Product Cross Reference

Safety Guidelines

Storage & Handling

Metric-Imperial Conversions

Welding Term Conversions

Disclaimer

REFERENCE

PRODUCT CROSS REFERENCE

Oxford Alloys Designation	AWS Specification	AWS Classification	EN/ISO Standard	EN/ISO Classification	UNS No.	Page No.
COATED ELECTRODES						
Nickel Alloys						
Oxford Alloy A	5.11	ENiCrFe-2	14172	ENi6092 (ENiCr16Fe9NbMo)	W86133	10
Oxford Alloy C-276	5.11	ENiCrMo-4	14172	ENi6276 (ENiCr15Mo15Fe6W)	W80276	11
Oxford Alloy 55	5.15	ENiFe-CI	1071	E C NiFe-CI	W82002	12
Oxford Alloy 59	5.11	ENiCrMo-13	14172	ENi6059 (ENiCr23Mo16)	W86059	13
Oxford Alloy 99	5.15	ENi-CI	1071	E C Ni-CI	W82001	14
Oxford Alloy 112	5.11	ENiCrMo-3	14172	ENi6625 (ENiCr22Mo9Nb)	W86112	15
Oxford Alloy 117	5.11	ENiCrCoMo-1	14172	ENi6617 (ENiCr22Co12Mo)	W86117	16
Oxford Alloy 122	5.11	ENiCrMo-10	14172	ENi6022 (ENiCr21Mo13W3)	W86022	17
Oxford Alloy 141	5.11	ENi-1	14172	ENi2061 (ENiTi-3)	W82141	18
Oxford Alloy 182	5.11	ENiCrFe-3	14172	ENi6182 (ENiCr15Fe6Mn)	W86182	19
Oxford Alloy 187	5.6	ECuNi	N/A	N/A	W60715	20
Oxford Alloy 190	5.11	ENiCu-7	14172	ENi4060 (ENiCu30Mn3Ti)	W84190	21
Stainless Steel						
Oxford Alloy 308/308H-16	5.4	E308/308H-16	3581A	E19 9 H	W30810	22
Oxford Alloy 308/308L-16	5.4	E308/308L-16	3581A	E19 9 L	W30813	23
Oxford Alloy 309/309H-16	5.4	E309/309H-16	3581A	E23 12 H	W30910	24
Oxford Alloy 309/309L-16	5.4	E309/309L-16	3581A	E23 12 L	W30913	25
Oxford Alloy 309LMo-16	5.4	E309LMo-16	3581A	E23 12 2 L	W30923	26
Oxford Alloy 310-16	5.4	E310-16	3581A	E25 20	W31010	27
Oxford Alloy 312-16	5.4	E312-16	3581A	E29 9	W31310	28
Oxford Alloy 316/316H-16	5.4	E316/316H-16	3581A	E19 12 2	W31610	29
Oxford Alloy 316/316L-16	5.4	E316/316L-16	3581A	E19 12 3 L	W31613	30
Oxford Alloy 317L-16	5.4	E317L-16	3581A	E19 13 4 N L	W31713	31
Oxford Alloy 320LR-16	5.4	E320LR-16	3581B	ES320LR	W88022	32
Oxford Alloy 330-16	5.4	E330-16	3581A	E18 36	W88331	33
Oxford Alloy 347-16	5.4	E347-16	3581A	E19 9 Nb	W34710	34
Oxford Alloy 385-16	5.4	E385-16	3581A	E20 25 5 Cu N L	W88904	35
Oxford Alloy 410-16	5.4	E410-16	3581A	E13	W41010	36
Oxford Alloy 410NiMo-16	5.4	E410NiMo-16	3581A	E13 4	W41016	37
Oxford Alloy 630-16	5.4	E630-16	3581B	ES630	W37410	38
Duplex & Super Duplex						
Oxford Alloy 2209-16	5.4	E2209-16	3581A	E22 9 3 N L	W39209	39
Oxford Alloy 2594-16	5.4	E2594-16	3581A	E25 9 4 N L	W39594	40
Chrome Moly						
Oxford Alloy 8018-B2	5.5	E8018-B2	3580A	ECrMo1x	W52018	41
Oxford Alloy 8018-B6	5.5	E8018-B6	3580A	ECrMo5x	W50218	42
Oxford Alloy 8018-B8	5.5	E8018-B8	3580A	ECrMo9x	W50418	43
Oxford Alloy 9015-B9	5.5	E9015-B9	3580A	ECrMo91x	W50425	44
Oxford Alloy 9018-B3	5.5	E9018-B3	3580A	ECrMo2x	W53018	45
Mild Steel						
Oxford Alloy 7018	5.1	E7018	2560A	E42 3 B 32	W07018	46
Oxford Alloy 7018-A1	5.5	E7018-A1	3580A	EMo x	W17018	47

Oxford Alloys Designation	AWS Specification	AWS Classification	EN/ISO Standard	EN/ISO Classification	UNS No.	Page No.
MIG & TIG						
Nickel Alloys						
Oxford Alloy C-276	5.14	ERNiCrMo-4	18274	SNi6276 (NiCr15Mo16Fe6W4)	N10276	50
Oxford Alloy 59	5.14	ERNiCrMo-13	18274	SNi16059 (NiCr23Mo16)	N06059	51
Oxford Alloy 60	5.14	ERNiCu-7	18274	SNi4060 (NiCu30Mn3Ti)	N04060	52
Oxford Alloy 61	5.14	ERNi-1	18274	SNi2061 (NiTi3)	N02061	53
Oxford Alloy 67	5.7	ERCuNi	N550	SCu7158 (CuNi30)	C71581	54
Oxford Alloy 82	5.14	ERNiCr-3	18274	SNi6082 (NiCr20Mn3Nb)	N06082	55
Oxford Alloy 617	5.14	ERNiCrCoMo-1	18274	SNi6617 (NiCr22Co12Mo9)	N06617	56
Oxford Alloy 622	5.14	ERNiCrMo-10	18274	SNi6022 (NiCr21Mo13Fe4W3)	N06022	57
Oxford Alloy 625	5.14	ERNiCrMo-3	18274	SNi6625 (NiCr22Mo9Nb)	N06625	58
Oxford Alloy 718	5.14	ERNiFeCr-2	18274	SNi7718 (NiFe19Cr19Nb5Mo3)	N07718	59
Oxford Alloy 825	5.14	ERNiFeCr-1	18274	SNi8065 (NiFe30Cr21Mo3)	N08065	60
Stainless Steel						
Oxford Alloy 308/308H	5.9	ER308/308H	14343A	19 9 H	S30880	61
Oxford Alloy 308/308L	5.9	ER308/308L	14343A	19 9 L	E30883	62
Oxford Alloy 308LSi	5.9	ER308LSi	14343A	19 9 LSi	S30888	63
Oxford Alloy 309/309L	5.9	ER309/309L	14343A	23 12 L	S30983	64
Oxford Alloy 309LSi	5.9	ER309LSi	14343A	23 12 LSi	S30988	65
Oxford Alloy 309LMo	N/A	N/A	14343A	23 12 2 L	N/A	66
Oxford Alloy 310	5.9	ER310	14343A	25 20	S31080	67
Oxford Alloy 312	5.9	ER312	14343A	29 9	S31380	68
Oxford Alloy 316/316H	5.9	ER316/316H	14343A	19 12 3 H	S31680	69
Oxford Alloy 316/316L	5.9	ER316/316L	14343A	19 12 3 L	S31683	70
Oxford Alloy 316LSi	5.9	ER316LSi	14343A	19 12 3 LSi	S31688	71
Oxford Alloy 317L	5.9	ER317L	14343A	19 13 4 L	S31783	72
Oxford Alloy 320LR	5.9	ER320LR	14343B	SS320LR	N08022	73
Oxford Alloy 330	5.9	ER330	14343A	18 36 H	N08331	74
Oxford Alloy 347	5.9	ER347	14343A	19 9 Nb	S34780	75
Oxford Alloy 385	5.9	ER385	14343A	20 25 5 CuL	N08904	76
Oxford Alloy 410	5.9	ER410	14343A	13	S41080	77
Oxford Alloy 410NiMo	5.9	ER410NiMo	14343A	13 4	S41086	78
Oxford Alloy 420	5.9	ER420	14343B	SS420	S42080	79
Oxford Alloy 630	5.9	ER630	14343B	SS630	S17480	80
Oxford Alloy 16-8-2	5.9	ER16-8-2	14343A	16 8 2	S16880	81
Duplex & Super Duplex						
Oxford Alloy 2209	5.9	ER2209	13434A	22 9 3 N L	S39209	82
Oxford Alloy 2594	5.9	ER2594	13434A	25 9 4 N L	S32750	83
Chrome Moly						
Oxford Alloy 80S-B2	5.28	ER80S-B2	12070	GCrMo1Si	K20900	84
Oxford Alloy 80S-B6	5.28	ER80S-B6	12070	GCrMo5	S50280	85
Oxford Alloy 80S-B8	5.28	ER80S-B8	12070	GCrMo9Si	S50480	86
Oxford Alloy 90S-B3	5.28	ER90S-B3	12070	GCrMo2Si	K30960	87
Oxford Alloy 90S-B9	5.28	ER90S-B9	12070	GCrMo91	S50482	88

PRODUCT CROSS REFERENCE

Oxford Alloys Designation	AWS Specification	AWS Classification	EN/ISO Standard	EN/ISO Classification	UNS No.	Page No.
Mild Steel						
Oxford Alloy 70S-2	5.18	ER70S-2	CD636B	SW2	K10726	89
Oxford Alloy 70S-3	5.18	ER70S-3	CD636B	SW3	K11022	90
Oxford Alloy 70S-6	5.18	ER70S-6	CD636B	SW6	K11140	91
Oxford Alloy 80S-D2	5.28	ER80S-D2	14341A	G4Mo	K10945	92
Oxford Alloy 80S-Ni1	5.28	ER80S-Ni1	14341B	SGN2	K11260	93
Oxford Alloy 80S-Ni2	5.28	ER80S-Ni2	14341B	SGN5	K21240	94
Aluminum						
Oxford Alloy 4043	5.10	ER4043	18273	Al4043 (AlSi5)	A94043	95
Oxford Alloy 5183	5.10	ER5183	18273	Al5183 (AlMg4,5MnO,7-A)	A95183	96
Oxford Alloy 5356	5.10	ER5356	18273	Al5356 (AlMg5Cr-A)	A95356	97
Titanium & Zirconium						
Oxford Alloy Ti-1	5.16	ERTi-1	N/A	STi 0100 (Ti99,8)	R50100	98
Oxford Alloy Ti-2	5.16	ERTi-2	N/A	STi 0120 (Ti99,6)	R50120	99
Oxford Alloy Ti-5	5.16	ERTi-5	N/A	STi 6400 (TiAl6V4)	R56400	100
Oxford Alloy Ti-7	5.16	ERTi-7	N/A	STi 2401 (TiPdO,2A)	R52401	101
Oxford Alloy Zr-2	5.24	ERZr-2	N/A	N/A	R60702	102
Bronze Alloys						
Oxford Alloy Alum Bronze A-2	5.7	ERCuAl-A2	N550	SCu 6180 (CuAl10)	C61800	103
Oxford Alloy Deox Copper	5.7	ERCu	N550	SCu 1898 (CuSn1)	C18980	104
Oxford Alloy Low Fuming Bronze	5.8	RBCuZn-C	N550	SCu 6810 (CuZn40SnSi)	C68100	105
Oxford Alloy Silicon Bronze	5.7	ERCuSi-A	N550	SCu 6560 (CuSi3Mn1)	C65600	106

Oxford Alloys Designation	AWS Specification	AWS Classification	EN/ISO Standard	EN/ISO Classification	UNS No.	Page No.
FLUX CORED						
Nickel Alloys						
Oxford Alloy 82T-1	5.34	ENiCr3T1-1/T1-4	N/A	TNi 6082-xy	W86082	108
Oxford Alloy 625T-1	5.34	ENiCrMo3T1-1/T1-4	N/A	TNi 6625-xy	W86625	109
Stainless Steel						
Oxford Alloy 308HT1-1/4	5.22	E308HT1-1/T1-4	17633A	T 19 9 H P C(M)	W30831	110
Oxford Alloy 308LT0-1/4	5.22	E308LT0-1/T0-4	17633A	T 19 9 L R C(M)	W30835	111
Oxford Alloy 308LT1-1/4	5.22	E308LT1-1/T1-4	17633A	T 19 9 L P C(M)	W30835	112
Oxford Alloy 309LT0-1/4	5.22	E309LT0-1/T0-4	17633A	T23 12 L R C(M)	W30935	113
Oxford Alloy 309LT1-1/4	5.22	E309LT1-1/T1-4	17633A	T23 12 L P C(M)	W30935	114
Oxford Alloy 316LT0-1/4	5.22	E316LT0-1/T0-4	17633A	T19 12 3L R C(M)	W31635	115
Oxford Alloy 316LT1-1/4	5.22	E316LT1-1/T1-4	17633A	T19 12 3L P C(M)	W31635	116
Oxford Alloy 317LT0-1/4	5.22	E317LT0-1/T0-4	17633A	T19 13 4 L R C(M)	W31735	117
Oxford Alloy 317LT1-1/4	5.22	E317LT1-1/T1-4	17633A	T19 13 4 L P C(M)	W31735	118
Oxford Alloy 347T0-1/4	5.22	E347T0-1/T0-4	17633A	T19 9Nb R C(M)	W34731	119
Oxford Alloy 347T1-1/4	5.22	E347T1-1/T1-4	17633A	T19 9Nb P C(M)	W34731	120
Duplex & Super Duplex						
Oxford Alloy 2209T1-1/4	5.22	E2209T1-1/T1-4	17633A	T22 9 3 NL P C(M)	W39239	121
Oxford Alloy 2594T1-1/4	5.22	E2594T1-1/T1-4	17633A	T25 9 4 NL P C(M)	W39594	122
Chrome Moly						
Oxford Alloy 81T1-B2	5.29	E81T1-B2	17634A	TCrMo1 P C(M)	W52031	123
Oxford Alloy 91T1-B3	5.29	E91T1-B3	17634A	TCrMo2 P C(M)	W53031	124
Mild Steel						
Oxford Alloy 71T-1M	5.20	E71T-1/1M	17632A	T46 2 P C(M)	W07601	125

PRODUCT CROSS REFERENCE

Oxford Alloys Designation	AWS Specification	AWS Classification	EN/ISO Standard	EN/ISO Classification	UNS No.	Page No.
SAW & FLUX						
Nickel Alloys						
Oxford Alloy 60	5.14	ERNiCu-7	18274	SNi4060 (NiCu30Mn3Ti)	N04060	128
Oxford Alloy 82	5.14	ERNiCr-3	18274	SNi6082 (NiCr20Mn3Nb)	N06082	129
Oxford Alloy 625	5.14	ERNiCrMo-3	18274	SNi6625 (NiCr22Mo9Nb)	N06625	130
Stainless Steel						
Oxford Alloy 308/308H	5.9	ER308/308H	14343A	19 9 H	S30880	131
Oxford Alloy 308/308L	5.9	ER308/308L	14343A	19 9 L	E30883	132
Oxford Alloy 309/309L	5.9	ER309/309L	14343A	23 12 L	S30983	133
Oxford Alloy 309LMo	N/A	N/A	14343A	23 12 2 L	N/A	134
Oxford Alloy 316/316L	5.9	ER316/316L	14343A	19 12 3 L	S31683	135
Oxford Alloy 317L	5.9	ER317L	14343A	19 13 4 L	S31783	136
Oxford Alloy 347	5.9	ER347	14343A	19 9 Nb	S34780	137
Duplex & Super Duplex						
Oxford Alloy 2209	5.9	ER2209	14343A	22 9 3 N L	S39209	138
Oxford Alloy 2594	5.9	ER2594	14343A	25 9 4 N L	S32750	139
Chrome Moly						
Oxford Alloy EB2	5.23	EB2	ENi2070	SCrMo1	K11172	140
Oxford Alloy EB3	5.23	EB3	ENi2070	SCrMo2	K31115	141
Oxford Alloy EB6	5.23	EB6	ENi2070	SCrMo5	S50280	142
Oxford Alloy EB8	5.23	EB8	ENi2070	SCrMo9	S50480	143
Flux						
Oxford Alloy NI-Flux	N/A	N/A	EN 760	SF CS 2 DC	N/A	144
Oxford Alloy OXF300 Flux	N/A	N/A	EN 760	SA FB 2 64 DC	N/A	145

⚠ WARNING

FUMES & GASES can be dangerous to your health

- **Keep fumes and gases from your breathing zone and general area.**
- **Keep your head out of the fumes.**
- **Use enough ventilation or exhaust at the arc, or both, to keep fumes and gases from your breathing zone and general area.**

Fumes and Gases

Because of the variables involved in fume and gas generation from arc welding, cutting and allied processes (such as the welding process and electrode, the base metal, coatings on the base metal, and other possible contaminants in the air), we'll have to treat the subject in a rather general way, lumping all but the more hazardous situations together. The precautions we describe will hold true for all arc welding processes.

The fume plume contains solid particles from the consumables, base metal, and base metal coating. For common mild steel arc welding, depending on the amount and length of exposure to these fumes, most immediate or short term effects are temporary, and include symptoms of burning eyes and skin, dizziness, nausea, and fever. For example, zinc fumes can cause metal fume fever, a temporary illness that is similar to the flu.

Long-term exposure to welding fumes can lead to siderosis (iron deposits in the lungs) and may affect pulmonary function. Bronchitis and some lung fibrosis have been reported.

Some consumables contain certain compounds in amounts which may require special ventilation and/ or exhaust. These Special Ventilation products can be identified by reading the labels on the package. If Special Ventilation products are used indoors, use local exhaust. If Special Ventilation products are used outdoors, a respirator may be required. Various compounds, some of which may be in welding fume, and reported health effects, in summary, are:
Barium: Soluble barium compounds may cause severe stomach pain, slow pulse rate, irregular heart beat, ringing of the ears, convulsions and muscle spasms. In extreme cases can cause death.

Cadmium also requires extra precautions. This toxic metal can be found on some steel and steel fasteners as a plating, or in silver solder. Cadmium fumes can be fatal even under brief overexposures, with symptoms much like those of metal fume fever. These two conditions should not be confused. Overexposure to cadmium can be enough to cause fatalities, with symptoms appearing quickly, and, in some circumstances, death a few days later.

Chromium: Chromium is on the IARC (International Agency for Research on Cancer) and NTP (National Toxicology Program) lists chromium as posing a carcinogenic risk to humans. Fumes from the use of stainless steel, hardfacing and other types of consumables contain chromium and/ or nickel. Some forms of these metals are known or suspected to cause lung cancer in processes other than welding and asthma has been reported. Therefore, it is recommended that precautions be taken to keep exposures as low as possible. OSHA recently adopted a lower PEL (Permissible Exposure Limit) for chromium (see Supplement 3). The use of local exhaust and/or an approved respirator may be required to avoid overexposure.

Coatings on the metal to be welded, such as paint, may also contain toxic substances, such as lead, chromium and zinc. In general, it is always best to remove coatings from the base metal before welding or cutting.

Cobalt: Exposure to cobalt can cause respiratory disease and pulmonary sensitization. Cobalt in metallic form has been reported to cause lung damage.

Copper: Prolonged exposure to copper fume may cause skin irritation or discoloration of the skin and hair.

Manganese: Manganese overexposure may affect the central nervous system, resulting in poor coordination, difficulty in speaking, and tremor of arms or legs. This condition is considered irreversible.

Nickel: Nickel and its compounds are on the IARC (International Agency for Research on Cancer) and NTP (National Toxicology Program) lists as posing a carcinogenic risk to humans.

Silica: Crystalline silica is present in respirable dust form submerged arc flux. Overexposure can cause severe lung damage (silicosis).

Zinc: Overexposure to zinc (from galvanized metals) may cause metal fume fever with symptoms similar to the common flu.

SAFETY GUIDELINES

The gases that result from an arc welding process also present potential hazard. Most of the shielding gases (argon, helium, and carbon dioxide) are non-toxic, but, as they are released, they displace oxygen in your breathing air, causing dizziness, unconsciousness, and death, the longer your brain is denied the oxygen it needs. Carbon monoxide can also be developed and may pose a hazard if excessive levels are present.

The heat and UV radiation can cause irritation to the eyes and lungs. Some degreasing compounds such as trichlorethylene and perchlorethylene can decompose from the heat and ultraviolet radiation of an arc. Because of the chemical breakdown of vapor-degreasing materials under ultraviolet radiation, arc welding should not be done in the vicinity of a vapor-degreasing operation. Carbon-arc welding, gas tungsten-arc welding and gas metal arc welding should be especially avoided in such areas, because they emit more ultraviolet radiation than other processes. Also, keep in mind that ozone and nitrogen oxides are formed when UV radiation passes through the air. These gases cause headaches, chest pains, irritation of the eyes, and an itchiness in the nose and throat.

There is one easy way to reduce the risk of exposure to hazardous fumes and gases: keep your head out of the fume plume! As obvious as this sounds, the failure to follow this advice is a common cause of fume and gas overexposure because the concentration of fume and gases is greatest in the plume. Keep fumes and gases from your breathing zone and general area using natural ventilation, mechanical ventilation, fixed or moveable exhaust hoods or local exhaust at the arc. Finally, it may be necessary to wear an approved respirator if adequate ventilation cannot be provided.

As a rule of thumb, for many mild steel electrode, if the air is visibly clear and you are comfortable, then the ventilation is generally adequate for your work. The most accurate way to determine if the worker exposure does not exceed the applicable exposure limit for compounds in the fumes and gases is to have an industrial hygienist take and analyze a sample of the air you are breathing. This is particularly important if you are welding with stainless, hardfacing or Special Ventilation products. All Oxford Alloys SDS have a maximum fume guideline number. If exposure to total fume is kept below that number, exposure to all fume from the electrode (not coatings or plating on the work) will be below the TLV.

There are also steps that you can take to identify hazardous substances in your welding environment. First, read the product label and safety data sheet for the electrode posted in the work place or in the electrode or flux container to see what fumes can be reasonably expected from use of the product and to determine if special ventilation is needed. Secondly, know what the base metal is, and determine if there is any paint, plating, or coating that could expose you to toxic fumes and/or gases. Remove it from the metal being welded, if possible. If you start to feel uncomfortable, dizzy or nauseous, there is a possibility that you are being overexposed to fumes and gases, or suffering from oxygen deficiency. Stop welding and get some fresh air immediately. Notify your supervisor and co-workers so the situation can be corrected and other workers can avoid the hazard. Be sure you are following these safe practices, the consumable labeling and SDS and improve the ventilation in your area. Do not continue welding until the situation has been corrected.

NOTE: The SDS for all Oxford Alloys consumables is available on Oxford Alloys' website: www.oxfordalloys.com

Before we turn to the methods available to control welding fume exposure, you should understand a few basic terms:

Natural Ventilation is the movement of air through the workplace caused by natural forces. Outside, this is usually the wind. Inside, this may be the flow of air through open windows and doors.

Mechanical Ventilation is the movement of air through the workplace caused by an electrical device such as a portable fan or permanently mounted fan in the ceiling or wall.

Source Extraction (Local Exhaust) is a mechanical device used to capture welding fume at or near the arc and filter contaminants out of the air.

The ventilation or exhaust needed for your application depends upon many factors such as:

- Workspace volume
- Workspace configuration
- Number of welders
- Welding process and current
- Consumables used (mild steel, hardfacing, stainless, etc.)
- Allowable levels (TLV, PEL, etc.)
- Material welded (including paint or plating)
- Natural airflow

Your work area has adequate ventilation when there is enough ventilation and/or exhaust to control worker exposure to hazardous materials in the welding fumes and gases so the applicable limits for those materials is not exceeded. See the SDS for the legal limits, the OSHA PEL (Permissible Exposure Limit), and the recommended guideline, the ACGIH TLV (Threshold Limit Value), for many compounds found in welding fume.

Ventilation

There are many methods which can be selected by the user to provide adequate ventilation for the specific application. The following section provides general information which may be helpful in evaluating what type of ventilation equipment may be suitable for your application. When ventilation equipment is installed, you should confirm worker exposure is controlled within applicable OSHA PEL and/or ACGIH TLV. According to OSHA regulations, when welding and cutting (mild steels), natural ventilation is usually considered sufficient to meet requirements, provided that:

1. The room or welding area contains at least 10,000 cubic feet (about 22 in x 22 in x 22 in) for each welder.
2. The ceiling height is not less than 16 feet.
3. Cross ventilation is not blocked by partitions, equipment, or other structural barriers.
4. Welding is not done in a confined space.

Spaces that do not meet these requirements should be equipped with mechanical ventilating equipment that exhausts at least 2000 CFM of air for each welder, except where local exhaust hoods or booths, or air-line respirators are used.

Important Safety Note:
When welding with electrodes which require special ventilation such as stainless or hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce hazardous fumes, keep exposure as low as possible and below exposure limit values (PEL and TLV) for materials in the fume using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, for example outdoors, a respirator may be required if exposure cannot be controlled to the PEL or TLV. (See SDS) Additional precautions are also required when welding on galvanized steel.

Electric Shock Can Kill You

Do not touch live electrical parts. To avoid electric shock, follow the recommended practices listed below. Faulty installation, improper grounding, and incorrect operation and maintenance of electrical equipment can be sources of danger.

1. Ground all electrical equipment and the work piece. Prevent accidental electrical shocks. Connect power supply, control cabinets, and work piece. to an approved electrical ground. The work lead is not a ground lead. It is used to complete the welding circuit. A separate connection is required to ground the work, or the work lead terminal on the power supply may be connected to ground. Do not mistake the work lead for a ground connection.
2. Use the correct cable size. Sustained over-loading will cause cable failure and result in possible electrical shock or fire hazard. Work cable should be the same rating as the torch cable.
3. Make sure all electrical connections are tight, clean and dry. Poor electrical connections can become over heated and even melt. They can also cause poor welds and produce dangerous arcs and sparks. Do not allow water, grease or dirt to accumulate on plugs, sockets or electrical units.
4. Moisture and water can conduct electricity. To prevent shock, it is advisable to keep work areas, equipment and clothing dry at all times. Fix water leaks immediately. Make sure that you are well insulated. Wear dry gloves, rubber-soled shoes, or stand on a dry board or platform.
5. Keep cables and connectors in good condition. Improper or worn electrical connections can cause short circuits and can increase the chance of an electrical shock. Do not use worn, damaged or bare cables.
6. Avoid open-circuit voltage. Open circuit voltage can cause electric shock. When several welders are working with arcs of different polarities or when using multiple alternating current machines, the open-circuit voltages can be additive. The added voltages increase the severity of the shock hazard.
7. Wear insulated gloves when adjusting equipment. Power should be shut off and insulated gloves should be worn when making any equipment adjustment to assure shock protection.
8. Follow recognized safety standards. Follow the recommendations in American National Standard Z49.1, Safety in Welding and Cutting, available from the American Welding Society, 550 N. W. LeJeune Road, Miami, FL 33126, and also the National Electrical Code, NFPA No. 70, which is available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
9. Cylinders must be kept out of the welding circuit to prevent arc burns on the cylinder.

STORAGE & HANDLING

Coated Electrodes

STORING COATED ELECTRODES

Oxford Alloy® coated electrodes may be stored for several years in their original hermetically sealed packaging provided the packages remain unopened and are stored in a dry area at room temperature (72°F; 22°C) minimum. Once the container is opened and electrodes used for a time period less than several hours, the container should be stored in a dry rod oven maintained at a temperature range of 300° F to 400°F (150-205°C). Once left out of a controlled environment, the electrode flux may absorb moisture at an uneven rate, leading to finger nailing or uneven burn-off of the electrode during use. Reconditioning will restore optimal welding characteristics to the electrodes.

RECONDITIONING OF COATED ELECTRODES

Condition	Pre-drying Temperature(1)	Final Re-drying Temperature
Electrodes exposed to air for less than one week; no direct contact with water.	–	370° - 430°C (700°-800°F)
Electrodes which have come in direct contact with water or which have been exposed to high humidity.	80 - 105°C (180°-220°F)	370° - 430°C (700°-800°F)

(1)Pre-dry for 1-2 hours.

MIG & TIG

STORING MIG & TIG

Oxford Alloy® bare wire for GMAW process is packed by sealing in plastic bags then boxed. Bare wires for GTAW process are packed in sealed tubes, and then boxed. The packaged wire should be stored in a dry area at room temperature (72°F; 22°C) minimum. If TIG & MIG filler metals are stored in their original packaging with no breach of the protection, the storage time may be several years.

Note: If the above conditions are not met, the storage time is reduced to no more than 6 months.

Handling of Wires out of the Package

The following minimum precautions should be taken to safeguard the wire after opening the original package:

1. It is recommended to use wires within one week of opening the original package.
2. Open wires should not be exposed to damp moisture conditions or extremes in temperature and/or humidity where surface condensation can occur.
3. When not in use, wires should be placed in original packaging and sealed as best as possible.

Special Precautions for copper coated MIG & TIG

It is advisable to dispose of any wire that has visible signs of rust on the wire where the package integrity has been compromised. When proper storage procedures are not followed, consumables may show signs of high moisture. High moisture can result in rough bead surface or slag that is unusually difficult to remove. In addition, it can also result in visible and/or internal porosity in the weld deposit, increase spatter, and decreased puddle control which can increase chances of slag entrapment. Oxidation (rust) of either the surface of the wire or internal fluxing agents increases the oxygen content of the wire that can lead to changes in alloy recovery. This, in turn, can deteriorate the mechanical properties of the weld metal.

Flux core wire

STORING FLUX CORE WIRE

Flux core wire should be stored in the original, unopened packaging until ready to use. To maintain the integrity of these products, flux core wire must be protected from the atmosphere. All flux cored wire, regardless of package, should be protected from condensation, including rain or snow. To ensure that condensation does not form on the product, it is recommended that the electrode be stored in an environment that is kept above the dew point temperature for a given relative humidity. Minimizing temperature variation will also help to protect the electrode from moisture condensation. It is advisable to maintain turnover in inventory to ensure the product is as close to the manufactured condition as possible.

As a general rule maximum storage time for welding consumables is estimated to be 3 years. This estimate is for material in the original, undamaged packages that is stored indoors at up to ~70% relative humidity and that are protected from the weather or other adverse conditions. Packages should be stored under conditions that minimize the likelihood of temperature variations that cause moisture condensation on the consumables.

These estimates are based on what we know about the packaging materials and the frequency of product improvements. Since actual storage conditions vary widely across geographical regions and from one customer to another, it is not possible to be more specific. For packages that are not hermetically sealed, a shorter storage time is advisable under sustained severe humidity conditions but is not possible to estimate. Note that product stored for longer than 3 years, may still be suitable for use. It depends on the product and the condition it is in.

SAW Wire and Flux

STORAGE FOR SUBMERGED ARC FLUX

Flux Package Type[1]	Flux Storage Conditions for General Welding Applications
Plastic or Multi-Wall Plastic/Paper Bag	Store indoors at < 90% RH. Protect from condensation
Bulk Bag with Liner	Store indoors at < 90% RH. Protect from condensation
Steel Drum	Protect from rain or snow
Plastic Pail	Protect from rain or snow

STORAGE FOR SUBARC WIRES

Wire Package Type[1]	Wire Storage Conditions for All Welding Applications
Any Type	Protect from rain or snow. Protect from condensation. Do not use wire with visible signs of rust.

[1]For other package types, consult your Technical Representative.

Re-Drying & Recycling Flux

Oxford Alloys submerged arc welding flux can be used directly from its original, undamaged package, if it has been stored according to the conditions listed in the chart above.

When proper procedures are not followed, flux may show signs of moisture. These can include porosity, a rough bead surface or slag that is unusually difficult to remove. In many instances these fluxes can be re-dryed in general welding applications.

Re-Drying Flux

To re-dry fluxes

- Remove flux from its original packaging and place in a clean oven set between 260°-480°C (500°-900°F).
- Leave in oven long enough to raise the temperature of the entire bulk of flux to your set temperature for a minimum of one hour.
- For ovens in which heating rods are inserted into the flux, do not let the temperature of flux adjacent to the rods exceed 480°C (900°F).

Recycling Flux

Non-consumed flux may be collected from the finished weld and recycled. To do so, please follow these procedures:

- Remove slag, metal, mill scale, and any other contaminants from the flux.
- Prevent damage to the flux from heavy impingement in flux transport systems.
- Avoid the separation of different sized particles in cyclones or "dead" corners.
- Remove excess fines from recycled fluxes.
- For optimal welding characteristics, it is recommended to add at least 20% new flux by weight to recycled flux.

METRIC-IMPERIAL CONVERSIONS

IF YOU HAVE	MULTIPLY BY	TO CONVERT TO
U.S. Units		**Metric Equivalents**
Inches	25.4	Millimeters
Inches	2.54	Centimeters
Feet	30.48	Centimeters
Feet	0.3048	Meters
Yards	0.9144	Meters
Square Inches	6.4516	Square Centimeters
Square Feet	0.0929	Square Meters
Square Yards	0.8361	Square Meters
Acres	0.4047	Hectares
Cubic Inches	16.387	Cubic Centimeters
Cubic Feet	0.0283	Cubic Meters
Cubic Feet	28.316	Liters
Cubic Yards	0.7646	Cubic Meters
Cubic Yards	764.55	Leters
To convert readings in degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32, then multiply by 5/19		

IF YOU HAVE	MULTIPLY BY	TO CONVERT TO
Metric Units		**U.S. Equivalents**
Millimeters	0.0394	Inches
Centimeters	0.3937	Inches
Centimeters	0.0328	Feet
Meters	3.2808	Feet
Meters	1.0936	Yards
Square Centimeters	0.1550	Square Inches
Square Meters	10.764	Square Feet
Square Meters	1.1960	Square Yards
Hectares	2.4711	Acres
Cubic Centimeters	0.0610	Cubic Inches
Cubic Meters	35.315	Cubic Feet
Liters	0.0353	Cubic Feet
Cubic Meters	1.308	Cubic Yards
Liters	0.0013	Cubic Yards
To convert readings in degrees Celsius (°C) to degrees Fahrenheit (°F), multiply by 9/5, then add 32		

WELDING TERM CONVERSIONS

PROPERTY	TO COVERT	FROM TO	MULTIPLY BY
area dimensions (mm^2)	$in.^2$	mm^2	$6.451\ 600 \times 10^2$
	mm^2	$in.^2$	$1.550\ 003 \times 10^{-3}$
current density	$A/in.^2$	A/mm^2	$1.550\ 003 \times 10^{-3}$
	A/mm^2	$A/in.^2$	$6.451\ 600 \times 10^2$
deposition rate (approximate conversion)	lb/h	kg/h	0.45
electrode force	pound-force	N	4.448 222
	kilogram-force	N	9.806 650
	N	lbf	$2.248\ 089 \times 10^{-1}$
flow rate (L/min)	ft^3/h	L/min	$4.719\ 475 \times 10^{-1}$
	gallon per hour	L/min	$6.309\ 020 \times 10^{-2}$
	gallon per minute	L/min	3.785 412
	L/min	ft^3/h	2.118 880
heat input	J/in.	J/m	3.937 008 x 10
	J/m	J/in.	$2.540\ 000 \times 10^{-2}$
impact energy	foot pound force	J	1.355 818
linear measurements	in.	mm	2.540 000 x 10
	ft	mm	$3.048\ 000 \times 10^2$
	mm	in.	$3.937\ 008 \times 10^{-2}$
	mm	ft	$3.280\ 840 \times 10^{-3}$
power density	$W/in.^2$	W/m^2	$1.550\ 003 \times 10^3$
pressure (gas and liquid)	W/mm^2	W/m^2	$6.451\ 600 \times 10^{-4}$
	psi	Pa	$6.894\ 757 \times 10^{-3}$
	lb/ft^2	Pa	4.788 026 x 10
	N/mm^2	Pa	$1.000\ 000 \times 10^6$
	kPa	psi	$1.450\ 377 \times 10^{-1}$
	kPa	lb/ft^2	2.088 543 x 10
	kPa	N/mm^2	$1.000\ 000 \times 10^{-3}$
	torr (mm Hg at 0°C)	kPa	$1.333\ 22 \times 10^{-1}$
	Micron (µm Hg at 0°C)	kPa	$1.333\ 22 \times 10^{-4}$
	kPa	torr	7.500 64 x 10
	kPa	micron	$7.500\ 64 \times 10^3$
tensile strength (MPa)	psi	kPa	6.894 757
	lb/ft^2	kPa	$4.788\ 026 \times 10^{-2}$
	N/mm^2	MPa	1.000 000
	MPa	psi	$1.450\ 377 \times 10^2$
	MPa	lb/ft^2	$2.088\ 543 \times 10^4$
	MPa	N/mm^2	1.000 000
thermal conductivity (W/(m · K)	Cal/(cm · s · °C)	W/(m · K)	$4.184\ 000 \times 10^2$
travel speed, wire feed speed (mm/s)	in./mm	mm/s	$4.233\ 333 \times 10^{-1}$
	mm/s	in./min	2.362 205

DISCLAIMER

Test Results

Test results for mechanical properties, deposit or electrode composition were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

Customer Assistance Policy

Oxford Alloys supplies high quality welding consumables. Our goal is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Oxford Alloys for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Oxford Alloys does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

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