

This MSDS consists of submerged fluxes and wires, and the list is as follow. The symbol () indicates MSDS No.

Submerged Flux

OK Flux 10.90 (ESC 1-14-2)

Submerged Wire

NCM-S625 (Wire) (ESC 1-17-3)


OK Autrod 19.81 (Strip) (ESC 1-17-3)

This Safety Data Sheet complies with the guidance on Occupation Safety and Health Act and enforcement regulations.

1. PRODUCT AND COMPANY IDENTIFICATION

- A. Product Name** Welding Material (Baked Type Flux for Submerged Arc Welding)
OK Flux 10.90
- B. Recommended use of the chemical and restrictions on use**
- 1) Recommended use Baked type flux for submerged arc welding (refer to product guide book)
 - 2) Restrictions on use Refer to 7. Handling and Storage
- C. Supplier's details**
- 1) Name ESAB SeAH Corporation
 - 2) Address 51 Seongju-dong, Seongsan-gu, Changwon, Kyungnam, Korea
 - 3) Phone number 055-269-8111
- D. Emergency phone number** 055-269-8111, 055-269-8225

2. HAZARD IDENTIFICATION

- A. Classification of product**
- Skin sensitizer: category 1
Carcinogenicity: category 2
Specific target organ toxicity (repeated exposure): category 2
- B. GHS Label elements, including precautionary statements**
- 1) Pictograms (Hazard symbols)

 - 2) Signal word Warning
 - 3) Hazard statements
H317 May cause an allergic skin reaction.
H351 Suspected of causing cancer.
H373 May cause damage to organs through prolonged or repeated exposure.
 - 4) Precautionary statements
 - A) Prevention**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
 - B) Response**
P302+P352 If on skin, wash with plenty of water.
P308+P313 If exposed or concerned, get medical advice/attention.
P314 Get medical advice/attention if you feel unwell.
P333+P313 If skin irritation or rash occurs, get medical advice/attention.
P363 Wash contaminated clothing before reuse.



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C) Storage

P405 Store locked up.

D) Disposal

P501 Dispose of contents/container in accordance with related laws.

C. Other hazards which do not result in classification No available data

D. Hazards During welding

When these products are used in a welding process, the most important hazards are heat, radiation, electric shock and welding fumes.

Heat : Spatter and melting metal can cause burn injuries and start fires.

Radiation : Arc rays can severely damage eyes or skin.

Electricity : Electric shock can kill.

Fumes : Overexposure to welding fume may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes. Chronic overexposure to welding fumes may affect pulmonary function.

- 1) Prevention** : Welding fumes and gases may be dangerous to your health. Use adequate ventilation to keep fumes from the breathing zone. Arc rays may injure eyes and burn skin. Wear adequate hand, head, eye and body protection.
- 2) Response** : .Not applicable
- 3) Storage** : Stored locked up and keep dry
- 4) Disposal** : Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS No.	OK Flux 10.90
Aluminum Oxide (Al ₂ O ₃)	1344-28-1	30~40
Chromium (Cr)	7440-47-3	1~2
Calcium Fluoride (CaF ₂)	7789-75-5	40~50
Manganese (Mn)	7439-96-5	10~15
Nickel (Ni)	7440-02-0	1~2
Sodium Silicate	1344-09-8	5~10
AWS Classification		

4. FIRST AID MEASURES

A. Eye contact

If irritation persists, obtain medical assistance.

To remove dusts or fumes flush with water for at least twenty minutes.

For radiation burns due to arc flash, see physician.

B. Skin contact

If skin irritation or erythema occurs, see physician.

Clean the contaminated clothing for reuse.

For skin burns from arc radiation, promptly flush with plenty of cold water.

Remove contaminated clothing and shoes, and isolate contaminated area.

To remove dust or particles wash with mild soap and water for at least twenty minutes.

C. Inhalation

If exposure, obtain medical assistance immediately.



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Move to safety area.

If breathing has stopped, perform Cardio Pulmonary Resuscitation (CPR) and obtain medical assistance immediately.

If breathing is difficult, provide fresh air and call physician.

Keep warm and stabilize body.

D. Ingestion

Call a physician or poison control center immediately.

Do not induce vomiting unless directed to do so by a physician.

E. Others

If exposure, obtain special medical assistance immediately.

Recognize materials and do protective action.

In an electric shock, Disconnect and turn off the power.

Use a nonconductive material to pull victim away from contact with live parts or wires.

If not breathing, begin artificial respiration, preferably mouth-to-mouth.

If no detectable pulse, begin Cardio Pulmonary Resuscitation (CPR).

Immediately call a physician.

5. FIRE-FIGHTING MEASURES

A. Suitable extinguishing media

No specific recommendations for welding consumables.

Welding arcs and sparks can ignite combustible and flammable materials.

Use the extinguishing media recommended for the burning materials and fire situation (CO₂, water).

Cover fire site with dried sand or soil.

B. Specific hazards arising from the chemical

A harmful gas will be produced at high temperature.

When heated, container may explode.

Friction, heat, and spark can ignite materials.

Materials can be re-ignited after extinguishing.

C. Special protective actions for fire-fighters

Wear proper protective equipment.

Keep a certain distance and extinguish the fire.

If not dangerous, remove container.

If impossible extinguish, protect surround and extinguish itself.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

Avoid inhalation of dust, fume, gas, mist, and spray.

Clean up the spilling and follow the section 8. C. individual protection measures.

Don't touch and don't walk around the spilling.

Remove all ignition sources.

If not dangerous, stop leaking.

Pay attention to the avoiding substances and condition.

B. Environmental precautions



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The spilling can cause pollution.

Block the inflow to waterway, drain, basement, and enclosed area.

C. Method and materials for containment and cleaning up

Absorb the spilling with the Inert materials (dried sand or soil) and put it to chemical waste container.

Wash the contaminated area with water and soap.

7. HANDLING AND STORAGE

A. Precautions for safe handling

Don't treat before reading and understanding all safe precautions.

Avoid inhalation of dust, fume, gas, mist, and spray.

Wash handling part after finishing handling.

Don't eat, drink, and smoke when treating.

Follow MSDS/label precautions when treating empty container.

Use with caution when handling and storing.

Remove the cap with caution.

If no a ventilation system, don't enter the storage area.

Prevent dust generation.

Don't touch products when welding.

Wear the nonconductive gloves.

Don't use damaged or wet gloves.

Wear insulating shoes at workplace.

Don't touch terminal of products, welding cable, and welding machine socket,

Don't wear wet clothing at conductive place.

Keep the instruction manual and precautions before welding.

Use proper welding cable and repair or exchange the damaged cables.

Remove hazardous materials (combustibles or flammable liquid) to prevent spatter from firing, or cover them with nonflammable materials.

Don't weld container or pipe with combustible or flammable materials, or enclosed container or pipe.

Don't put a hot welding material around combustible or flammable materials.

Remove hidden combustible or flammable materials when welding around ceiling, floor, and wall.

Keep extinguisher around workplace.

B. Conditions for safe storage

Keep away food and drink.

Store in a well-ventilated and low humidity place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Control parameters

1) Internal and external regulations

Ingredients	CAS No.	Internal		External		Notes
		TWA ⁽¹⁾ (mg/m ³)	STEL ⁽²⁾ (mg/m ³)	TLV ⁽³⁾ (mg/m ³)	PEL ⁽⁴⁾ (mg/m ³)	
Aluminum Oxide (Al ₂ O ₃)	1344-28-1	10	-	1**(as Al)	15*, 5**	
Chromium (Cr)	7440-47-3	0.5	-	0.5	1	



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Calcium Fluoride (CaF ₂)	7789-75-5	-	-	2.5	2.5	
Manganese (Mn)	7439-96-5	1	3	0.2	5	
Nickel (Ni)	7440-02-0	1	-	1.5***	1	
Sodium Silicate	1344-09-8	-	-	-	-	

(1) TWA : Time Weighted Average

(2) STEL : Short Time Exposure Limit

(3) TLV : Threshold Limit Values according to American Conference of Governmental Hygienists, 2012

(4) PEL : Permissible Exposure Limits according to the Occupational Safety & Health Administration (USA)

* Total dust, ** Respirable fraction, *** Inhalable fraction.

^ Value from OSHA expressed in PPM and value shown is conversion to mg/m³

AIHA WEEL (particulates only)

Respirable dust

2) Biological limit values

Not available

B. Appropriate engineering controls

To install local ventilation system in the vicinity of welding fume sources is more effective than to deal with fume spreaded at workplace

Natural ventilation : If the concentration is low, the space is 284m³ or more per two workers, and a ceiling height of space is more 5 meter, the natural ventilation is applied. It is also applied to the non-enclosed space with dilution.

Local ventilation : Install the appropriate local ventilation system depending on the nature of processing and welding materials. If the local ventilation is installed newly, the combined type, local air supply and local exhaust, is recommended. Local ventilation system installed closer to the worker as possible is desirable. It must have the ventability lower than the expoosure limit. It is the most effective system to remove fume, but if the exhaust is too larger, welding defects will be occurred because of disturbance of the shelding gas. Workers should turn on it while working and conduct maintenance.

Portable local ventilation : It is applied when working in a confined space such as ship-body assembly or in the tank. Local air supply and local exhaust takes place at the same time. If necessary, run all the time. If welding fume exhausts to other workplace, portable dust collection equipment should be installed.

Full ventilation : Workplace is ventilized with fans and blowers. It is effecive when workplace is a relatively small volume. To remove fume, parallel push-pull ventilation should be considered. It should be designed and installed according to the workplace.

C. Individual protection measures

Use proective equipment cerified by the Korea Occupational Safety and Health agency while welding.

1) Respiratory protecton

To prevent fume or hazardous gases, wear a mask while welding as below.

Dust mask : Wear it in a bad ventilation condition while welding.

Remove dust or dry frequently after using.

Gas mask : Wear a gas mask when ventilation is not sufficient such as inside the tank or in a narrow place.

Select a gas mask that can be used to combined with protective goggles

Use the proper canister according to hazardous substance.

Air-supplied respirator : Use air-line mask with compressed air.

2) Eye protection

Use a facial mask with filter screen from the ultraviolet of arc or spatter. There are face shield helmet or hand shielded helmet.



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Use shielding grade as welding type.

Welding type	Shielding grade
Shielded metal arc welding	10-12
Gas metal arc welding	11-12
Gas tungsten arc welding	12
Flux cored arc welding	11-12

3) Hand protection

Wear the nonconductive gloves.

Don't use damaged or wet gloves.

4) Body protection

Wear leather apron and welding gloves to prevent burns and take insulating shoes at workplace.

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance

1) Physical state Solid

2) Colour Silver or gray

B. Odour Not available

C. Odour threshold Not available

D. pH Not available

E. Melting point/freezing point Not available

F. Initial boiling point and boiling range Not available

G. Flash point Not available

H. Evaporation rate Not available

I. Flammability (Solid, Gas) Not available

J. Upper/lower flammability or explosive limits Not available

K. Vapour pressure Not available

L. Vapour density Not available

M. Relative density Not available

N. Solubility Not available

O. Partition coefficient: n-octanol/water Not available

P. Auto-ignition temperature Not available

Q. Decomposition temperature Not available

R. Viscosity Not available

S. Molecular weight Not available

10. STABILITY AND REACTIVITY

A. Reactivity, chemical stability, and possibility of hazardous reactions

Although may be burnt, ignition is difficult.

During fire, irritant gases and fume will be produced.

B. Conditions to avoid

Ignition sources (heat, spark, blaze)



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C. Incompatible materials

Combustible or flammable materials, chemical substances like acids and strong bases

D. Hazardous decomposition products

May produce irritant gases and fume

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure	Not available
B. Health hazard information	
1) Acute toxicity	Not available
A) Oral	Not available
B) Dermal	Not available
C) Inhalation	Not available
2) Skin corrosion/irritation	Not available
3) Serious eye damage/irritation	Not available
4) Respiratory sensitization	Not available
5) Skin sensitization	May cause an allergic skin reaction.
6) Carcinogenicity	Suspected of causing cancer
A) Occupation safety and health acts	Not available
B) The ministry of employment and labor	2 (Nickel)
C) IARC	Group 2 (Nickel)
D) OSHA	Not available
E) ACGIH	A5 (Nickel)
F) NTP	R (Nickel)
G) EU CLP	Carc. 2 (Nickel)
7) Germ cell mutagenicity	Not available
8) Reproductive toxicity	Not available
9) STOT-single exposure	Not available
10) STOT-repeated exposure	May cause damage to organs through prolonged or repeated exposure.
11) Aspiration hazard	Not available

12. ECOLOGICAL INFORMATION

A. Toxicity	
1) Fish	Not available
2) Crustacea	Not available
3) Birds	Not available
B. Persistence and degradability	
1) Persistence	Not available
2) Degradability	Not available
C. Bioaccumulative potential	
1) Bioconcentration factor	Not available



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- 2) Biodegradation Not available
- D. Mobility in soil Not available
- E. Other adverse effects Not available

13. DISPOSAL CONSIDERATIONS

- A. Disposal method Disposal contents and container as wastes control act.
- B. Precautions Disposal contents and container as wastes control act.

14. TRANSPORT INFORMATION

- A. UN number Not available
- B. UN proper shipping name Not available
- C. Transport hazard class Not available
- D. Packing group Not available
- E. Environmental hazards Not available
- F. Special precautions for user
 - 1) Fire emergency action Not available
 - 2) Leak emergency action Not available

15. REGULATORY INFORMATION

A. Internal regulation

No available internal regulation against products.

Ingredient	Occupation Safety and Health Act						Toxic Chemicals Control Act	Safety Control of Dangerous Substances Act	Wastes Control Act
	Control material	Work environment monitoring material	Special health monitoring material	Exposure standard material	Acceptable standard material	Permission material			
Al ₂ O ₃	O	O	O	O	X	X	X	X	X
Cr	O	O	O	O	O	O	X	X	X
CaF ₂	X	X	X	X	X	X	X	X	specified
Mn	O	O	O	O	X	X	X	X	X
Ni	O	O	O	O	O	X	X	X	X
Na-silicate	X	X	X	X	X	X	X	X	specified

Work environment monitoring material : unless noted, measure every 6 months.

Special health monitoring material : unless noted, measure every 12 months.

O : included

X : not included.

B. Other internal or external regulations

No available other internal or external regulation against products.

Ingredient	Al ₂ O ₃	Cr	CaF ₂	Mn	Ni	Na-silicate
Internal regulation						
Persistent Organic Pollutant Act	X	X	X	X	X	X



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External regulation						
OSHA	X	X	X	X	X	X
CERCLA	X	2267.995kg	X	X	45.3599kg	X
EPCRA 302	X	X	X	X	X	X
EPCRA 304	X	X	X	X	X	X
EPCRA 313	included	included	X	included	included	X
Rotterdam convention material	X	X	X	X	X	X
Stockholm convention material	X	X	X	X	X	X
Montreal protocol material	X	X	X	X	X	X
EU classification (result)	X	X	X	X	Carc. Cat. 3; R40 R43 T; R48/23, R52, R53	X
EU classification (R-phrase)	X	X	X	X	R40 R43 R48/23 R52/53	X
EU classification (S-phrase)	X	X	X	X	S2 S36/37/39 S45 S61	X

X : not included.

16. OTHER INFORMATION

A. References

EU REGULATION (EC) No 1272/2008

EU DIRECTIVE 2009/2/EC

The Ministry of Employment and Labor notification No. 2012-31

Threshold Limit Values according to American Conference of Governmental Hygienists, 2012

Permissible Exposure Limits according to the Occupational Safety & Health Administration (USA)

Chemical Information System (<http://ncis.nier.go.kr/ncis>)

Korea Occupational Safety & Health Agency (<http://www.kosha.or.kr>)

National Emergency Management Agency (<http://www.nema.go.kr>)

B. First issued date

2013. 06. 11

C. Revision

1) Revision No.

1

2) Date revised

2013.12.02

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1. PRODUCT AND COMPANY IDENTIFICATION

- A. Product Name** Welding Material (Wire for Submerged Arc Welding)
NCM-S625 (Wire), OK Band 11.92 (Strip), OK Autrod 19.81 (Strip),
SMP-S308(L), SMP-S309(L), SMP-S316(L)
- B. Recommended use of the chemical and restrictions on use**
- 1) Recommended use Wire for submerged arc welding (refer to product guide book)
- 2) Restrictions on use Refer to 7. Handling and Storage
- C. Supplier's details**
- 1) Name ESAB SeAH Corporation
- 2) Address 51 Seongju-dong, Seongsan-gu, Changwon, Kyungnam, Korea
- 3) Phone number 055-269-8111
- D. Emergency phone number** 055-269-8111, 055-269-8225

2. HAZARD IDENTIFICATION

- A. Classification of product** Skin sensitizer: category 1
Carcinogenicity: category 2
Specific target organ toxicity (repeated exposure): category 1

B. GHS Label elements, including precautionary statements

1) Pictograms (Hazard symbols)



- 2) Signal word Warning
- 3) Hazard statements
H317 May cause an allergic skin reaction.
H351 Suspected of causing cancer.
H372 Cause damage to organs through prolonged or repeated exposure.
- 4) Precautionary statements
- A) Prevention**
- P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 Wash the contaminated part thoroughly after handling..
P270 Don't eat, drink or smoke when using this product
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
- B) Response**
- P302+P352 If on skin, wash with plenty of water.
P308+P313 If exposed or concerned, get medical advice/attention.
P314 Get medical advice/attention if you feel unwell.



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P333+P313 If skin irritation or rash occurs, get medical advice/attention.

P363 Wash contaminated clothing before reuse.

P405 Store locked up.

P501 Dispose of contents/container in accordance with related laws.

C) Storage

D) Disposal

C. Other hazards which do not result in classification No available data

D. Hazards During welding

When these products are used in a welding process, the most important hazards are heat, radiation, electric shock and welding fumes.

Heat : Spatter and melting metal can cause burn injuries and start fires.

Radiation : Arc rays can severely damage eyes or skin.

Electricity : Electric shock can kill.

Fumes : Overexposure to welding fume may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes. Chronic overexposure to welding fumes may affect pulmonary function.

1) **Prevention** : Welding fumes and gases may be dangerous to your health. Use adequate ventilation to keep fumes from the breathing zone. Arc rays may injure eyes and burn skin. Wear adequate hand, head, eye and body protection.

2) **Response** : .Not applicable

3) **Storage** : Stored locked up and keep dry

4) **Disposal** : Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS No.	NCM-S625 (Wire)	OK Band 11.92 (Strip)	OK Autrod 19.81 (Strip)	SMP-S308(L)	SMP-S309(L)	SMP-S316(L)
Aluminum (Al)	7429-90-5	-	-	<1	-	-	-
Chromium (Cr)	7440-47-3	20~30	20~30	20~25	19.5~22.0	23~25	18~20
Cobalt (Co)	7440-48-4	-	-	<0.3	-	-	-
Copper (Cu)	7440-50-8	<1	<1	-	<1	<1	<1
Iron (Fe)	7439-89-6	1~2	1~2	1~2	60~75	55~65	55~70
Manganese (Mn)	7439-96-5	<1	<1	<1	1.0~2.5	1.0~2.5	1.0~2.5
Molybdenum (Mo)	7439-98-7	5~10	5~10	15-20	<1	<1	2~3
Nickel (Ni)	7440-02-0	>60	>60	>50	9~11	12~14	11~14
Niobium (Nb)	7440-03-01	2~5	2~5	-	-	-	-
Silicon (Si)	7440-21-3	-	-	-	<1	<1	<1
Tantalum (Ta)	7440-25-7	<1	<1	-	-	-	-
AWS Classification		A5.14 ERNiCrMo-3	A5.14 ERNiCrMo-3	A5.14 ERNiCrMo-13	A5.9 ER308(L)	A5.9 ER309(L)	A5.9 ER316(L)

4. FIRST AID MEASURES

A. Eye contact

If irritation persists, obtain medical assistance.

To remove dusts or fumes flush with water for at least twenty minutes.

For radiation burns due to arc flash, see physician.



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B. Skin contact

If skin irritation or erythema occurs, see physician.

Clean the contaminated clothing for reuse.

For skin burns from arc radiation, promptly flush with plenty of cold water.

Remove contaminated clothing and shoes, and isolate contaminated area.

To remove dust or particles wash with mild soap and water for at least twenty minutes.

C. Inhalation

If exposure, obtain medical assistance immediately.

Move to safety area.

If breathing has stopped, perform Cardio Pulmonary Resuscitation (CPR) and obtain medical assistance immediately.

If breathing is difficult, provide fresh air and call physician.

Keep warm and stabilize body.

D. Ingestion

Call a physician or poison control center immediately.

Do not induce vomiting unless directed to do so by a physician.

E. Others

If exposure, obtain special medical assistance immediately.

Recognize materials and do protective action.

In an electric shock, Disconnect and turn off the power.

Use a nonconductive material to pull victim away from contact with live parts or wires.

If not breathing, begin artificial respiration, preferably mouth-to-mouth.

If no detectable pulse, begin Cardio Pulmonary Resuscitation (CPR).

Immediately call a physician.

5. FIRE-FIGHTING MEASURES

A. Suitable extinguishing media

No specific recommendations for welding consumables.

Welding arcs and sparks can ignite combustible and flammable materials.

Use the extinguishing media recommended for the burning materials and fire situation (CO₂, water).

Cover fire site with dried sand or soil.

B. Specific hazards arising from the chemical

A harmful gas will be produced at high temperature.

When heated, container may explode.

Friction, heat, and spark can ignite materials.

Materials can be re-ignited after extinguishing.

C. Special protective actions for fire-fighters

Wear proper protective equipment.

Keep a certain distance and extinguish the fire.

If not dangerous, remove container.

If impossible extinguish, protect surround and extinguish itself.

6. ACCIDENTAL RELEASE MEASURES



This Safety Data Sheet complies with the guidance on Occupation Safety and Health Act and enforcement regulations.

A. Personal precautions, protective equipment and emergency procedures

- Avoid inhalation of dust, fume, gas, mist, and spray.
- Clean up the spilling and follow the section 8. C. individual protection measures.
- Don't touch and don't walk around the spilling.
- Remove all ignition sources.
- If not dangerous, stop leaking.
- Pay attention to the avoiding substances and condition.

B. Environmental precautions

- The spilling can cause pollution.
- Block the inflow to waterway, drain, basement, and enclosed area.

C. Method and materials for containment and cleaning up

- Absorb the spilling with the Inert materials (dried sand or soil) and put it to chemical waste container.
- Wash the contaminated area with water and soap.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Don't treat before reading and understanding all safe precautions.
- Avoid inhalation of dust, fume, gas, mist, and spray.
- Wash handling part after finishing handling.
- Don't eat, drink, and smoke when treating.
- Follow MSDS/label precautions when treating empty container.
- Use with caution when handling and storing.
- Remove the cap with caution.
- If no a ventilation system, don't enter the storage area.
- Prevent dust generation.
- Don't touch products when welding.
- Wear the nonconductive gloves.
- Don't use damaged or wet gloves.
- Wear insulating shoes at workplace.
- Don't touch terminal of products, welding cable, and welding machine socket,
- Don't wear wet clothing at conductive place.
- Keep the instruction manual and precautions before welding.
- Use proper welding cable and repair or exchange the damaged cables.
- Remove hazardous materials (combustibles or flammable liquid) to prevent spatter from firing, or cover them with nonflammable materials.
- Don't weld container or pipe with combustible or flammable materials, or enclosed container or pipe.
- Don't put a hot welding material around combustible or flammable materials.
- Remove hidden combustible or flammable materials when welding around ceiling, floor, and wall.
- Keep extinguisher around workplace.

B. Conditions for safe storage

- Keep away food and drink.
- Store in a well-ventilated and low humidity place.



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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

A. Control parameters

1) Internal and external regulations

Ingredient	CAS No.	Internal		External		Notes
		TWA ⁽¹⁾ (mg/m ³)	STEL ⁽²⁾ (mg/m ³)	TLV ⁽³⁾ (mg/m ³)	PEL ⁽⁴⁾ (mg/m ³)	
Aluminum (Al)	7429-90-5	10	-	1 ^{**} (as Al)	15 [*] , 5 ^{**}	
Chromium (Cr)	7440-47-3	0.5	-	0.5	1	
Cobalt (Co)	7440-48-4	0.02 (Dust and Fume)	0.02	0.02	0.1 (Dust and Fume)	
Copper (Cu)	7440-50-8	1	2	1	1	
Iron (Fe)	7439-89-6	-	-	5 ^{**}	10 (fume)	
Manganese (Mn)	7439-96-5	1	3	0.2	5	
Molybdenum (Mo)	7439-98-7	10 [*] , 5 ^{**}	-	3 ^{**} , 10 ^{***}	15 [*]	
Nickel (Ni)	7440-02-0	1	-	1.5 ^{***}	1	
Niobium (Nb)	7440-03-1	-	-	-	-	
Silicon (Si)	7440-21-3	10	-	-	15 [*] , 5 ^{**} -	
Tantalum (Ta)	7440-25-7	-	-	-	5	
Silicon Dioxide (SiO ₂)	60676-86-0	0.1	-	-	10 ^{****} / (%SiO ₂ +2)	
Titanium Oxide (TiO ₂)	13463-67-7	10	-	10	15 [*]	
Zinc Oxide (ZrO ₂)	1314-13-2	5	10	5	5	

(1) TWA : Time Weighted Average

(2) STEL : Short Time Exposure Limit

(3) TLV : Threshold Limit Values according to American Conference of Governmental Hygienists, 2012

(4) PEL : Permissible Exposure Limits according to the Occupational Safety & Health Administration (USA)

* Total dust, ** Respirable fraction, *** Inhalable fraction.

^ Value from OSHA expressed in PPM and value shown is conversion to mg/m³

AIHA WEEL (particulates only)

Respirable dust

2) Biological limit values

Not available

B. Appropriate engineering controls

To install local ventilation system in the vicinity of welding fume sources is more effective than to deal with fume spreaded at workplace

Natural ventilation : If the concentration is low, the space is 284m³ or more per two workers, and a ceiling height of space is more 5 meter, the natural ventilation is applied. It is also applied to the non-enclosed space with dilution.

Local ventilation : Install the appropriate local ventilation system depending on the nature of processing and welding materials. If the local ventilation is installed newly, the combined type, local air supply and local exhaust, is recommended. Local ventilation system installed closer to the worker as possible is desirable. It must have the ventability lower than the expoosure limit. It is the most effective system to remove fume, but if the exhaust is too larger, welding defects will be occurred because of disturbance of the shelding gas. Workers should turn on it while working and conduct maintenance.

Portable local ventilation : It is applied when working in a confined space such as ship-body assembly or in the tank. Local air supply and local exhaust takes place at the same time. If necessary, run all the time.



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If welding fume exhausts to other workplace, portable dust collection equipment should be installed.

Full ventilation : Workplace is ventilized with fans and blowers. It is effective when workplace is a relatively small volume. To remove fume, parallel push-pull ventilation should be considered. It should be designed and installed according to the workplace.

C. Individual protection measures

Use protective equipment certified by the Korea Occupational Safety and Health agency while welding.

1) Respiratory protection

To prevent fume or hazardous gases, wear a mask while welding as below.

Dust mask : Wear it in a bad ventilation condition while welding.

Remove dust or dry frequently after using.

Gas mask : Wear a gas mask when ventilation is not sufficient such as inside the tank or in a narrow place.

Select a gas mask that can be used to combined with protective goggles

Use the proper canister according to hazardous substance.

Air-supplied respirator : Use air-line mask with compressed air.

2) Eye protection

Use a facial mask with filter screen from the ultraviolet of arc or spatter. There are face shield helmet or hand shielded helmet.

Use shielding grade as welding type.

Welding type	Shielding grade
Shielded metal arc welding	10-12
Gas metal arc welding	11-12
Gas tungsten arc welding	12
Flux cored arc welding	11-12

3) Hand protection

Wear the nonconductive gloves.

Don't use damaged or wet gloves.

4) Body protection

Wear leather apron and welding gloves to prevent burns and take insulating shoes at workplace.

9. PHYSICAL AND CHEMICAL PROPERTIES

A. Appearance

1) Physical state Solid

2) Colour Silver or gray

B. Odour Not available

C. Odour threshold Not available

D. pH Not available

E. Melting point/freezing point Not available

F. Initial boiling point and boiling range Not available

G. Flash point Not available

H. Evaporation rate Not available

I. Flammability (Solid, Gas) Not available

J. Upper/lower flammability or explosive limits Not available



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K. Vapour pressure	Not available
L. Vapour density	Not available
M. Relative density	Not available
N. Solubility	Not available
O. Partition coefficient: n-octanol/water	Not available
P. Auto-ignition temperature	Not available
Q Decomposition temperature	Not available
R. Viscosity	Not available
S. Molecular weight	Not available

10. STABILITY AND REACTIVITY

A. Reactivity, chemical stability, and possibility of hazardous reactions

Although may be burnt, ignition is difficult.

During fire, irritant gases and fume will be produced.

B. Conditions to avoid

Ignition sources (heat, spark, blaze)

C. Incompatible materials

Combustible or flammable materials, chemical substances like acids and strong bases

D. Hazardous decomposition products

May produce irritant gases and fume

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure	Not available
B. Health hazard information	
1) Acute toxicity	Not available
A) Oral	Not available
B) Dermal	Not available
C) Inhalation	Not available
2) Skin corrosion/irritation	Not available
3) Serious eye damage/irritation	Not available
4) Respiratory sensitization	Not available
5) Skin sensitization	May cause an allergic skin reaction.
6) Carcinogenicity	Suspected of causing cancer
A) Occupation safety and health acts	Not available
B) The ministry of employment and labor	2 (Nickel)
C) IARC	Group 2 (Nickel)
D) OSHA	Not available
E) ACGIH	A5 (Nickel)
F) NTP	R (Nickel)
G) EU CLP	Carc. 2 (Nickel)
7) Germ cell mutagenicity	Not available



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		material	material						
Al	O	O	O	O	X	X	X	X	X
Cr	O	O	O	O	O	O	X	X	X
Co	O	O	O	O	X	X	X	X	X
Cu	O	O	O	O	X	X	X	X	specified
Fe	O	O	X	X	X	X	X	X	X
Mn	O	O	O	O	X	X	X	X	X
Mo	X	X	X	O	X	X	X	X	specified
Ni	O	O	O	O	O	X	X	X	X
Nb	X	X	X	X	X	X	X	X	X
Si	X	X	X	O	X	X	X	500kg	specified
Ta	X	X	X	X	X	X	X	X	X

Work environment monitoring material : unless noted, measure every 6 months.

Special health monitoring material : unless noted, measure every 12 months.

O : included

X : not included.

B. Other internal or external regulations

No available other internal or external regulation against products.

Ingredient	Al	Cr	Cu	Fe	Mn
Internal regulation					
Persistent Organic Pollutant Act	X	X	X	X	X
External regulation					
OSHA	X	X	X	X	X
CERCLA	X	2267.995kg	2267.995kg	X	X
EPCRA 302	X	X	X	X	X
EPCRA 304	X	X	X	X	X
EPCRA 313	included	included	included	X	included
Rotterdam convention material	X	X	X	X	X
Stockholm convention material	X	X	X	X	X
Montreal protocol material	X	X	X	X	X
EU classification (result)	F: R15 R17	X	X	X	X
EU classification (R-phrase)	F: R15 R17	X	X	X	X
EU classification (S-phrase)	S2 S7/8 S43	X	X	X	X

X : not included.

Ingredient	Mo	Nb	Ni	Si	Ta
Internal regulation					
Persistent Organic Pollutant Act	X	X	X	X	X
External regulation					
OSHA	X	X	X	X	X



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CERCLA	X	X	45.3599kg	X	X
EPCRA 302	X	X	X	X	X
EPCRA 304	X	X	X	X	X
EPCRA 313	X	X	included	X	X
Rotterdam convention material	X	X	X	X	X
Stockholm convention material	X	X	X	X	X
Montreal protocol material	X	X	X	X	X
EU classification (result)	X	X	Carc. Cat. 3; R40 R43 T; R48/23, R52, R53	X	X
EU classification (R-phrase)	X	X	R40 R43 R48/23 R52/53	X	X
EU classification (S-phrase)	X	X	S2 S36/37/39 S45 S61	X	X

X : not included.

16. OTHER INFORMATION

A. References

EU REGULATION (EC) No 1272/2008

EU DIRECTIVE 2009/2/EC

The Ministry of Employment and Labor notification No. 2012-31

Threshold Limit Values according to American Conference of Governmental Hygienists, 2012

Permissible Exposure Limits according to the Occupational Safety & Health Administration (USA)

Chemical Information System (<http://ncis.nier.go.kr/ncis>)

Korea Occupational Safety & Health Agency (<http://www.kosha.or.kr>)

National Emergency Management Agency (<http://www.nema.go.kr>)

B. First issued date

2013. 06. 11

C. Revision

1) Revision No.

1

2) Date revised

2013.12.02