

Product Trade Name	Shield-Bright 316H ⑥	Shield-Bright 316L ⑥	Shield-Bright 317L ⑥	Shield-Bright 347 ⑥	Shield-Bright 347H ⑥	Shield-Bright 2209 ⑥	Shield-Bright 2509 ⑥
Carbon	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	17-20	17-20	17-20	17-20	17-20	21-23	23-25
Copper	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Columbium*	--	--	--	<1	<1	--	--
Manganese	1-3	1-3	1-3	1-3	1-3	1-3	1-3
Molybdenum	1-3	1-3	2-4	<0.5	<0.5	2-4	2-4
Nickel	9-11	9-11	10-12	8-10	8-10	7-9	8-10
Silicon	0.2-2	0.2-2	0.2-2	0.2-2	0.2-2	0.2-2	0.2-2
Zirconium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aluminum Oxide	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoride Compounds**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron Oxide	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese Oxide	--	--	--	--	--	--	<0.5
Potassium Oxide	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon Dioxide	<1	<1	<1	<1	<1	<1	<1
Sodium Oxide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Titanium Dioxide	8-12	8-12	8-12	8-12	8-12	8-12	8-12
Zirconium Dioxide	<2	<2	<2	<2	<2	<2	<2
Iron	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)
AWS A5.22 Classification	E316HT1-1 E316HT1-4	E316LT1-1 E316LT1-4	E317LT1-1 E317LT1-4	E347T1-1 E347T1-4	E347T1-1 E347T1-4	E2209T1-4	None

Product Trade Name	Cryo-Shield-308L ⑥	Shield-Bright X-tra 308L ⑥	Shield-Bright X-tra 309L ⑥	Shield-Bright X-tra 309LMo ⑥	Shield-Bright X-tra 316L ⑥	Shield-Bright X-tra 317L ⑥
Carbon	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	17-20	17-20	21-24	21-24	17-20	17-20
Copper	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Columbium*	--	--	--	--	--	--
Manganese	1-3	1-3	1-3	1-3	1-3	1-3
Molybdenum	<0.5	<0.5	<0.5	2-4	2-4	2-4
Nickel	8-10	8-10	10-13	10-13	10-13	10-13
Silicon	0.2-2	0.2-2	0.2-2	0.2-2	0.2-2	0.2-2
Zirconium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aluminum Oxide	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoride Compounds**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron Oxide	<0.2	<1.5	<1.5	<1.5	<1.5	<1.5
Manganese Oxide	--	--	--	1-2	--	1-2
Potassium Oxide	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
Silicon Dioxide	<1	1-4	1-4	1-4	1-4	1-4
Sodium Oxide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Titanium Dioxide	8-12	2-5	2-5	2-5	2-5	2-5
Zirconium Dioxide	<2	<2	<2	<2	<2	<2
Iron	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)	Bal. (>45)
AWS A5.22 Classification	E308LT1-1 E308LT1-4	E308LT0-1 E308LT0-4	E309LT0-1 E309LT0-4	E309LMoT0-1 E309LmoT0-4	E316LT0-1 E316LT0-4	E317LT0-1 E317LT0-4

NOTE: * Also known as Niobium (Nb)
** Fluoride Compounds are listed in Section II Hazardous Ingredients Table. If anyone of those fluorides is present within a product in substantial amounts, it is separately listed and does not contribute to the total shown for fluoride compounds.

⑥ See Note in Section VI

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 (1993)	
			TWA (mg/m ³)		TWA (mg/m ³)	STEL (mg/m ³)
Aluminum Oxide (Al ₂ O ₃)	(1344-28-1)		10		5 (Respirable Fraction)	--
Carbon (C)	(7440-44-0)		3.5 (Carbon Black)		3.5 (Carbon Black)	--
Chromium (Cr)	(7440-47-3)	*	0.5 (Metal) 0.05 (CrVI inorganic compounds as Cr, water soluble) 0.01 (CrVI inorganic compounds as Cr, water insoluble)		0.5 (Metal) C 0.1 (as Chromate)	--
Columbium (Cb)	(7440-03-1)		10 (Nuisance Particulate)		5 (Respirable Dust)	--
Iron (Fe)	(7439-89-6)		5 (Oxide Fume)		10 (Total Particulate)	--
Iron Oxide (Fe ₂ O ₃)	(1309-37-1)		5 (Oxide Fume)		10 (Total Particulate)	--
Manganese (Mn)	(7439-96-5)	*	0.2 (Fume)		1 (Fume)	3
Silico Manganese	(12743-28-1)					
Ferro Manganese	(12604-53-4)					
Ferro Manganese Silicon	(68797-82-0)					
Manganese Compounds, as Mn			0.2		1 (Fume)	3
Manganese Oxide	(1344-43-0)	*				
Molybdenum (Mo), Insoluble Compounds as Mo	(7439-98-7)		10 (Inhalable Fraction) 3 (Respirable Fraction)		5 (Soluble)	--
Soluble Compounds as Mo			0.5 (Respirable Fraction)			
Nickel (Ni)	(7440-02-0)	*	1.5 (Inhalable Fraction, elemental) 0.2 (Inhalable insoluble inorganic compounds) 0.1 (Inhalable soluble inorganic compounds)		0.1 (Soluble)	--
Potassium Oxide Fused flux Feldspar	(68476-25-5)		Not listed		Not Listed	--
Silicon (Si)	(7440-21-3)		10 (Dust)		5 (Respirable)	--
Silicon Dioxide (SiO ₂)	(14808-60-7)		0.05 (Respirable Fraction)		10/(% SiO ₂ +2) ; SiO ₂ measured as Respirable Fraction	--
Sodium Oxide Fused Flux Feldspar	(68476-25-2)		Not listed		Not listed	--
Titanium Dioxide (TiO ₂)	(13463-67-7)		10 (Dust)		5 (Respirable)	--
Welding Fume	(Not Specified)		5		--	--
Zirconium (Zr)	(7440-67-7)		5	10 (STEL)	5	10
Zirconium Dioxide (ZrO ₂)	(7440-67-7)		5 (as Zr)	10 (STEL)	5 (as Zr)	10

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, 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.

III. Physical Data

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

Physical State: GAS () LIQUID () SOLID (X)

Odor and Appearance: Tubular stainless steel wire containing minerals and alloys. Odorless.

IV. Fire & Explosion Hazard

Flammable/Explosive: NO (X) YES ()

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

Extinguishing Media: This product will not burn; however, 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 and Cutting" and "Safe Practices" Code: SP, 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, Batterymarch Park, Quincy, MA 02269 for additional fire prevention and protection information.

Special Fire Fighting Procedures: Full protective equipment required. When involved in a fire, these products may emit toxic and irritating fumes of the metals, metal oxides and their compounds.

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). 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, 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 LEVELS. 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.

Possible hazards during processing by soldering, brazing, braze welding, welding or arc spray metallizing.

	<u>ACGIH TLV</u>	<u>OSHA PEL</u>
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
Phosgene gas	0.1 ppm	0.1 ppm

VI. Physical and Health Hazard Data

WARNING: Electric arc working may create one or more of the following health or 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 17982 "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.

Potential Health Effects: Direct contact with the product causes irritation of the eyes; irritation of the skin is not expected. If the product is pulverized the airborne dust may irritate the mucous membranes and upper respiratory tract. The dust may also contain crystalline silica which must be considered a possible carcinogen under OSHA 29CFR1910.1200. Exposure level must be kept below those levels specified in Section II.

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. Exposure to the fluoride ion may cause hypocalcemia—calcium deficiency in the blood that can result in muscle cramps and inflammation and necrosis of mucous membranes.

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.

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. 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. Nickel and chromium are considered carcinogenic. Long term overexposure to nickel fumes may also cause pulmonary fibrosis and edema. Chromates may cause an ulceration and perforation of 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 respirable crystalline silica may result in silicosis, a disabling lung disease; overexposure to respirable crystalline silica is a known cause of carcinogenicity in humans. Chronic fluoride absorption can result in osseous fluorosis, increased radiographic density of the bones and mottling of the teeth. Welding fumes (not otherwise specified) are possibly carcinogenic to humans.

Exposure limits for the ingredients are listed in Section II. The 1989 OSHA TWA for welding fume is 5 mg/m³. 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.

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.

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.

Silica-Crystalline Cristobolite; Silica-Crystalline Quartz- IARC-1: Carcinogenic to humans; NTP-K: Known to be a human carcinogen; TLV-A2: Suspected human carcinogen.

Silica fume--IARC-3: Unclassifiable (inadequate evidence) as to carcinogenicity in humans.

Vanadium Pentoxide V2O5-- IARC-2B: Possibly carcinogenic to humans; TLV-A4: Not classified as a human carcinogen.

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

⊗ 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. Keep exposure as low as possible.

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 TLVs. 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 in 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.