the design of ventilation and exhaust systems. 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, the fumes and gases must be kept below the TLVs and the *equivalent exposure* must compute to less than one.

Note: OSHA proposed FACT Sheet on Exposure to Hexavalent Chromium: Areas where airborne concentrations are or are expected to be higher than PEL must be regulated. If a worker is exposed to 30 days in a 12 consecutive month period, engineering and work practice controls are required.

PERSONAL PROTECTIVE EQUIPMENT:

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 that is too dark to see the weld zone. Then go to the next lighter shade that gives sufficient view of the weld zone. Provide protective screens and flash goggles, if necessary, to shield others. Wear safety glasses with UV protective side shields or goggles to provide needed protection from reflected radiation and to prevent eye contact. Readily available eye baths are recommended in areas where operations may produce fumes and dusts.

Skin Protection: Wear head, hand and body protection that help to prevent injury from hot metal, sparks, slag, infrared radiation, UV radiation, abrasions, contusions and heat stress. Protective clothing will not generally prevent shock except for leather if kept dry. The clothing may include heat/fire resistant gloves, overalls, aprons, sleeves, footwear, welder's spats and head cover. Gloves made of leather with inside seams (or those that give equal performance) are preferred. Wear garments made of leather, heavyweight tightly woven wool or cotton. Keep clothing clean (free of oil, grease or solvents) and in good repair. Do not wear clothing with frayed edges, tears or holes. Do not roll up sleeves or trousers (pants should not be cuffed).

Hygienic Work Practices: Avoid contact to eyes, skin, and mucous membranes. Avoid inhalation of vapors, gases, fumes and dusts. Wash thoroughly after handling and use. Do not smoke, eat, drink, chew gum or tobacco, or apply cosmetics within the

working area. Do not store or bring tobacco products, gum, food, drinks or cosmetics within the working area. Otherwise follow the standards of good industrial hygiene practices.

IX. Physical and Chemical Properties

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

X. Stability and Reactivity

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

Reacts With: Air ____ Water ____ Heat ____ Oxidizers X Acids X Alkalis ____ Metals ____ Other ____ None ____

Hazardous Reaction Products: Contact with acid may evolve hydrogen gas.

Comments: Review Section II.

XI. Toxicological Information

Introduction: Electric arc working creates health and physical hazards. Fumes and gases can be dangerous to your health. Fumes and gases containing fluoride burn eyes and skin on contact and can be fatal if swallowed. Electric shock can kill you. Arc rays can injure eyes and burn skin. Heat rays (infrared radiation) from flame or hot metal can injure eyes. Noise can damage hearing. An additional 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.

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 the composition and in the quantity of the decomposition 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 (in some forms) are considered carcinogenic. Long term overexposure to nickel fumes may also cause pulmonary fibrosis and edema. Chromium compounds have a corrosive action on the skin and mucous membranes, lesions form on exposed skin and the nasal septum. Liver damage and allergic skin rash have also been reported. Overexposure to manganese compounds may 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. High levels of copper may cause central nervous system damage characterized by nerve fiber separation and cerebral degeneration. 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. Chronic overexposure to iron (>50-100 mg Fe per day) can result in pathological deposition of iron in body tissues, symptoms of which are fibrosis of the pancreas, diabetes mellitus, and liver cirrhosis. Overexposure to respirable crystalline silica may result in silicosis, a disabling lung disease; overexposure to respirable crystalline silica is a known cause of carcinogenicity in humans. Welding fumes (not otherwise specified) are possibly carcinogenic to humans.

Exposure limits for the ingredients are listed in Section II. The 2003 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 firm lines between safe and excessive concentrations. As noted in Section V, the fume from welding, brazing, soldering and allied processes is a mixture of many components. Therefore, a statutory computation of the *equivalent exposure* is required. The *equivalent exposure* value for the fume mixture from the welding or from an allied process 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.

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.

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 Subsulfide: 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.

Vanadium Pentoxide, as V₂O₅: TLV-A4 not classified as a human carcinogen.

Welding Fumes (not otherwise classified)—IARC-2B: Possibly carcinogenic to humans.

XII. Ecological Information

Product Persistence: The continuous solid wires and rods consist of alloyed steel and are expected to slowly corrode in an outdoors-ambient environment.

Biodegradability: No test data.
Ecotoxicity: No test data.
Biological Oxygen Demand (BOD): No test data.
Chemical Oxygen Demand: No test data.
Note on Ecological Toxicity: None.

XIII. Disposal Considerations

Waste Disposal Method: Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with Federal, State and Local regulations. If used or waste product(s), such as slag and filtered fumes, are disposed of, testing including TCLP, should be conducted to determine hazard characteristics.

RCRA: The (unused) product does not contain hazardous RCRA listed components.

XIV. Transport Information

U.S. DEPARTMENT OF TRANSPORTATION:

Proper Shipping Name: NOT DOT REGULATED.

XV. Regulatory Information

Environmental Protection:

United States EPA Toxic Substance Control Act: All constituents of these products are on the TSCA inventory list.
Canadian Environmental Protection Act (CEPA): All constituents of these products are on the Domestic Substance List (DSL).

EPCRA (SARA Title III) 302 Extremely Hazardous Substances:

Ingredient name	304 EHS RQ	302 EHS TPQ
No ingredients listed in this section.		

EPCRA (SARA Title III) 313 Toxic Chemical (may be subject to annual reporting; see Section II for weight percent):

Ingredient name	CAS Number	Ingredient name	CAS Number
Aluminum (Al)	7429-90-5	Manganese (Mn)	7439-96-5
Chromium (Cr)	7440-47-3	Nickel (Ni)	7440-02-0
Copper (Cu)	7440-50-8	Vanadium (V)	7440-62-2

Note on Welding Process Emission Factors to compute released quantities. *The Plain English Guide to the Clean Air Act*, EPA-400-K-93-001, April 1993, AP-42, Section 12.19 contains compiled emission factors for the SMAW, GMAW, FCAW and SAW welding processes. The emission factors for SAW are substantially lower than the open arc processes. The emission factors for GTAW are very low and generally not measured. Also See: ANSI/AWS F1.6 "Guide for Estimating Welding Emissions for EPA and Ventilation Permit Reporting" available from the American Welding Society.

CERCLA Reportable Quantities:

Ingredient name	CAS Number	RQ (pounds)
Chromium (Cr)	7440-47-3	5000
Copper (Cu)	7440-50-8	5000
Nickel (Ni)	7440-02-0	100

CANADIAN ENVIRONMENTAL PROTECTION ACT PRIORITIES LISTS

- PSL1** *Hexavalent Chromium Compounds* are found in the emissions from the process.
Oxidic, Sulphidic, and Soluble Inorganic Nickel Compounds may be in the emissions from the process.
- PSL2** *Respirable particulate matter less than or equal to 10 microns* in the welding fumes from the process are respirable.

CANADA; INGREDIENT DISCLOSURE LIST

Chromium, elemental	7440-47-3	Vanadium, elemental	7440-62-2
Manganese, elemental	7439-96-5	Ferrovandium	12604-58-9
Molybdenum, elemental	7439-98-7	Ferrosilicon	8049-17-0
Nickel, elemental	7440-02-2		

State Right-To-Know:

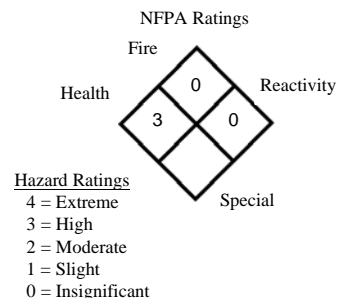
California Proposition 65

- ⓘ **WARNING:** This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code §25249.5 et seq.)
 - ⓘ **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.)
- See: AWS "Safety and Health Fact Sheet No. 23" at: www.aws.org.

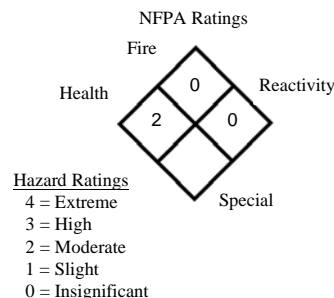
XVI. Other Information

NFPA and HMIS Classifications:

NFPA: Welding solid steel wire electrodes are not NFPA rated. As a Mixture, the solid continuous wire and rod welding electrodes have been assigned the highest number in each category that a component material is known to be rated or is deemed to warrant.



Nickel and Chromium Bearing Wires and Rods



Non Nickel and Chromium Bearing Wires and Rods.

HMIS: Welding solid electrodes are not HMIS rated. The label and the values presented on this page are best effort intended to communicate safety information and practices.

HMIS RATINGS

HEALTH:	1
FLAMMABILITY:	0
PHYSICAL HAZARD:	0

Personal Protection
B

HMIS: The Submerged Arc Welding, Gas Metal Arc Welding, and Gas Tungsten Arc Welding Processes with these wires and rods are not HMIS rated. The label and the values presented on this page are a best effort intended to communicate safety information and practices.

HMIS RATINGS		
HEALTH:	*	4
FLAMMABILITY:		4
PHYSICAL HAZARD:		4
Personal Protection See Section VIII		

Note: This product has been classified according to hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

ISSUED BY: The ESABNA MSDS Group

717-637-8911

THE ESAB GROUP and its employees request the users of these products to study this Material Safety Data Sheet (MSDS,) the product labels, the power source manual and instructions, and process literature, especially the sources cited herein, and to 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.

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.