



UNDERWATER WET WELDING ELECTRODES

Section 1: Identification

Product Name:	Broco Underwater Wet Welding Electrodes		
MSDS Issue Date:	September 1, 2021		
Product Code:	UW/CS-1, Mild Steel UW/CS-2, Mild Steel UW/CS-3, Mild Steel UW/EZ-1, Mild Steel UW/EZ-2, Mild Steel UW/EZ-3, Mild Steel UW/PT-1, Mild Steel UW/PT-2, Mild Steel UW/SS-1, Stainless Steel UW/SS-2, Stainless Steel UW/HN332, High Nickel		
CAS Number(s):	See section 3		
Product Usage:	Underwater cutting consumables for Broco underwater oxy-arc exothermic cutting torch. Use with oxygen.		
Manufacturer:	Broco, Inc. 400 S. Rockefeller Ave. Ontario, CA 91761 USA	Phone: Fax: E-Mail: Web Site:	909-483-3222 909-483-3233 sales@brocoinc.com www.broco-rankin.com
Emergency Response & Training Solutions	1-800-924-6804 1-440-349-2700 CIN #: 3730		

Section 2: Hazard(s) Identification

This section covers the materials from which this product is manufactured. The fumes and gases produced during welding with normal use of this product are also addressed in Section 8.

The term "hazardous" in "Hazardous Materials" should be interpreted as a term required and defined in OSHA Hazard Communication Standard (29 CFR Part 1910.1200).

General Hazard Statement: Solid metallic products are generally classified as "articles" and do not constitute hazardous materials in solid form under the definitions of the OSHA Hazard Communication Standard (29 CFR 1910.1200). Any articles manufactured from these solid products would be generally classified as non-hazardous. However, some hazardous elements contained in these products can be emitted under certain processing conditions such as but not limited to: burning, melting, cutting, sawing, brazing, grinding, crushing, machining, milling, and welding.

Broco Underwater Wet Welding Electrodes consist of a solid wire cored, flux covered welding electrode, with flux-enhancing coating and a waterproof wax top coating.

Classification Of The Substance Or Mixture:

Inert, non-hazardous as supplied. No hazard exists until this product is used in welding.

Hazard Statements:

WELDING WITH BROCO UNDERWATER WELDING ELECTRODES CAUSES FUMES TO BE RELEASED. MAY BE HARMFUL IF INHALED. MAY IRRITATE THE EYES, SKIN, AND RESPIRATORY TRACT. ARC RAYS CAN DAMAGE EYES AND SKIN. MOLTEN MATERIAL MAY CAUSE THERMAL BURNS. ELECTRIC SHOCK CAN KILL.

When used as intended underwater in conjunction with an electric arc from a welding power source, intense heat, ultra-violet (UV) rays, fumes and gases are generated. When used as intended for underwater welding, exposure to UV rays and electric shock possibility are the greatest sources of risk to health of the operator.

Fumes and gases may be trapped in bubbles and rise to the water's surface where they are released into the atmosphere. Personnel at the surface must take precautions to ensure the area is adequately ventilated and to wear appropriate respiratory equipment when necessary.

Section 2: Hazard(s) Identification (continued)

EMERGENCY OVERVIEW

Effects of Over-exposure:

Electric arc welding may create one or more of the following health hazards:

FUMES AND GASES can be dangerous to your health.

SHORT-TERM (acute) OVEREXPOSURE to welding fumes may result in discomfort, such as dizziness, nausea, or dryness or irritation of nose, throat, or eyes.

LONG-TERM (chronic) OVEREXPOSURE to welding fumes can lead to siderosis (iron deposits in lungs), central nervous system, liver or kidney damage, skin and respiratory sensitization (allergic reaction), and is believed by some investigators to affect pulmonary function.

PRIMARY ROUTE OF ENTRY is the respiratory system.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing eye, respiratory or allergic conditions.

ARC RAYS can injure eyes and burn skin.

ELECTRIC SHOCK can kill.

CARCINOGENICITY: Certain hexavalent chromium compounds and nickel metal and compounds are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens, found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs, or listed by OSHA/ACGIH as potential carcinogens.

Sparks and fumes are produced from welding. Inhalation of fumes may cause metal-fume fever.

Avoid breathing dust/fume/gas/mist/vapors/spray

Wear protective gloves/protective clothing/eye protection

In case of contact with eyes, rinse immediately with plenty of water and seek medical attention

In case of insufficient ventilation, wear suitable respiratory equipment

Avoid surrounding combustibles (electric arc welding generates sparks)

Sparks, splatter and molten material generated by this process can cause fire, severe property damage, and bodily injury.

Arc rays (UV) and splatter can injure eyes and exposed skin. Always wear proper eye protection with appropriate shade filter. Exposure to UV radiation from a cutting arc can result in keratoconjunctivitis (welders flash). Symptoms include inflammation, blurred vision and headache. Seek medical attention, preferably an eye specialist.

Coatings and residue may irritate skin and eyes. Wash hands thoroughly with soap and water after handling.

Aggravated Medical Conditions: Allergies. Skin disorders. Respiratory disorders. Central nervous system. Pre-existing eye disorders. Blood disorders. Kidney disorders. Liver disorders. Nasal cavities. Lungs.

Welding releases hazardous fumes. Overexposure to metal fumes may cause pulmonary edema (fluid in the lungs) and methemoglobinemia. May also cause pulmonary fibrosis and lung cancer. Lead compounds may be absorbed by ingestion, by inhalation and through the skin. Lead may damage kidney function, the blood forming system and the reproductive system. Inorganic lead compounds can cause developmental damage. Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the process, procedures, and electrodes used. The following are typical constituents of welding fumes and gases. When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form than ingredients listed above. Decomposition products of normal operation include those originating from the volatilization reaction, or oxidation of the materials shown above, plus those from the base metal and coating, etc. which may include paint, plating, galvanizing, or phosphate coatings on steels which would produce phosphine gas and other contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities which may be decomposed by the arc into toxic gases such as phosgene).

It is understood, however, that the elements and or oxides to be mentioned are virtually always present as complex oxides and not as metals. (Characterization of Arc Welding Fume: American Welding Society). The elements or oxides listed here correspond to the ACGIH categories located in TLV (Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment). Reasonably expected constituents of the fume would include complex oxides or compounds of iron, manganese, titanium, silicon, silica, molybdenum, amorphous silica fume, calcium oxide, aluminum, chromium, fluorspar or fluorides, nickel, strontium, potassium, and sodium. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc.

One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. (See ANSI / AWS F1.1, available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126. Also, from AWS is F1.3 "Evaluating Contaminants in the Welding Environment – A Sampling Strategy Guide", which gives additional advice on sampling). At a minimum, materials listed in this section should be analyzed. When underwater welding is taking place it may be advisable to collect air samples near the water's surface where fumes are released into the atmosphere if bystanders are in a close proximity.

Section 2: Hazard(s) Identification (continued)

Hazardous Ingredient	CAS	EINECS ^f	Regulatory Hazard Classification/Designation 67/548/EEC ^Δ	IARC ^E	NTP ^Z	OSHA ^H	65 ^Θ
ALUMINUM	7429-90-5	231-072-3	F – R10, R15, R17	---	---	---	---
ALUMINUM OXIDE	1344-28-1	215-691-6	None	---	---	---	---
CALCIUM CARBONATE	1317-65-3	215-279-6	None	---	---	---	---
CALCIUM FLUORIDE	7789-75-5	232-188-7	Xn - R20/22	---	---	---	---
CELLULOSE	9004-34-6	232-674-9	None	---	---	---	---
CHROMIUM	7440-47-3	231-157-5	O - R9; Carc 1 ^Φ - R45; Muta 2 - R46; Repr 3 - R62; T+ - R26; T - R24/25, R48/23; C - R35, R42/43; N - R50, R53 ^{ΣΣ}	1 ^{ΣΣ} , 3 ^Σ	K ^{ΣΣ}	X ^{ΣΣ}	X ^{ΣΣ}
COLUMBIUM	7440-03-1	231-113-5	None	---	---	---	---
COPPER	7440-50-8	231-159-6	None	---	---	---	---
FLUORSPAR	7789-75-5	232-188-7	None	---	---	---	---
IRON	7439-89-6	231-096-4	None	---	---	---	---
MAGNESIUM CARBONATE	546-93-0	208-915-9	None	---	---	---	---
MANGANESE	7439-96-5	231-105-1	Xn - R20/22 ^Y	---	---	---	---
MICA	12001-26-2	None	None	---	---	---	---
MOLYBDENUM	7439-98-7	231-107-2	Xn - R48/20/22; Xi - R36/37 ^X	---	---	---	---
NICKEL	7440-02-0	231-111-4	Carc 3 ^Φ - R40; T - R43, R48/23	1	K	X	X
PARAFFIN WAX	8002-74-2	232-315-6	None	---	---	---	---
POTASSIUM	7440-09-7	231-119-8	F – R14/15, R14; C – R34	---	---	---	---
POTASSIUM OXIDE	12136-45-7	235-227-6	None	---	---	---	---
PROPRIETARY MATERIAL	TRADE SECRET						
SILICA	14808-60-7	238-878-4	Xn - R48/20, R40/20	1 ^Ψ	K	X	X
(Amorphous Silica Fume)	69012-64-2	273-761-5	None	3	K	---	X
SILICON	7440-21-3	231-130-8	None	---	---	---	---
SODIUM	7440-23-5	231-132-9	F – R14/15, R14; C – R34	---	---	---	---
SODIUM ALUMINUM FLUORIDE	15096-52-3	239-148-8	X _N – R20/22; T – R48/23/25; N – R51/53	---	---	---	---
SODIUM FLUORIDE	7681-49-4	231-667-8	T-R25, Xi – R36/38	---	---	---	---
SODIUM OXIDE	1313-59-3	215-208-9	None	---	---	---	---
TITANIUM DIOXIDE	13463-67-7	236-675-5	None	2B	---	---	---
TUNGSTEN	7440-33-7	231-143-9	None	---	---	---	---
ZIRCONIUM	7440-67-7	231-176-9	F – R15, R17	---	---	---	---

Γ – European Inventory of Existing Chemical Substances Number Δ - European Union Directive 67/548/EEC – Annex 1 E – International Agency for Research on Cancer (1 – Human Carcinogen, 2A – Probably Carcinogenic to Humans, 2B – Possibly Carcinogenic to Humans, 3 – Unclassifiable as to Carcinogenicity in Humans, 4 Probably Not Carcinogenic to Humans) Z – US National Toxicology Program (K – Known Carcinogen, S – Suspected Carcinogen) H – OSHA Known Carcinogen List Θ – California Proposition 65 (X – On Proposition 65 list) --- Dashes indicate the ingredient is not listed with the IARC, NTP, OSHA or 65 Φ – Carcinogen, Mutagen or Reproductive Category per European Council Directive 67/548/EEC Annex I Σ – Metal and Chromium III Compounds ΣΣ – Chromium VI Compounds ΣΣΣ – Chromium (VI) Trioxide EU 67/548/EEC Classification/Designation Y – Manganese Dioxide EU 67/548/EEC Classification/Designation X – Molybdenum Trioxide EU 67/548/EEC Classification/Designation Ψ – Silica Crystalline α-Quartz

The following symbols correspond with the EU 67/548/EEC column above are in European Union Directive 67/548/EEC Annex 1 and EC 1272/2008 Annex VI – Table 3.2:



Xn – Harmful



Xi – Irritant



O - Oxidizer



C – Corrosive



N – Dangerous for the Environment



T – Toxic



T+ - Extremely Toxic

Section 2: Hazard(s) Identification (continued)

When welding electrodes are consumed in the normal course of work using an electric arc airborne metal fumes are produced that may typically include:

Fume Constituent (Gases) CAS No.	Fume Constituents (Solids)	CAS No.
Carbon Dioxide (CO ₂) 124-38-9	Calcium Fluoride (CaF ₂)	7789-75-5
Carbon Monoxide (CO) 630-08-0	Chromates (CrO ₃)	1333-82-0
Dinitrogen Tetroxide (N ₂ O ₄) 10544-72-6	Copper Oxide (CuO)	1344-70-3
Hydrogen Fluoride (HF) 7664-39-3	Manganese Tetraoxide (Mn ₃ O ₄)	1317-35-7
Nitric Oxide (NO) 10102-43-9	Nickel Oxide (NiO)	1314-06-3
Nitrogen Dioxide (NO ₂) 10102-44-0	Silicon Dioxide (SiO ₂) (quartz)	14808-60-7
Ozone (O ₃) 10028-15-6	Iron Oxide (Fe ₂ O ₃)	1309-37-1
Phosgene (COCl ₂) * 75-44-5	Molybdenum Trioxide (MoO ₃)	1313-27-5
Phosphine (PH ₃) ** 7803-51-2	Niobium Oxide (NbO)	12034-57-0
	Potassium Oxide (KO)	12136-45-7
	Sodium Aluminum Fluoride (Na ₃ AlF ₆)	15096-52-3
	Sodium Fluoride (NaF)	7681-49-4
	Sodium Oxide (NaO)	1313-59-3
	Titanium Dioxide (TiO ₂)	13463-67-7

* May result from contact with chlorinated hydrocarbon vapors.

** May result from welding on phosphate coated steels.

Section 3: Composition / Information on Ingredients

The following is composition information of the product as may be manufactured:

Hazardous Ingredient	CAS	EINECS [†]	Weight %	Product
ALUMINUM	7429-90-5	231-072-3	<5	CS, EZ, SS
ALUMINUM OXIDE	1344-28-1	215-691-6	<5	CS, EZ, SS
CALCIUM CARBONATE	1317-65-3	215-279-6	<1-10	CS, EZ, SS, HN
CALCIUM FLUORIDE	7789-75-5	232-188-7	<1-10	HN
CELLULOSE	9004-34-6	232-674-9	<5	CS, EZ
CHROMIUM	7440-47-3	231-157-5	<1-30	SS, HN
COLUMBIUM	7440-03-1	231-113-5	<2	SS, HN
COPPER	7440-50-8	231-159-6	0-4	SS, HN
FLUORSPAR	7789-75-5	232-188-7	1-10	SS
IRON	7439-89-6	231-096-4	70-90	CS, EZ, SS, HN
MAGNESIUM CARBONATE	546-93-0	208-915-9	<2	CS, EZ
MANGANESE	7439-96-5	231-105-1	1-10	CS, EZ, SS, HN
MICA	12001-26-2	None	<6	CS, EZ, SS
MOLYBDENUM	7439-98-7	231-107-2	<10	SS, HN
NICKEL	7440-02-0	231-111-4	<35	SS, HN
POTASSIUM	7440-09-7	231-119-8	<1	HN
POTASSIUM OXIDE	12136-45-7	235-227-6	<2	CS, EZ, SS
PROPRIETARY MATERIAL	TRADE SECRET		<2	CS, EZ, SS
SILICA	14808-60-7	238-878-4	<7	CS, EZ, SS, HN
(Amorphous Silica Fume)	69012-64-2	273-761-5		
SILICON	7440-21-3	231-130-8	<10	SS, HN
SODIUM	7440-23-5	231-132-9	<10	HN
SODIUM ALUMINUM FLUORIDE	15096-52-3	239-148-8	<10	HN
SODIUM FLUORIDE	7681-49-4	231-667-8	<2	HN
SODIUM OXIDE	1313-59-3	215-208-9	<2	CS, EZ, SS
TITANIUM DIOXIDE	13463-67-7	236-675-5	<20	CS, EZ, SS, HN
TUNGSTEN	7440-33-7	231-143-9	<5	SS
ZIRCONIUM	7440-67-7	231-176-9	<2	SS

Section 4: First Aid Measures

Notes to Physician: May cause sensitization in susceptible persons. Treat symptomatically.

Emergency and first aid procedures:

After inhalation of fumes: Supply fresh air and be sure to call a doctor. Remove patient from exposure, keep warm and at rest. In case of unconsciousness, place patient stably in the recovery position for transportation.

After skin contact: Dusts or particulates may cause mechanical irritation due to abrasion. (Coated steel may cause skin irritation in sensitive individuals) Some components in this product are capable of causing an allergic reaction, possibly resulting in burning, itching and skin eruptions. Contact with heated material may cause thermal burns. Wash skin with soap and water. In the case of burns, skin irritation or allergic reactions see a physician.

After eye contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Keep eye wide open while rinsing. Consult a physician.

Ingestion - Not considered an ingestion hazard. However, if excessive amounts of dust or particulates are swallowed, treat symptomatically and supportively. Get medical attention. Do not induce vomiting. Immediately call for medical help. Provided patient is conscious, rinse out mouth with water then give patient 200-300 ml of water to drink. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed:

Arc rays, fumes and spatter may cause eye irritation
Skin contact may cause irritation
May cause irritation to the respiratory system

Section 5: Firefighting measures

This product does not present fire or explosion hazards as shipped and is nonreactive, nonflammable, nonexplosive and essentially nonhazardous until welded.

Suitable Extinguishing Media:

For molten metal, use dry powder or sand.

Unsuitable Extinguishing Media:

DO NOT use water for fires involving molten metal. Do not use Carbon Dioxide (CO₂). Firefighters should not enter confined spaces without wearing NIOSH/MSHA approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.

Thermal decomposition can lead to release of irritating gases and vapors. In the event of fire and/or explosion do not breathe fumes. May cause sensitization by inhalation and skin contact.

Partially consumed welding consumables may remain hot for a period of time after completion of a welding process.

See American National Standard (ANSI) Z49.1 for further general safety information on the use and handling of welding consumables and associated procedures.

Section 6: Accidental Release Measures

Personal Precautions, Protective Equipment And Emergency Procedures: Solid objects can be picked up and placed into a container. Wear proper personal protective equipment while handling. Do not discard as general trash.

Environmental Precautions:

Some grades of steel may contain reportable quantities of alloying elements. See Section 15 for additional information. Do not allow to enter drains, sewers or watercourses.

Methods and Material for Containment and Cleanup:

Waste Disposal Methods - Dispose used or unused product in accordance with applicable Federal, State, and Local regulations. Please recycle

Reference to Other Sections: Personal Protection: See Section 8.

Section 7: Handling and Storage

Storage Temperatures: Stable under normal temperatures and pressures. Keep packages out of direct sunlight and away from extreme heat as the electrode's protective coating may soften and cause the electrodes stick together.

Precautions to be taken in handling and storing:

Keep material dry.

Keep in package until ready to use.

Avoid contact with sharp edges or heated material.

Do not touch face or eyes after handling. Wash hands thoroughly with soap and water.

No specific requirements in the form supplied. Handle with care to avoid cuts. Wear gloves when handling welding consumables. Avoid exposure to dust. Do not ingest. Some individuals can develop an allergic reaction to certain materials. Retain all warning and product labels.

Storage: Keep separate from acids and strong bases to prevent possible chemical reactions.

Section 8: Exposure Controls / Personal Protection

Only personnel trained in commercial diving operations and trained in underwater welding should operate the underwater welding equipment.

Operations with potential for generating high concentrations of airborne particulates or fumes should be evaluated and controlled as necessary. Exercise caution when welding in all environments.

Eye Protection:

When welding underwater use welding and cutting lens of a shade appropriate to protect the operators eyes (typically from #5 shade to #12) based upon the intensity of the electric 'welding' arc and the clarity/turbidity of the water. Start with the darkest lens available and adjust if needed by selecting the next lightest until the most appropriate for the job and conditions is determined. On the surface when welding use protective face shield with minimum #12 shade welding lens. Dust resistant safety goggles are recommended under circumstances where particles could cause mechanical injury.

Skin:

Appropriate diving dress should be used underwater to include appropriate diving suit, electrical insulating, flameproof, protective gloves to protect from shock and sparks and appropriate footwear.

At the surface, appropriate protective gloves (leather welding gloves) and protective clothing (suitable for cutting and welding) and protective shoes (leather, steel toed) should be worn as necessary. Good personal hygiene practices should be followed including cleansing exposed skin several times daily with soap and water and laundering or dry cleaning soiled work clothing.

Full head and neck protection may be necessary based upon environmental conditions and the tendency of the welding materials to spall, spark and spray.

Respiratory Protection:

Use only in well ventilated areas. Provide adequate exhaust to assure clean air within the breathing zone of operators and bystanders. Keep head out of fumes. When welding materials whose oxides are potentially toxic, use special breathing apparatus.

NIOSH/MSHA approved dust/fume/mist respirator should be used to avoid excessive exposure when welding and should be used when engineering controls are insufficient to lower welding fumes below the TLV. See Section 2 for component material information exposure limits. If such concentrations are sufficiently high that this respirator is inadequate, or high enough to cause oxygen deficiency, use a positive pressure self-contained breathing apparatus (SCBA). Follow all applicable respirator use, fitting, and training standards and regulations.

Ventilation:

Provide general and/or local exhaust ventilation to control airborne levels of dust or fumes below exposure limits.

Exposure Guidelines:

No permissible exposure limits (PEL) or threshold limit values (TLV) exist for steel. Various grades of steel will contain different combinations of component elements. Trace elements may also be present in minute amounts.

Welding fumes have been associated with adverse health effects. Welding fumes have been known to contain components that may cause cancer or reproductive effects. The following components are listed by NTP, OSHA, or IARC as carcinogens: Nickel, chromium (hexavalent), cobalt, lead, cadmium, antimony (trioxide), arsenic, beryllium.

See Section 11, for additional, specific information on effects noted above.

Section 8: Exposure Controls / Personal Protection (cont.)

SPECIAL PRECAUTIONS (IMPORTANT): Maintain exposure below the PEL/TLV/OEL. Use industrial hygiene monitoring to ensure that your use of this material does not create exposures which exceed PEL/TLV/OEL. Always use exhaust ventilation.

See American National Standard (ANSI) Z49.1 and OSHA Publication 2206 (29 CFR 1910) for further general safety information on the use and handling of welding consumables and associated welding process.

Read and understand the instructions and the labels on the packaging. Welding fumes do not have a specific OSHA PEL or ACGIH TLV. The OSHA PEL for Particulate – Not Otherwise Classified (PNOC) is 5 mg/m³ – Respirable Fraction, 15 mg/m³ – Total Dust. The ACGIH TLV for Particles – Not Otherwise Specified (PNOS) is 3 mg/m³ – Respirable Particles, 10 mg/m³ – Inhalable Particles. The individual complex compounds within the fume may have a lower OSHA PEL or ACGIH TLV than the OSHA Particulate – Not Otherwise Classified (PNOC) and ACGIH Particles – Not Otherwise Specified (PNOS). An Industrial Hygienist, the OSHA Permissible Exposure Limits for Air Contaminants (29 CFR 1910.1000), and the ACGIH Threshold Limit Values should be consulted to determine the specific fume constituents present and their respective exposure limits. European Union Occupational Exposure Limits (EU OEL) are listed with the most stringent limit among the EU member nations. All exposure limits are in milligrams per cubic meter (mg/m³).

INGREDIENT	CAS	EINECS	OSHA PEL	ACGIH TLV	EU OEL
ALUMINUM###	7429-90-5	231-072-3	5 R* (Dust)	1 R* {A4}	4 I*; 1.5 R* - Germany
ALUMINUM OXIDE##	344-28-1	215-691-6	5 R*	1 R* {A4}	1.5 R* (Aerosol) - Germany; 2 - Poland
CALCIUM CARBONATE	1317-65-	215-279-6	5 R*, 5 (as CaO)	3 R*, 2 (as CaO)	3 R* (Aerosol) – Switzerland; 10 I* (Aerosol) – UK
CALCIUM FLUORIDE	7789-75-5	232-188-7	2.5 (as F)	2.5 (as F)	0.5 mg/m ³ TWA (Aerosol, as F) - Russia
CELLULOSE	9004-34-6	232-674-9	5 R*	10	3 R* (Aerosol) – Switzerland; 10 I* (Aerosol) – UK
CHROMIUM#	7440-47-3	231-157-5	1 (Metal)	0.5 (Metal) {A4}	0.1 I* (Aerosol) - Switzerland
			0.5 (Cr II & Cr III Cpnds)	0.5 (Cr III Cpnds) {A4}	0.005; 0.01*** - Denmark
			0.005 (Cr VI Cpnds)	0.05 (Cr VI Sol Cpnds) {A1}	0.005 (Total Aerosol); 0.015*** (Total Aerosol) - Sweden
			0.01 (Cr VI Insol Cpnds) {A1}		
COLUMBIUM	7440-03-1	231-113-5	5 R*	3 R*	0.5; 1*** - Denmark
COPPER	7440-50-8	231-159-6	0.1 (Fume), 1 (Dust)	0.2 (Fume), 1 (Dust)	0.1 I* (Aerosol); 0.2 I*** (Aerosol) - Germany
					0.1; 0.2*** - Denmark
FLUORSPAR	7789-75-5	232-188-7	2.5 (as F)	2.5 (as F) {A4}	1 I* (Aerosol as F); 4*** (Aerosol as F) - Germany
IRON+	7439-89-6	231-096-4	5 R*	5 R* (Fe2O3) {A4}	3 R* (Aerosol as Fe2O3) – Switzerland
					7*** (as Fe2O3) - Denmark
MAGNESIUM CARBONATE	546-93-0	208-915-9	5 R*	3 R*	3 R* (Aerosol) – Switzerland; 10 I* (Aerosol) – UK
MANGANESE#	7439-96-5	231-105-1	5 CL ** (Fume)	0.1 I* {A4} □	0.02 R* (Aerosol); 0.16 R*** (Aerosol) - Germany
			1, 3 STEL*** □	0.02 R* □□	0.2 I* (Aerosol) - Germany
					0.2; 0.4*** - Denmark
MICA	12001-26-2	None	3 R*	3 R*	0.8 R* (Aerosol); 10 I* (Aerosol) – UK
MOLYBDENUM	7439-98-7	231-107-2	5 R*	3 R*; 10 I* (Ele and Insol)	3 R* - Spain;
				0.5 R* (Sol Cpnds) {A3}	4; 10*** - Poland
NICKEL#	7440-02-0	231-111-4	1 (Metal)	1.5 I* (Ele) {A5}	0.05; 0.1*** - Denmark
			1 (Sol Cpnds)	0.1 I* (Sol Cpnds) {A4}	
			1 (Insol Cpnds)	0.2 I* (Insol Cpnds) {A1}	
PARAFFIN WAX	8002-74-2	232-315-6		2	
POTASSIUM	7440-09-7	231-119-8	5 R	3 R	
POTASSIUM OXIDE	12136-45-7	235-227-6	5 R*	3 R*	1.5 R* (Dust NOS - Aerosol) - Germany
SILICA++	14808-60-7	238-878-4	0.1 R*	0.025 R* {A2}	0.1 (Fused, Respirable Dust) - Denmark
(Amorphous Silica Fume)	69012-64-2	273-761-5	0.8	3 R*	0.2*** (Fused, Respirable Dust) - Denmark
SILICON+	7440-21-3	231-130-8	5 R*	3 R*	2 I*; 4 I*** - Denmark
SODIUM	7440-23-5	231-132-9	5 R	3 R	4 R* (Aerosol); 10 I* (Aerosol) - Denmark
SODIUM ALUMINUM FLUORIDE					
	15096-52-3	239-148-8	2.5 (as F)	2.5 (as F)	2.5 R
SODIUM FLUORIDE	7681-49-4	231-667-8	2.5 (as F)	2.5 (as F)	1 R (Inhalable, skin) - Germany
SODIUM OXIDE	1313-59-3	215-208-9	5 R*	3 R*	1.5 R* (Dust NOS - Aerosol) - Germany
TITANIUM DIOXIDE	13463-67-7	236-675-5	15 (Dust)	10 {A4}	1.5 R* - Germany
TUNGSTEN	7440-33-7	231-143-9	5 R*	5, 10 STEL*** (Insol Cpnds)	1 I* (Aerosol); 2 I*** (Aerosol) - Austria
				1, 3 STEL*** (Sol Cpnds)	
ZIRCONIUM	7440-67-7	231-176-9	5 (Zr Cpnds)	5, 10 STEL*** (Zr Cpnds) {A4}	1 I* (Aerosol); 0.1 I*** (Aerosol) - Germany

R* - Respirable Fraction R*** - Respirable Fraction - Short Term Exposure Limit I* - Inhalable Fraction I*** - Inhalable Fraction - Short Term Exposure Limit ** - Ceiling Limit *** - Short Term Exposure Limit + - As a nuisance particulate covered under "Particulates Not Otherwise Regulated" by OSHA or Particulates Not Otherwise Classified" by ACGIH ++ - Crystalline silica is bound within the product as it exists in the package. However, research indicates silica is present in welding fume in the amorphous (noncrystalline) form #- Reportable material under Section 313 of SARA ## - Reportable material under Section 313 of SARA only in fibrous form □ NIOSH REL TWA and STEL □ Limit of 0.1 mg/m³ is for Inhalable Mn in 2013 by ACGIH □□ Limit of 0.02 mg/m³ is for Respirable Mn in 2013 by ACGIH Ele – Element Sol – Soluble Insol – Insoluble Inorg – Inorganic Cpnds – Compounds NOS – Not Otherwise Specified {A1} - Confirmed Human Carcinogen per ACGIH {A2} - Suspected Human Carcinogen per ACGIH {A3} - Confirmed Animal Carcinogen with Unknown Relevance to Humans per ACGIH {A4} - Not Classifiable as a Human Carcinogen per ACGIH {A5} - Not Suspected as a Human Carcinogen per ACGIH (noncrystalline) form

Section 9: Physical and Chemical Properties

Appearance: Welding stick electrode, wax covered, silver, grey or off-white color.
Welding consumables are nonreactive, nonflammable, nonexplosive and essentially nonhazardous until welded.
Boiling Point: Not applicable
Melting Point: Approximately 2800°F
pH: Not applicable
Specific Gravity (at 15.6°C): Not applicable
Density (at 15.6°C): Not applicable
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
% Volatile, by Volume: Not applicable
Solubility in Water: Insoluble.
Evaporation Rate (Butyl Acetate = 1): Not applicable
Other Physical and Chemical Data: None

Section 10: Stability and Reactivity

This material is only intended for use per the welding parameters it was designed for.
Stability: Stable material
Conditions to Avoid: None
Materials to Avoid: Combustibles (sparks are generated during welding). Reacts with strong acids to form hydrogen gas. Do not store near strong oxidizers.
General: When this product is used for welding, hazardous fumes may be created. Other factors to consider include the base metal, base metal preparation and base metal coatings. All of these factors can contribute to the fume and gases generated during welding. The amount of fume varies with the welding parameters. Know the material be welded. Molten metal will burn skin. Smoke will irritate eyes. Bright light emitted by flame can damage eyes. UV and heat emitted by flame can damage skin. Refer to ANSI Z49.1

Section 11: Toxicological Information

Effects of short-term (acute) exposure to material: Welding fumes may result in discomfort such as dizziness, nausea, dryness or irritation of the nose, throat and eyes. Fumes can aggravate asthma or bronchial conditions. Arc rays can burn eyes and skin. Welding produces heat and sparks that can burn skin and ignite clothing. **Aluminum Oxide** - Irritation of the respiratory system. **Calcium Oxide** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Chromium** - Inhalation of fume with chromium (VI) compounds can cause irritation of the respiratory tract, lung damage and asthma-like symptoms. Swallowing chromium (VI) salts can cause severe injury or death. Dust on skin can form ulcers. Eyes may be burned by chromium (VI) compounds. Allergic reactions may occur in some people. **Columbium** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Copper** - Metal fume fever characterized by metallic taste, tightness of chest and fever. Symptoms may last 24 to 48 hours following overexposure. **Fluorides** - Fluoride compounds evolved may cause skin and eye burns, pulmonary edema and bronchitis. **Iron, Iron Oxide** - None are known. Treat as nuisance dust or fume. **Magnesium, Magnesium Oxide** - Overexposure to the oxide may cause metal fume fever characterized by metallic taste, tightness of chest and fever. Symptoms may last 24 to 48 hours following overexposure. **Manganese** - Metal fume fever characterized by chills, fever, upset stomach, vomiting, irritation of the throat and aching of body. Recovery is generally complete within 48 hours of the overexposure. **Mica** - Dust may cause irritation of the respiratory system, skin and eyes. **Molybdenum** - Irritation of the eyes, nose and throat. **Nickel, Nickel Compounds** - Metallic taste, nausea, tightness in chest, metal fume fever, allergic reaction. **Potassium Oxide** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Silica (Amorphous)** - Dust and fumes may cause irritation of the respiratory system, skin and eyes. **Sodium Oxide** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Strontium Compounds** - Strontium salts are generally non-toxic and are normally present in the human body. In large oral doses, they may cause gastrointestinal disorders, vomiting and diarrhea. **Titanium Dioxide** - Irritation of respiratory system. **Tungsten** - Dust may cause irritation of the skin and eyes. Inhalation of dust may cause acute airways obstructive asthma which is reversible following overexposure. Symptoms are tightening chest and productive cough. **Zirconium** - May cause irritation of the eyes, nose and throat due to mechanical effects.

Section 11: Toxicological Information (cont.)

Effects of long-term (chronic) overexposure: Welding Fumes - Excess levels may cause bronchial asthma, lung fibrosis, pneumoconiosis or "siderosis." **Aluminum Oxide** - Pulmonary fibrosis and emphysema. **Calcium Oxide** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Chromium** - Ulceration and perforation of nasal septum. Respiratory irritation may occur with symptoms resembling asthma. Studies have shown that chromate production workers exposed to hexavalent chromium compounds have an excess of lung cancers. Chromium (VI) compounds are more readily absorbed through the skin than chromium (III) compounds. Good practice requires the reduction of employee exposure to chromium (III) and (VI) compounds. **Columbium** - No adverse long term health effects have been reported in the literature. **Copper** - Copper poisoning has been reported in the literature from exposure to high levels of copper. Liver damage can occur due to copper accumulating in the liver characterized by cell destruction and cirrhosis. High levels of copper may cause anemia and jaundice. High levels of copper may cause central nervous system damage characterized by nerve fiber separation and cerebral degeneration. **Fluorides** - Serious bone erosion (Osteoporosis) and mottling of teeth. **Iron, Iron Oxide Fumes** - Can cause siderosis (deposits of iron in lungs) which some researchers believe may affect pulmonary function. Symptoms may include chronic bronchitis, emphysema, and shortness of breath upon exertion. Penetration of iron particles in the skin or eye may cause an exogenous or ocular siderosis which may be characterized by a red-brown pigmentation of the affected area. Ingestion overexposures to iron may affect the gastrointestinal, nervous, and hematopoietic system and the liver. Iron and steel founding, but not iron or iron oxide, has been listed as potentially carcinogenic by IARC. Lungs will clear in time when exposure to iron and its compounds ceases. Iron and magnetite (Fe₃O₄) are not regarded as fibrogenic materials. **Magnesium, Magnesium Oxide** - No adverse long term health effects have been reported in the literature. **Manganese** - Long-term overexposure to manganese compounds may affect the central nervous system. Symptoms may be similar to Parkinson's disease and can include slowness, changes in handwriting, gait impairment, muscle spasms and cramps and less commonly, tremor and behavioral changes. Employees who are overexposed to manganese compounds should be seen by a physician for early detection of neurologic problems. Overexposure to manganese and manganese compounds above safe exposure limits can cause irreversible damage to the central nervous system, including the brain, symptoms of which may include slurred speech, lethargy, tremor, muscular weakness, psychological disturbances and spastic gait. **Mica** - Prolonged overexposure may cause scarring of the lungs and pneumoconiosis characterized by cough, shortness of breath, weakness and weight loss. **Molybdenum** - Prolonged overexposure may result in loss of appetite, weight loss, loss of muscle coordination, difficulty in breathing and anemia. **Nickel, Nickel Compounds** - Lung fibrosis or pneumoconiosis. Studies of nickel refinery workers indicated a higher incidence of lung and nasal cancers. **Potassium Oxide** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Silica (Amorphous)** - Research indicates that silica is present in welding fume in the amorphous form. Long-term overexposure may cause pneumoconiosis. Noncrystalline forms of silica (amorphous silica) are considered to have little fibrotic potential. **Sodium Oxide** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Titanium Dioxide** - Pulmonary irritation and slight fibrosis. **Tungsten** - Long term overexposure may cause pulmonary fibrosis characterized by a rapid onset of cough, sputum and dyspnea on exertion. **Zirconium** - May cause pulmonary fibrosis and pneumoconiosis.

Medical conditions aggravated by exposure: Persons with pre-existing impaired lung functions (asthma-like conditions). Persons with a pacemaker should not go near welding and cutting operations until they have consulted their doctor and obtained information from the manufacturer of the device. Respirators are to be worn only after being medically cleared by your company designated physician.

Emergency and first aid procedures: Call for medical aid. Employ first aid techniques recommended by the American Red Cross. If irritation or flash burns develop after exposure, consult a physician.

Carcinogenicity: Chromium VI compounds, nickel compounds and silica (crystalline quartz) are classified as IARC Group 1 and NTP Group K carcinogens. Titanium dioxide compounds are classified as IARC Group 2B carcinogens. Chromium VI compounds, nickel compounds, silica (crystalline quartz) and welding fumes must be considered as carcinogens under OSHA (29 CFR 1910.1200).

CALIFORNIA PROPOSITION 65: WARNING: This product contains a chemical or, when used for welding, 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 Section 25249.5 et seq.)

Section 12: Ecological Information

Welding processes can release fumes directly to the environment. Welding electrodes can degrade if left outside and unprotected. Residues from welding consumables and processes could degrade and accumulate in the soil and groundwater.

Section 13: Disposal Consideration

Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. Dispose of product, packaging, residue, etc. in an environmentally responsible manner and in accordance with federal, state, and local health and environmental regulations. Prevent materials from entering drains, sewers, or waterways.

Section 14: Transport Information

No international regulations or restrictions are applicable. No special precautions are necessary.

DOT Proper Shipping Name: Not regulated

DOT Hazard Classification: Not regulated

UN/NA Number: Not applicable

DOT Packing Group: Not applicable

Labeling Requirements: Not applicable

Placards: Not applicable

DOT Hazardous Substance: Not applicable

DOT Marine Pollutant: Not applicable

Section 15: Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture:

United States 29 CFR 1910.1200(g), 'Safety data sheets'; EC Regulation (EC) No. 1907/2006., Regulation (EC) No. 1272/2008 (CLP), Directive 67/548/EEC & Directive 1999/45/EC.

Read and understand the manufacturer's instructions, your employer's safety practices and the health and safety instructions on the label and the material safety data sheet. Observe all local and federal rules and regulations. Take all necessary precautions to protect yourself and others.

United States EPA Toxic Substance Control Act: All constituents of these products are on the TSCA inventory list or are excluded from listing.

CERCLA/SARA Title III: Reportable Quantities (RQs) and/or Threshold Planning Quantities (TPQs):

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA):

Products on this MSDS are a solid solution in the form of a solid article. Steel is not reportable, however, it contains hazardous substances that may be reportable if released in pieces with diameters less than or equal to 0.004 inches (RQ marked with a "**").

Chemical Name	Reportable Quantity (in lb)
Chromium	5000*
Nickel	100*
Copper	5000*

Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III

SECTION 311/312 HAZARD CATEGORIES: Immediate Health Effect, Delayed Health Effect

This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right – To – Know Act of 1986 (40 CFR 372):

SECTION 313 REPORTABLE INGREDIENTS:

Chemical Name	CAS Number	Concentration (% by weight)	Reportable
Aluminum	7429-90-5	<0.01	No – Less than 1%
Chromium	7440-47-3	0.01-1.0	Yes – greater than 0.1%
Copper	7440-50-8	0-4	Yes – Greater than 0.1%
Manganese	7439-96-5	0.2-2	Yes – Greater than 1%
Nickel	7440-02-0	<1.0	Yes – Greater than 0.1%

Concentrations based on analytical data of typical products.

See Section 3 for weight percentage.

California Proposition 65:

This product contains chemicals: (chromium [hexavalent], nickel) known to the State of California to cause cancer and chemicals known to the State of California to cause birth defects or other reproductive harm.

Regulatory Lists:

Some components of this product may be specifically listed by individual states; other product-specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on local regulatory requirements, contact the appropriate agency in the state.

Canadian WHMIS classification: Class D; Division 2, Subdivision A

Canadian Environmental Protection Act (CEPA): All constituents of these products are on the Domestic Substance List (DSL).

Section 16: Other Information

The information and recommendations contained herein are based upon data believed to be up-to-date and correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information and recommendations contained herein. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. Broco, Inc. accepts no responsibility and disclaims all liability for any harmful effects that may be caused by (incorrect) use, handling, purchase, resale, or exposure to our product. During welding, precautions should be taken for airborne contaminants that may originate from components of the welding electrode. Arc or spark generated when welding could be a source of ignition for combustible and/or flammable materials. Customers and users of our product must comply with all applicable health and safety laws, regulations, and orders. In particular, they are under an obligation to carry out a risk assessment for the particular work places and to take adequate risk management measures in accordance with the national implementation legislation of EU Directives 89/391 and 98/24, U.S. Code Of Federal Regulations, and relevant national legislation.

The following Risk and Safety Phrase Texts and Hazard Statements correspond with the columns labeled - EU 67/548/EEC within Section 2 of this material safety data sheet. Take appropriate precautions and protective measures to eliminate or limit the associated hazard.

EU Directive 67/548/EEC - Risk Phrase Texts

R9 – Explosive when mixed with combustible material
R20/22 – Harmful by inhalation and if swallowed
R24/25 – Toxic in contact with skin and if swallowed
R26 – Very toxic by inhalation
R35 – Causes severe burns
R36/37 – Irritating to eyes and respiratory system
R40 – Limited evidence of a carcinogenic effect
R40/20 – Harmful: possible risk of irreversible effects through inhalation
R42/43 – May cause sensitization by inhalation and skin contact
R43 – May cause sensitization by skin contact
R45 – May cause cancer
R46 – May cause heritable genetic damage
R48/20 – Harmful: danger of serious damage to health by prolonged exposure through inhalation
R48/20/22 – Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/23 – Toxic: danger of serious damage to health by prolonged exposure through inhalation
R50 – Very toxic to aquatic organisms
R53 – May cause long-term adverse effects in the aquatic environment
R62 – Possible risk of impaired fertility

For additional information please refer to the following sources:

USA: American National Standard (ANSI) Z49.1 "Safety in Welding and Cutting", ANSI/American Welding Society (AWS) F1.5 "Methods for Sampling and Analyzing Gases from Welding and Allied Processes", ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes", AWSF3.2M/F3.2 "Ventilation Guide for Weld Fume", American Welding Society, 8669 NW 36 Street, # 130, Miami, Florida 33166-6672. Safety and Health Fact Sheets available from AWS at www.aws.org.

OSHA Publication 2206 (29 C.F.R. 1910), U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Hygienists (ACGIH), 6500 Glenway Ave., Cincinnati, Ohio 45211, USA.

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.

UK: WMA Publication 236 and 237, "Hazards from Welding Fume", "The arc welder at work, some general aspects of health and safety".

Canada: CSA Standard CAN/CSA-W117.2-01 "Safety in Welding, Cutting and Allied Processes".