

1. PRODUCT IDENTIFICATION & COMPANY INFORMATION

Product name:	Various grades of welding and metal spraying consumable carrying the trademarks DURANICKEL, INCOLOY, INCONEL, INCO-CORED, INCO-WELD, MONEL, Nickel, NILO, NI-ROD, INCOFLUX Full list given in tables 2.1-.2.4												
Other/generic names:	Filler Metal, Flux, Flux Cored, Welding Electrode, Weldstrip, & Thermal Spray (TSW)												
Product use:	Welding & metal spraying consumables, See applicable product technical data sheets on website for information of typical scope of use and application, not all products are suitable for all processes or applications. <table border="0"> <tr> <td><i>Filler Metal</i></td> <td><i>Used for joining and overlaying, using GTAW, GMAW, Plasma and SAW (with suitable flux) welding processes</i></td> </tr> <tr> <td><i>Flux Cored</i></td> <td><i>Used for joining and overlaying, using GMAW welding processes</i></td> </tr> <tr> <td><i>Welding Electrode</i></td> <td><i>Used for joining and overlaying, using SMAW welding process</i></td> </tr> <tr> <td><i>Weldstrip</i></td> <td><i>Used for overlaying, (with suitable flux) for submerged arc or electroslag welding process</i></td> </tr> <tr> <td><i>INCOFLUX</i></td> <td><i>Flux used for joining or overlaying with appropriate filler metal or weldstrip for submerged arc or electroslag welding process</i></td> </tr> <tr> <td><i>Thermal Spray(TSW)</i></td> <td><i>Used to apply nickel alloy coating by a variety of thermal spray process</i></td> </tr> </table>	<i>Filler Metal</i>	<i>Used for joining and overlaying, using GTAW, GMAW, Plasma and SAW (with suitable flux) welding processes</i>	<i>Flux Cored</i>	<i>Used for joining and overlaying, using GMAW welding processes</i>	<i>Welding Electrode</i>	<i>Used for joining and overlaying, using SMAW welding process</i>	<i>Weldstrip</i>	<i>Used for overlaying, (with suitable flux) for submerged arc or electroslag welding process</i>	<i>INCOFLUX</i>	<i>Flux used for joining or overlaying with appropriate filler metal or weldstrip for submerged arc or electroslag welding process</i>	<i>Thermal Spray(TSW)</i>	<i>Used to apply nickel alloy coating by a variety of thermal spray process</i>
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Manufacturer:	Special Metals Welding Products Company		
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For more information	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Tel +1 828-465-0352</td> <td style="width: 50%;">Tel +44 (0)1432 382200</td> </tr> <tr> <td>Fax +1 828-464-8993</td> <td>Fax +44 (0)1432 264030</td> </tr> <tr> <td>Email info@smwpc.com</td> <td>Email sales.uk@smwpc.com</td> </tr> </table>	Tel +1 828-465-0352	Tel +44 (0)1432 382200	Fax +1 828-464-8993	Fax +44 (0)1432 264030	Email info@smwpc.com	Email sales.uk@smwpc.com
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2. COMPOSITION/INFORMATION ON INGREDIENTS

Information on ingredients is given in Table 1 and the compositions of individual products in the alloy families or categories listed above are given in the product composition tables 2.1-2.4. Please refer to the appropriate alloy name or designation.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Silver to gray metal wire or strip. (Welding Electrode are flux coated, Flux Cored has a flux center; flux is granular powder). Not normally considered hazardous as shipped. Ends and edges can be sharp and gloves should be worn when handling.

POTENTIAL HEALTH HAZARDS

Skin: Although not normally hazardous, some individuals can develop allergic skin reactions to nickel and other metallic ingredients. Ends of wire and edges of strips may be sharp and can cause cuts. During welding and spraying - Fumes generated may be irritating to the skin. UV radiation produced can cause burns (ray burn). Hot metal can cause burns.

Eyes: As shipped, product does not pose a hazard to the eyes however ends of wire and edges of strip are sharp and can cause cuts. During welding and spraying - Fumes generated can be irritating to the eye. Ends of wire may be sharp and can cause cuts or hot and cause burns. UV radiation produced can cause burns (arc eye).

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- Inhalation:** Fumes generated by welding and spraying processes can be irritating and toxic.
- Ingestion:** Not a likely route of entry. Metal ingestion can cause toxic effects.
- Delayed effects:** Inhalation of welding or spraying fumes may cause damage to the lungs and respiratory tract including but not limited to fibrosis of the lung which can reduce lung capacity and produce difficulty breathing. Cobalt and Nickel are animal carcinogens and inhalation of fumes and dusts should be avoided. Prolonged inhalation of Manganese fumes and dusts may cause irreversible damage to the nervous system resulting in Parkinson's Disease-like symptoms (tremors, weakness, paralysis, etc.)

	Nickel	Cobalt
EC Label No	231-111-4	231-158-0
Index No	028-002-00-7	028-001-00-9
Designation:	Xn Harmful	Xn Harmful
Risk Phrases:	R40 Possible risk of irreversible effects R43 May cause sensitization by skin contact	R42/43 May cause sensitization by inhalation and skin contact R53 May cause long-term adverse effects in aquatic environments

4. FIRST AID MEASURES

- Skin:** Wash skin with soap and water to remove any metallic particles. If a rash or burn develops, seek medical attention.
- Eyes:** Flush particles from eyes with clean water for at least 15 minutes. If irritation persists or burn develops, seek medical attention.
- Inhalation:** Remove from exposure. If respiratory irritation persists, seek medical attention.
- Ingestion:** If metallic particles are swallowed, seek medical assistance.
- Advice to physician:** Treat symptomatically.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

Flash Point & Method	Solid material – No flash point
Autoignition Temperature:	Not flammable
Flame Propagation Rate (solids):	Not flammable
OSHA Flammability Class:	None – solid material
Extinguishing Media:	Use agent appropriate for surrounding fire.
Unusual Fire And Explosion Hazards:	None
Special Fire Fighting Precautions/Instructions:	Wear self-contained breathing apparatus. Hazardous metallic fumes can be generated in a fire.

Nonflammable except for packaging, however sparks from welding or grinding in user operations could ignite flammable or combustible liquids, vapors and solids.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: Wear proper protective clothing. Pick up spilled articles and place into container.

7. HANDLING AND STORAGE

- Normal Handling:** Under normal circumstances the materials do not produce any hazardous products and as such do not require any special precautions. However, see Section 10 "STABILITY AND REACTIVITY". The transient handling of the materials would not be expected to produce any sensitization but it is good practice to use gloves for handling. The normal precautions for handling heavy objects with possible sharp edges should also be observed.
- Personal hygiene - Apply good standards, wash hands after use and before eating.

Storage Recommendations: Store in a dry place and protect from contamination with other materials.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general ventilation and local exhaust ventilation when welding, spraying, cutting or grinding to maintain concentrations of metal dusts and/or fumes below allowable exposure values. Maintain exposures below the published exposure levels. Use industrial hygiene air monitoring to ensure that your use of this material does not create exposures that exceed the recommended exposure limits. Refer to the following sources for important additional information:

In U.S.A.: 29 CFR 1910, ANSI Z49.1, American Welding Society, OSHA, U.S. Dept of Labor
 In Canada: Canadian Standards Association, CAN/CSA - W17.2-M87
 In UK: Current exposure limits under Health & Safety Executive EH40 are given in table 2.

PERSONAL PROTECTIVE EQUIPMENT

Skin Protection: Wear gloves, face protection and flame retardant clothing, do not expose skin to the heat, radiation and spatter from welding or spraying operations.

Eye Protection: Eye protection, to the appropriate national standard, is recommended when welding, cutting, spraying or grinding. Do not expose eyes to the heat and radiation from welding operations, use appropriate grade optical filters (welding glass) for welding or spraying process operations.

Respiratory Protection: Respiratory protection is necessary when exposure limits for airborne contaminants are exceeded during welding, grinding or cutting operations. Use air-supplied respirator in confined spaces.
In the USA, use only NIOSH-approved respirators in accordance with 29 CFR 1910.134, or other nationally approved respirators.
In the EU, if required use protection to EN136 (full face respirators), EN140 (half mask respirators), EN149 (filtered half masks (disposable)) or other appropriate EN standard. In the rest of the world use respiratory protection to the appropriate national standard.

Additional Recommendations: Source of running water to wash skin and eyes
 Wear ear protection to the appropriate national standards where high levels of noise are experienced.

Exposure Guidelines See Appendix 1

9. PHYSICAL AND CHEMICAL PROPERTIES

	Filler Metal, Weld Strip and Thermal Spray Wire	Welding Electrode	Flux Cored Wire	Flux
Appearance:	Grey to silver	Varies grey, black, brown coating with metallic silver inner	Metallic silver outer with flux core	Varies grey, brown, green particles
Physical State:	Solid	Solid	Solid	Solid (Powder)
Molecular Weight:	Mixture	Mixture	Mixture	Mixture
Chemical Formula:	Mixture	Mixture	Mixture	Mixture
Odor:	Odorless	Odorless	Odorless	Odorless
Specific Gravity (water = 1.0):	8 – 9	4-7	5 - 8	
Bulk Density				0.8 – 1.1
Solubility In Water (wt. %):	Insoluble	Insoluble	Insoluble	Insoluble
Melting Point:	> 2300F (1260 °C)	> 1800F (>1000°C)	> 1800F (>1000°C)	> 1800F (>1000°C)
Flash Point	None	None	None	None

Other physical and chemical properties, e.g. as described in 91/155/EEC and in the Approved Code of Practice, ref. 11, have no safety implications in relation to these materials.

10. STABILITY AND REACTIVITY

These consumables are stable and no hazardous decomposition products are formed upon exposure to water or the atmosphere. Nickel can react with carbon monoxide in reducing atmospheres to form nickel carbonyl, an extremely toxic gas.

11. TOXICOLOGICAL INFORMATION

Nickel and cobalt are classified as Category 3 carcinogens. The exposure route of concern is inhalation.

As shipped, these complex alloys in massive form have no known toxicological properties other than causing allergic reactions in individuals sensitive to the metal(s) contained in the alloys. However, dust from flux or user-generated dusts and fumes may on contact with the skin or eyes produce mechanical irritation. Chronic exposures coupled with sweat could cause dermatitis (skin) or conjunctivitis (eyes).

Excessive inhalation of dust or user-generated fumes from welding or metal spraying may, depending on the specific features of the process used, pose a long-term health hazard. The International Agency for Research on Cancer (IARC) has concluded that welding fumes are possibly carcinogenic to humans.

The ingredients of fumes and gases generated in welding, metals spraying and grinding will depend on the base metal and the details of the specific process being used. Ingredients may include metals, metal oxides, chromates, fluorides, carbon monoxide, ozone, and oxides of nitrogen. Phosgene can be produced if chlorinated solvent vapors are present in user operations.

More detailed toxicological information is given in APPENDIX 1

Contamination or surface preparations etc. can affect the composition of the produced fume.

Metals Spraying - Many variations of process are available; refer to table 2.1 in association with guidance from equipment manufacturers for likely constituents of produced fume.

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Chromium	The International Agency for Research on Cancer (IARC) considers hexavalent chromium to be a carcinogen (lung, nasal) but does not have adequate evidence for chromium metal and trivalent chromium. Fumes have been associated with lung fibrosis.
Iron	Prolonged inhalation of iron oxide fumes can lead to siderosis, which presents as a benign pneumoconiosis.
Molybdenum	Repeated inhalation of fumes has caused kidney damage, respiratory irritation and liver damage in animals.
Nickel	Nickel metal is "reasonably anticipated to be a human carcinogen" (National Toxicology Program's 10 th Report). IARC states that nickel metal is possibly carcinogenic to humans. Epidemiological studies of workers exposed to nickel powders, dusts and fumes in the nickel alloy and stainless steel producing industries do not indicate a significant respiratory cancer hazard. Inhalation of nickel powder produced malignant tumors in rodent studies. Single intratracheal installations of nickel powder at levels close to the LD ₅₀ have caused malignancies in hamsters. Can cause skin sensitization in susceptible individuals through prolonged contact with skin.
Niobium	No data available.

12. ECOLOGICAL INFORMATION

As a solid metal object, Filler Metal products are not considered toxic to aquatic species.
Flux (being of mineral constituents) from flux coated electrodes, flux cored wire and flux may degrade over time.
Observe national and local standards for fume extraction systems

13. DISPOSAL CONSIDERATIONS

Unused consumable wastes are normally collected to recover metal values.
Dispose of fume, flux, slag, weld grinding residues, over-spray etc, from the work area, or from filters, in accordance with national, federal, state or local regulations. Nickel is regulated in many countries as hazardous to the environment. Other metals may be regulated in specific jurisdictions. In UK most alloyed material would be regarded as special waste. Observe all National, State, and local environmental regulations.

Packaging - Dispose of by recycling.

14. TRANSPORT INFORMATION

No special precautions are necessary for the transport of these materials.

15. REGULATORY INFORMATION

Classification and labelling requirements

Alloys containing less than 1% of nickel or cobalt are not classified as "dangerous for supply". Alloys containing more than 1% of either metal are classified as the metals themselves (see Section 3). However, in recognition of their essentially non-hazardous nature, these alloys in the massive form are not required to be labelled as hazardous.

Product Labeling - UK Manufacture

WARNING: PROTECT YOURSELF AND OTHERS. READ AND UNDERSTAND THIS LABEL. TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURER'S HAZARD DATA

Fumes and gases can be dangerous to your health. Arc rays can injure eyes and burn skin. Electric shock can kill. Read and understand the manufacturer's instructions and your employer's safety practices. Keep your head out of the fumes. Use enough ventilation or exhaust at the arc to keep fumes and gases from your breathing zone, and the general area. Wear correct eye, ear and body protection. Do not touch live electrical parts.

DO NOT REMOVE THIS LABEL

Product Labeling – USA Manufacture

PROTECT YOURSELF AND OTHERS – READ AND UNDERSTAND THIS LABEL – TAKE PRECAUTIONS WHEN WELDING – ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS HAZARD DATA AVAILABLE TO HIM

Fumes and gas as can be dangerous to your health. Arc rays can injure eyes and burn skin. Electric shock can kill. Read and understand the manufacturer's instructions and your employers safety practices. Keep your head out of the fume. Use enough ventilation, exhaust at the arc or both, to keep fumes and gases from your breathing zone, and the general area. Wear correct eye ear and body protection. Do not touch live electrical parts. See WMA publication 236 hazards from welding fume available from the manufacturer.

DO NOT REMOVE THIS LABEL

WARNING POSSIBLE CANCER HAZARD OR LUNG DAMAGE IF INHALED – MAY CAUSE ALLERGIC REACTION – MAY CONTAIN FLUORIDES

PROTECT YOURSELF AND OTHERS – before use, read and understand this label, the manufacturer's instructions, Material Safety Data Sheets [MSDS's], and your employer's safety practices, which should be based on the manufacturer's hazard data available to him. See American National Standard Z49.1, Safety in Welding and Cutting and OSHA Safety and Health Standards 29CFR1910.

FUMES AND GAS can be dangerous to your health. Skin sensitization, irritation of skin, eye and respiratory tract, neurological damage, or death can result from over exposure. Keep your head out of the fumes. Use ventilation, preferably local exhaust ventilation, adequate to keep the concentration of the fumes and gases below the exposure limits. Special attention to ventilation is required in confined, small or crowded spaces. If adequate ventilation is not available, wear appropriate respiratory protection. Wash skin after contact with dust or fumes.

Arc rays can injure eyes and burn skin. Electric shock can kill. Do not touch live electrical parts. Wear correct eye, ear and body protection

DO NOT REMOVE THIS LABEL

SARA SECTION 313 SUPPLIER NOTIFICATION:

Individual consumables covered by this MSDS may contain the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40 CFR 372: Chromium, Copper, Manganese, and Nickel. Refer to "Section 2" of this MSDS for the filler metal name and the percent by weight, and "Table 1" for the CAS Number for each chemical.

16. OTHER INFORMATION

Current Issue Date: September 2014
Previous Issue Date: March 2011
Changes to MSDS From Previous Issue Are Due To: Change of format which includes additional information.

MSDS prepared by Special Metals Technical Department, in compliance with directive 91/115/EEC, 93/112/EEC and HSE (UK) Welding Information Sheet No.1 and is provided in good faith based upon the experience and knowledge of the company. It should not be taken as a guarantee of alloy properties for ordering these materials. Users should make their own assessment of workplace risks as required by other health and safety legislation

Trademarks DURANICKEL®, INCOLOY®, INCONEL®, INCOFLUX®, INCO-WELD®, MONEL®, NILO®, NIMONIC®, NI-ROD®, 686CPT® & 725NDUR® are trademarks of the Special Metals Group of Companies.

Bibliography:

1. U.S. National Toxicology Program - 10th Report On Carcinogens
2. Health and Safety Executive UK - EH40 - Occupational exposure limits; EH42 - Monitoring Strategies for toxic substances; EH44 - Dust the Workplace - general principles of protection; EH54 - Assessment of Exposure to Fume from Welding and Allied Processes; EH55 - The Control of Exposure to Fume from Welding, Brazing and Similar Processes; EH60 - Nickel and its inorganic compounds.
3. EH Health and Safety Executive's publications (www.hse.gov.uk)
4. HSC. Information approved for the classification, packaging and labeling of dangerous substances for supply and conveyance by road.
5. European Commission Directive 5/3/91 - 91/155/EEC.

6. European Commission Directive 10/12/93 - 93/112/EEC.
7. Twelfth adaptation of Council Directive 67/548/EEC - 91/325/EEC.
8. Sixth amendment of Council Directive 67/548/EEC - 79/831/EEC.
9. The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 No. 1689.
10. International Agency for Research on Cancer. Monographs on the evaluation of carcinogenic risks to humans. Vol 49 Chromium Nickel and Welding, 1990.
11. Approved Code of Practice. ISBN 0 7176 0859X.
12. European Norm - EN 1811.

Table 2.1
Nominal Composition (Weight %) Of
Filler Metal, Thermal Spray Wires and Weldstrips Covered By This MSDS

Trade Name	Al	Cr	Co	Cu	Fe	Mn	Mo	Ni	Nb	Si	Ti	W
DURANICKEL® 301 & 301TSW™	4	-	-	-	-	-	-	94	-	1	1	-
INCOLOY® 65	-	21	-	2	30	1	3	42	-	-	1	-
INCOLOY® 825	-	21	-	2	30	1	3	42	-	-	1	-
INCONEL® 52	<1	29	-	-	9	1	-	59	-	-	-	-
INCONEL® 52M™	1	30	-	-	9	1	-	57	1	-	1	-
INCONEL® 52MSS™	-	30	-	-	8.5	-	3.5	55	2.5	-	-	-
INCONEL® 53MD™	3	29	-	-	3	1	-	64	-	-	-	-
INCONEL® 601	1	23	-	1	14	1	-	61	-	-	-	-
INCONEL® 617	1	22	12	-	2	1	9	52	-	1	-	-
INCONEL® 62	-	16	-	-	8	1	-	74	3	-	-	-
INCONEL® 622	-	20	-	-	5	-	14	58	-	-	-	3
INCONEL® 625, 625T, 625TSW™ and 625ULTRA™	-	22	-	-	1	-	9	61	4	-	-	-
INCONEL® 718 & 718TSW™	-	19	-	-	19	-	3	53	5	-	1	-
INCONEL® 72 & 72TSW™	-	44	-	-	-	-	-	55	-	-	1	-
INCONEL® 72M™	1	37	-	-	0.5	-	1	57	1	-	0.5	-
INCONEL® 82 & 82T	-	20	-	-	1	3	-	72	3	-	-	-
INCONEL® 92	-	16	-	-	7	2	-	71	1	-	3	-
INCONEL® 740H	<1	24	18	-	2	-	1	51	1.5	-	1	-
INCO-WELD® 686CPT®	-	21	-	-	1	-	16	58	-	-	-	4
INCO-WELD® 725NDUR®	-	21	-	-	9	-	9	57	3	-	1	-
INCO-WELD® C-276 & C276TSW™	-	16	2	-	6	-	16	57	-	-	-	3
INCO-WELD® HX	-	22	2	-	19	-	9	47	-	-	-	1
MONEL® 400 TSW	-	-	-	32	1	1	-	67	-	-	-	-
MONEL® 60, 60N & 60TSW™	-	-	-	27	-	4	-	65	1	1	2	-
MONEL® 67 & 67N	-	-	-	68	1	1	-	31	-	1	-	-
NC 80/20	-	20	-	-	-	1	-	79	-	-	-	-
Nickel 200 TSW	-	-	-	-	-	-	-	99	-	-	-	-
Nickel 61 & 61N	-	-	-	-	-	-	-	96	-	-	3	-
NILO® CF36™	-	-	-	-	61	-	-	36	2	-	-	-
NI-ROD® 44	-	-	-	-	48	10	-	42	-	-	-	-
NI-ROD® 44HT™	-	7	-	-	37	11	-	43	1	-	-	-
NI-ROD® 55	-	-	-	-	44	-	-	55	-	-	-	-
NI-ROD® 99	-	-	-	-	-	-	-	99	-	-	-	-

Table 2.2
Composition (Weight %)
Of Flux Coated Electrodes Covered By This MSDS

PRODUCT NAME	Al	Al ₂ O ₃	BaCO ₃	BaF ₂	C	CaCO ₃	CaF ₂	Cr	Co	Cu	Fe	Fe ₂ O ₃	K ₂ O	K ₂ SiO ₃	Li ₂ CO ₃	MgO	Mn	MnO	Mo	Nb	Ni	SiO ₂	Na ₃ AlF ₆	Na ₂ SiO ₃	SrCO ₃	Ti	TiO ₂	W
INCONEL® 112 & 112T						5-10		15-40			1-5								5-10	1-5	40-70	1-5	5-10	1-5			1-5	
INCONEL® 112AC						5-10		15-40			1-5		1-3	1-5					5-10	1-5	40-70	1-5	5-10	1-5			1-5	
INCONEL® 116																												
INCONEL® 117						5-10		15-40	5-10		1-5						0.5-2		5-10		40-70	0.5-2	5-10	1-5			1-5	
INCONEL® 122						5-10	1-5	15-40			1-5								10-30		40-70	0.1-1	5-10	1-5			1-5	1-5
INCONEL® 152						1-5		10-30			5-10						1-5			1-5	40-70	0.1-1	5-10	1-5	1-5		1-5	
INCONEL® 152M						1-5		10-30			5-10						1-5			1-5	40-70	0.1-1	5-10	1-5	1-5		1-5	
INCONEL® 152MSS						1-5		20-30			5-10									1-5	40-70		5-10	1-5	1-5			1-10
INCONEL® 182 & 182T						5-10		10-30			5-10						1-5	1-5		1-5	40-70	0.1-1	1-10	1-5		1-5	1-5	
INCO-WELD® 686CPT®		1-5				3-7		10-30											10-30		30-60			1-5			3-7	1-5
INCO-WELD® A						5-10		10-30			6-12						1-5		1-5	1-5	30-60	0.1-2	5-10	1-5			3-7	
INCO-WELD® C-276						1-5		10-30	1-5		3-7						1-5		10-30		30-60	0.1-1	5-10	1-5			5-10	1-5
MONEL® 187 & 187N						5-10	1-5			40-70				0.7-0.9			1-5				15.40	1.5	5-10	1-5		1-5	1-5	
MONEL® 190 & 190N			1-5			1-5	1-5			15-40							1-5				40-70	1-5	5-10	1-5		1-5	1-5	
Nickel 141 & 141N		1-5				5-10															40-70	0.5-2	5-10	1-5		1-5		
NI-ROD®	1-5		0-1		1-5	1-5	1-5				1-5	1-5									60-100			1-5	7-13			
NI-ROD® 44			1-5	1-5	1-5	1-5				1-5	30-60						7-13				30-60				7-13			
NI-ROD® 55					1-5	1-5	1-5				30-60	1-5									30-60				7-13			
NI-ROD® 55X			1-5	1-5	1-5	1-5				1-5	30-60						1-5				30-60				5-10			
NI-ROD® 99X			1-5	1-5	1-5	1-5				1-5	1-5						1-5				60-100							

Table 2.3
Composition of Flux-Cored Welding Wires Covered By This MSDS

Weight %	CaO	CaF ₂	C	Cr	Fe	Mn	MnO	Mo	NaAlF ₆	Na ₂ O	Nb	Ni	SiO ₂	TiO ₂	K ₂ ZrF ₆	ZrO ₂
INCO-CORED® 625 AP	1-5			15-20			1-5	5-10		1-5	1-5	50-60	0.1-0.5	5-10		
INCO-CORED® 82 AP				15-20	1-5	1-5					1-5	57-63	0.1-0.5	5-10		
NI-ROD® FC55		7-13	1-5		30-60	1-5			1-5			30-60				

Table 2.4
Composition of Flux Covered By This MSDS

Product Name	Al ₂ O ₃	CaF ₂	CaO	Cr ₂ O ₃	MgO	Mn	MnO	Nb	Ni	K ₂ SiO ₃	K ₂ O	SiO ₂	NaAlF ₆	TiO ₂	ZrO ₂	K ₂ ZrF ₆	NaF	Others
INCOFLUX® 5		60-100					10-30			1-5		1-5	3-7					
INCOFLUX® 5N																		
INCOFLUX® 7	15-40	40-70				1-5				1-5			3-7		5-20			Fe ₃ O ₄ 1-5
INCOFLUX® 8		60-100					10-30			1-5		1-5	3-7					Fe ₃ O ₄ 1-5
INCOFLUX® 9	1-5	15-20	28-33		2-6							28-33			4-8			
INCOFLUX® ESS1	10-15	65-80	10-15	3-8	3-7	1-5		1-5	1-5		1-3	1-5				3-7		Cr 1-5
INCOFLUX® ESS2	5-10	65-80		3-8	3-7	2-7		1-5	1-5	1-5	1-5	2-7	2-7			1-6	1-6	Cr 1-5
INCOFLUX® ESS3	20-40	45-70										5-15						
INCOFLUX® ESS4	5-10	65-80		5-10	3-7	2-7		1-5	1-5		1-5	2-7					1-6	Cr 1-5
INCOFLUX® ESS5																		
INCOFLUX® NT100	15-40	40-70			3-7				1-5	1-5			3-7	3-7				
INCOFLUX® NT110	30-70	10-40					0-20			5-20		0-10		0-10				Cu 0-5 Na ₂ O 0-5 Na ₂ Si ₄ O ₉ 5-20
INCOFLUX® NT120	26-33	30-35				0-5	2-4	1-5	1-5			2-4		4-7	8-13		1-6	CaSiO ₃ 1-5 Cr 0-5 Fe 1-6 Mo 1-6 Na ₂ O 2-4 Na ₂ Si ₄ O ₉ 1-6
INCOFLUX® SAS1	30-70	10-40	0-10			0-5	0-5			5-20		0-10		0-10				CaCO ₃ 0-10 Na ₂ O 0-5 Na ₂ Si ₄ O ₉ 5-20
INCOFLUX® SAS2	35-45	35-45		2-8		5-10				1-5								CaSiO ₃ 5-15 Cr 2-6 CaTiO ₃ 5-15
INCOFLUX® SAS3																		

Table 3.1
Composition of Welding Fume for Select Filler Metal Wires Covered By This MSDS (Weight %)

	Si	Ti	Al	Fe	Mn	Ni	Cr	Mo	Nb	Cu	Co
INCOLOY® 65	0.2	0.6	0.2	23	0.4	39	19	2	<0.1	2.8	-
INCONEL® 617	0.2	.03	0.7	1	0.6	40	16	8	<0.1	0.4	8
INCONEL® 625, 625T & 625TSW™	0.1	0.2	0.2	0.3	0.2	49	17	9	2	<0.1	-
INCONEL® 718 & 718TSW™	<0.1	0.9	0.6	15	0.4	44	15	3	3	0.4	-
INCONEL® 82 & 82T	0.3	0.3	0.2	1	6	56	15	<0.1	1	<0.1	-
INCO-WELD® C-276 & C276TSW™	0.1	<0.1	1	14	3	28	10	11	<0.1	0.8	-
MONEL® 60, 60N & 60TSW™	0.3	2	<0.1	2	5	47	<0.1	<0.1	<0.14	24	-
MONEL® 67 & 67N	0.4	1	0.6	2	2	10	<0.1	<0.1	<0.1	64	-
NC 80/20	0.4	0.1	0.1	0.4	2	57	16	<0.1	<0.1	0.6	-
Nickel 61 & 61N	<0.1	2	0.1	0.2	0.7	69	<0.1	<0.1	<0.1	1.3	-
NI-ROD® 44	<0.1	0.3	0.2	32	16	30	<0.1	<0.1	<0.1	<0.1	-
NI-ROD® 55	0.8	<0.1	0.1	33	4	31	<0.1	<0.1	<0.1	<0.1	-

Table 3.2
Composition of Welding Fume for Select Flux Coated Welding Electrodes Covered by This MSDS (Weight %)

	Ni	Cr Total	Cr 6	Fe	Mn	Cu	Co	Ti	Ba	F
INCONEL® 112 & 112T	1.95	2.80	0.79	0.76	0.16	0.06	0.03	2.58	<0.1	26.7
INCONEL® 117	2.32	3.14	0.93	0.54	0.84	0.03	0.91	1.05	<0.1	28.4
INCONEL® 182 & 182T	1.59	2.14	0.55	0.94	10.5	0.06	0.03	3.29	<0.1	23.2
INCO-WELD® A	2.10	2.33	0.61	1.00	1.62	0.03	0.03	0.23	0.90	29.3
INCO-WELD® C-276	5.0	4.0	2.7	2.0	2.0	0.2	-	3.0	<0.1	-
MONEL® 187 & 187N	0.76	0.02	<0.01	0.42	2.33	10.7	0.03	3.36	2.90	30.4
MONEL® 190 & 190N	1.79	0.04	<0.01	0.26	2.43	8.7	0.04	1.23	1.83	24.9
Nickel 141 & 141N	3.15	0.02	<0.01	.56	.60	0.02	0.03	1.91	<0.01	30.2
NI-ROD®	13.9	0.01	0.01	3.77	0.27	0.02	0.05	0.64	<0.1	8.4
NI-ROD® 44	2.41	0.03	0.01	9.73	11.8	1.40	0.02	0.13	7.25	3.4
NI-ROD® 55	2.1	0.03	0.01	1.45	0.37	0.02	0.02	0.23	0.49	3.1
NI-ROD® 55X	1.23	0.02	<0.01	5.30	1.14	1.40	0.03	0.10	9.88	3.0
NI-ROD® 99X	3.23	0.03	<0.01	3.21	3.69	1.29	0.04	0.03	8.30	5

Appendix 1

INGREDIENTS, TOXICOLOGICAL AND EXPOSURE LIMIT INFORMATION

The following information is primarily directed to the ingredients of the complex alloys listed in table 2.1, 2.2, 2.3, 2.5, 2.6, and 2.7. Although it is the user's responsibility to assess end products, intermediates, or fugitive emissions arising out of the use of these alloys, information is also provided for common fume ingredients. *UK EH40 limits for the ingredients are shown in italics at the end of each section.*

Ingredient		EINECS Number	CAS Number	Exposure Limits ⁽¹⁾ :
Symbol	Name			
Al	Aluminum		7429-90-5	TLV: 10 mg/m ³ (Metal dust); 5 mg/m ³ (Welding fumes) PEL: 15 mg/m ³ (Total metal dust); 5 mg/m ³ (Metal dust – respirable fraction) LD ₅₀ : Not Available <i>EH40 - Aluminum metal: Total inhalable dust OES 10 mg/m³ (8 hours TWA), Total respirable dust OES 4 mg/m³ (8 hours TWA)</i>
Al ₂ O ₃	Aluminum Oxide (Alumina)		1344-28-1	TLV: 10 mg/m ³ PEL: 15 mg/m ³ (Total dust); 5 mg/m ³ (respirable) LD ₅₀ : Not Available <i>EH40 Total inhalable dust OES 10 mg/m³ (8 hours TWA), Total respirable dust OES 4 mg/m³ (8 hours TWA)</i>
BaCO ₃	Barium Carbonate		513-77-9	TLV: 0.5 mg/m ³ (Soluble compounds, as Ba) PEL: 0.5 mg/m ³ (Soluble compounds, as Ba) LD ₅₀ : 418 mg/kg, rat, oral <i>EH40 OES 0.5 mg/m³ (soluble compounds, as Ba)</i>
BaF ₂	Barium Fluoride		7787-32-8	TLV: 0.5 mg/m ³ (Soluble compounds, as Ba) PEL: 0.5 mg/m ³ (Soluble compounds, as Ba) LD ₅₀ : 250 mg/kg, rat, oral <i>EH40 OES 0.5 mg/m³ (soluble compounds, as Ba)</i>
C	Carbon		7440-44-0	TLV: 3.5 mg/m ³ (As carbon black) PEL: 3.5 mg/m ³ (As carbon black) LD ₅₀ : 440 mg/kg, mouse, intravenous
CaCO ₃	Calcium Carbonate		1317-65-3	TLV: 10 mg/m ³ PEL: 15 mg/m ³ (Total dust); 5 mg/m ³ (Respirable fraction) LD ₅₀ : 6,450 mg/kg, rat, oral <i>EH40: Total inhalable dust OES 10 mg/m³ (8 hours TWA), Total respirable dust OES 4 mg/m³ (8 hours TWA)</i>
CaF ₂	Calcium Fluoride (Fluorspar)		7789-75-5	TLV: 2.5 mg/m ³ (as F) PEL: 2.5mg/m ³ (as F) LD ₅₀ : 4,250mg/kg, rat, oral

CaO	Calcium Oxide	1305-78-8		TLV: 2 mg/m ³ , as Calcium Oxide PEL: 5 mg/m ³ , as Calcium Oxide LD50: Not Known EH40: Total inhalable dust OES 2 mg/m ³ (8 hours TWA)
CaSiO ₃	Calcium Metasilicate	1344-95-2		TLV: 10 mg/m ³ (Dust) PEL: 15 mg/m ³ (Total dust) 5 mg/m ³ (Respirable) LD50: Not Available EH40: Total inhalable dust OES 10 mg/m ³ (8 hours TWA), Total respirable dust OES 4 mg/m ³ (8 hours TWA)
Co	Cobalt	231-158-0	7440-48-4	TLV: 0.02 mg/m ³ (Dust & fume as Co) PEL: 0.1 mg/m ³ (As Co metal) LD50: 6,170 mg/kg, rat, oral EH40 OES 0.1 mg/m ³ (8 hours TWA)
Cr	Chromium	231-157-5	7440-47-3	TLV: 0.5 mg/m ³ PEL: 1.0 mg/m ³ (Metal as Cr) LD50: Not Available EH40: Chromium VI compounds (as Cr) OES 0.05 mg/m ³ (8 hours TWA) Chromium II compounds (as Cr) OES 0.5 mg/m ³ (8 hours TWA) Chromium III compounds (as Cr) OES 0.5 mg/m ³ (8 hours TWA) Chromium OES 0.5 mg/m ³ (8 hours TWA)
Cr ₂ O ₃	Chromic Oxide	1308-38-9		TLV: 0.5 mg/m ³ , as Cr PEL: 0.5 mg/m ³ (Metal as Cr) LD50: Not Available
Cu	Copper	231-159-6	7440-50-8	TLV: 1 mg/m ³ (Dusts & mists, as Cu), 0.2 mg/m ³ (Fume) PEL: 1 mg/m ³ (Dusts & mists, as Cu), 0.1 mg/m ³ (Fume as Cu) LD50: 35 mg/kg, mouse, intraperitoneal EH40: Fume OES 0.2 mg/m ³ (8 hours TWA) Dusts & mists (as Cu) OES 1.0 mg/m ³ (8 hours TWA), 2.0 mg/m ³ (15 minute reference period)
Fe/ Fe ₂ O ₃	Iron	231-096-4	7439-89-6	TLV: No limit set (For Fe ₂ O ₃ fume the TLV is 5 mg/m ³ as Fe) PEL: No limit set (For Fe ₂ O ₃ dust & fume the PEL is 10 mg/m ³ as Fe) LD50: Not Available EH40 Iron Oxide, fume (as Fe) OES 5.0 mg/m ³ (8 hours TWA), 10 mg/m ³ (15 minute reference period)

Fe ₃ O ₄	Ferrosoferric Oxide	1317-61-9	TLV: No limit set (For Fe ₂ O ₃ fume, 5 mg/m ³ as Fe) PEL: No limit set (For Fe ₂ O ₃ dust and fume, 5 mg/m ³ as Fe) LD50: Not Available
K ₂ O	Potassium Oxide	12136-45-7	TLV: 2 mg/m ³ Ceiling value as KOH PEL: 2 mg/m ³ Ceiling value as KOH LD50: Not Available
K ₂ SiO ₃	Potassium Silicate	1312-76-1	TLV: Not Established PEL: Not Established LD50: >1000 mg/kg, oral, rat
K ₂ ZrF ₆	Potassium Fluozirconate	16923-95-8	TLV: 2.5 mg/m ³ (Fluorides, as F) PEL: 2.5 mg/m ³ (Fluorides, as F) LD50: 98 mg/kg, mouse, oral
LiCO ₃ Li ₂ CO ₃	Lithium Carbonate	554-13-2	TLV: No limit set PEL: No limit set LD50: Oral 525 mg/kg, rat Dermal LD 50, > 2000 mg/kg, rat
MgO	Magnesium Oxide	1309-48-4	TLV: 10 mg/m ³ (As fume) PEL: 15 mg/m ³ (Total dust or fume) LD50: Not Available EH40 Total inhalable dust OES 10 mg/m ³ (8 hours TWA), Total fume and respirable dust OES 4 mg/m ³ (8 hours TWA)
Mn	Manganese	231-105-1 7439-96-5	TLV: 0.2 mg/m ³ elemental and inorganic compounds, as Mn PEL: 5 mg/m ³ (Ceiling, as Mn compounds); 5 mg/m ³ (Fume, as Mn) LD ₅₀ : 9,000 mg/kg, rat, oral EH40 Manganese and its inorganic compounds (as Mn) OES 0.5 mg/m ³ (8 hours TWA)
MnO	Manganous Oxide	1344-43-0	TLV: 0.2 mg/m ³ (as Mn) PEL: 1mg/m ³ (fume) 5mg/m ³ (Stel, Ceiling) LD ₅₀ : >50mg/kg, intratracheal rat.

Mo	Molybdenum	231-107-2	7439-96-7	TLV: 10 mg/m ³ (Insoluble and metal compounds, as Mo) PEL: 15 mg/m ³ (Insoluble compounds, total dust as Mo) LD ₅₀ : Not Available <i>EH40 - Molybdenum compounds (as Mo):</i> <i>Soluble - OES 5.0 mg/m³ (8 hours TWA), 10 mg/m³ (15 minute reference period)</i> <i>Insoluble - OES 10 mg/m³ (8 hours TWA), 20 mg/m³ (15 minute reference period)</i>
Na ₂ O	Sodium Oxide		1313-59-3	TLV: 2 mg/m ³ (ceiling level as NaOH) PEL: 2mg/m ³ (as NaOH) LD ₅₀ : Not Available
Na ₂ Si ₄ O ₉ / Na ₂ SiO ₃	Sodium Silicate		1344-09-8	TLV: Not Established PEL: Not Established LD50: 1153 mg/kg, oral, rat
Na ₂ AlF ₆	Sodium Aluminum Fluoride (Sodium Fluoaluminite)		15096-52-3	TLV: No limit set PEL: No limit set LD50: 200 mg/kg, rat, oral
NaF	Sodium Flouride		7681-49-4	TLV: 2.5 mg/m ³ (as F) PEL: 2.5 mg/m ³ (as F) LD ₅₀ : 0.18g/kg, rat, oral
Nb	Niobium	231-113-5	7440-03-1	TLV: No limit set PEL: No limit set LD ₅₀ : Not Available
Ni	Nickel R43	231-111-4	7440-02-0	TLV: 1.5 mg/m ³ as metal (Inhalable Fraction) PEL: 1 mg/m ³ for metal and insoluble compounds as Ni LD ₅₀ : >9,000 mg/kg, rat, oral <i>EH40 - Nickel and its inorganic compounds (except nickel carbonyl): Water soluble nickel compounds (as nickel) OES 0.1 mg/m³ (8hours TWA). Nickel & water in-soluble nickel compounds (as Ni) OES 0.5 mg/m³(8-hour TWA)</i>
Si	Silicon	231-130-8	7440-21-3	TLV: 10 mg/m ³ PEL: 10 mg/m ³ Total dust; 5 mg/m ³ Respirable fraction LD50: 3,160 mg/kg, rat, oral in amorphous form <i>EH40 Total inhalable dust OES 10 mg/m³ (8 hours TWA). Total respirable dust OES 4 mg/m³ (8 hours TWA).</i>
SiO ₂	Silicon Dioxide Silica		60676-86-0	TLV: 10 mg/m ³ (Metal dust); 5 mg/m ³ (Welding fumes) PEL: 15 mg/m ³ (Total metal dust); 5 mg/m ³ (Metal dust - respirable fraction) LD ₅₀ : Not Available <i>EH40: Silica, fused respirable dust, OES 0.08 mg/m³ (8-hour TWA)</i>

SrCO ₃	Strontium Carbonate	1633-05-2	TLV: No limit set PEL: No limit set LD50: Not Available
Ti	Titanium	231-142-3 7440-32-6	TLV: No limit set PEL: No limit set LD ₅₀ : Not Available <i>EH40 - As Titanium dioxide: Total inhalable dust OES 10 mg/m³ (8 hours TWA), Total respirable dust OES 4 mg/m³ (8 hours TWA)</i>
Ta	Tantalum	7440-25-7	TLV: 5 mg/m ³ (Metal & oxide dusts) PEL: 5 mg/m ³ (Metal & oxide dusts) LD ₅₀ : Not Available <i>EH40 OES 5.0 mg/m³ (8 hours TWA), 10 mg/m³ (15 minute reference period)</i>
TiO ₂	Titanium Dioxide	13463-67-7	TLV: 10 mg/m ³ (Dust); PEL: 5 mg/m ³ (Respirable) LD ₅₀ : Not Available <i>EH40: Total inhalable dust OES 10.0 mg/m³(8-hour TWA), total respirable OES 4 mg/m³</i>
W	Tungsten	231-143-9 7440-33-7	TLV: 5 mg/m ³ insoluble compounds, as W STEL: 10 mg/m ³ for soluble compounds, as W PEL: No limit set LD ₅₀ : 2,000mg/kg, rat, unreported route <i>EH40: Soluble compounds, OES 1.0 mg/m³ (8-hour TWA) and 3 mg/m³ (15 minute reference period). In-soluble compounds, OES 5 mg/m³(8-hour TWA) and 10.0 mg/m³ (15 minutes reference period)</i>
ZrO ₂	Zirconium Dioxide	1314-23-4	TLV: 5 mg/m ³ (as Zr) 10 mg/m ³ (STEL) PEL: 5 mg/m ³ (as Zr) 10 mg/m ³ (STEL) LD ₅₀ : Not Available <i>EH40 Zirconium compounds (as Zr), OES 5mg/m³ (8-hour TWA), 10 mg/m³ (15-minute reference period)</i>