

# Material Safety Data Sheet

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Revision Date

Revision Number 0

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name** Copper / Copper Alloys  
**Synonyms** Cu.

### Distributor

ThyssenKrupp Materials NA, Inc.  
22355 W. Eleven Mile Road  
Southfield, Michigan 48034  
TEL: 248-233-5681

**Emergency Telephone Number** 248-233-5681

## 2. HAZARDS IDENTIFICATION

### **WARNING!**

### **Emergency Overview**

Non-combustible as supplied.  
Small chips, fines and dust from processing may be readily ignitable.  
Hazardous fumes can also occur in post-processing operations  
Product dust may be irritating to eyes, skin and respiratory system.  
Dust may form explosive mixture in air  
Possibly cancer hazard by inhalation

**Appearance** Silver or yellow to red

**Physical State** Solid.

**Odor** Odorless

### **OSHA Regulatory Status**

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

### **Potential Health Effects**

#### **Principle Routes of Exposure**

Eye contact. Skin contact. Inhalation.

### **Acute Toxicity**

**Eyes**  
**Skin**

Dust contact with the eyes can lead to mechanical irritation.  
Contact with dust can cause mechanical irritation or drying of the skin. Contact with oils from processing may cause irritation. Prolonged skin contact may defat the skin and produce dermatitis. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

**Inhalation**

May be harmful if inhaled. Inhalation of dust in high concentration may cause irritation of respiratory system. Inhalation of fumes may cause metal-fume fever.

**Ingestion**

May be harmful if swallowed. May cause additional affects as listed under "Inhalation".

<b>Chronic Effects</b>	Repeated contact may cause allergic reactions in very susceptible persons. Avoid repeated exposure. Prolonged exposure may cause chronic effects. Repeated or prolonged skin contact may cause skin irritation and/or dermatitis and sensitization of susceptible persons. May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination. May cause adverse effects on the bone marrow and blood-forming system. May cause adverse liver effects.  Elevated temperature processing such as welding and plasma arc cutting may release hazardous fumes. Inhalation of beryllium dust or fume may cause chronic beryllium disease (CBD) and is a cancer hazard. Overexposure to metal fumes may cause pulmonary edema (fluid in the lungs) and methemoglobinemia. May also cause pulmonary fibrosis and lung cancer. Lead compounds may be absorbed by ingestion, by inhalation and through the skin. Lead may damage kidney function, the blood forming system and the reproductive system. Inorganic lead compounds can cause developmental damage.
<b>Aggravated Medical Conditions</b>	Allergies. Skin disorders. Respiratory disorders. Central nervous system. Pre-existing eye disorders. Blood disorders. Kidney disorders. Liver disorders. Nasal cavities. Lungs.
<b>Interactions with Other Chemicals</b>	Irritants. Sensitizers. Epoxies. Use of alcoholic beverages may enhance toxic effects.
<b>Environmental Hazard</b>	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. See Section 12 for additional Ecological Information.

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

Each alloy may contain one or more of the following ingredients. Consult the Technical Data Sheet for the composition of specific alloys.

Chemical Name	CAS-No	Weight %
Copper	7440-50-8	45.00-99.00
Zinc oxide	1314-13-2	0.00-40.0
Nickel	7440-02-0	0.00-33.0
Lead	7439-92-1	0.00-16.0
Aluminum	7429-90-5	0.00-13.50
Tin	7440-31-5	0.00-13.0
Iron oxide	1309-37-1	0.00-5.50
Manganese	7439-96-5	0.00-5.0
Silicon	7440-21-3	0.01-0.5
Thallium	7440-28-0	0.00-3.4
Cobalt	7440-48-4	0.00-2.70
Beryllium	7440-41-7	0.00-2.00
Cadmium and compounds (as Cd)	7440-43-9	0.00-1.00
Arsenic	7440-38-2	0.00-0.50
Sulfur dioxide	7446-09-5	0.00-0.30
Zirconium	7440-67-7	0.00-0.25

Copper and Copper Alloys may be comprised of all or variations of the alloys shown here.

#### 4. FIRST AID MEASURES

<b>Eye Contact</b>	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Keep eye wide open while rinsing. Consult a physician.
<b>Skin Contact</b>	Wash skin with soap and water. In the case of skin irritation or allergic reactions see a physician.
<b>Inhalation</b>	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Consult a physician.
<b>Ingestion</b>	Do NOT induce vomiting. Call a physician or Poison Control Center immediately. Drink plenty of water. Never give anything by mouth to an unconscious person.
<b>Notes to Physician</b>	May cause sensitization of susceptible persons. Treat symptomatically.

#### 5. FIRE-FIGHTING MEASURES

<b>Flammable Properties</b>	This product does not present fire or explosion hazards as shipped. Small chips, fines, and dust from processing may be readily ignitable.
<b>Flash Point</b>	Not applicable.
<b>Suitable Extinguishing Media</b>	Class D extinguishing agents on fines, dust or molten metal. Use coarse water spray on chips and fines.
<b>Unsuitable Extinguishing Media</b>	DO NOT use halogenated extinguishing agents on small chips or fines. DO NOT use water for fires involving molten metal. These fire extinguishing agents will react with burning material.
<b>Explosion Data</b>	
<b>Sensitivity to Mechanical Impact</b>	None
<b>Sensitivity to Static Discharge</b>	None
<b>Specific Hazards Arising from the Chemical</b>	Thermal decomposition can lead to release of irritating gases and vapors. In the event of fire and/or explosion do not breathe fumes. May cause sensitization by inhalation and skin contact.
<b>Protective Equipment and Precautions for Firefighters</b>	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

<b><u>NFPA</u></b>	<b>Health Hazard 2</b>	<b>Flammability 0</b>	<b>Instability 0</b>	<b>Physical and Chemical Hazards -</b>
<b><u>HMIS</u></b>	<b>Health Hazard 2*</b>	<b>Flammability 0</b>	<b>Physical Hazard 0</b>	<b>Personal Protection X</b>

\*Indicates a chronic health hazard.

#### 6. ACCIDENTAL RELEASE MEASURES

<b>Personal Precautions</b>	Use personal protective equipment. Keep people away from and upwind of spill/leak.
<b>Environmental Precautions</b>	Prevent further leakage or spillage if safe to do so. Prevent product from entering drains. Do not flush into surface water or sanitary sewer system.
<b>Methods for Containment</b>	Prevent further leakage or spillage if safe to do so.
<b>Methods for Cleaning Up</b>	Avoid dust formation. Collect scrap for recycling.  If product is molten, contain the flow using dry sand or salt flux as a dam. All tools and containers which come in contact with molten metal must be preheated or specially coated and rust free. Allow the spill to cool before remelting as scrap.

## 7. HANDLING AND STORAGE

**Handling**

Avoid contact with skin, eyes and clothing. Wear personal protective equipment. Avoid dust formation. Keep material dry. Avoid contact with sharp edges or heated material. Hot and cold aluminum are not visually different. Hot aluminum does not always glow red.

**Storage**

Keep container tightly closed in a dry and well-ventilated place.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Copper 7440-50-8	TWA: 0.2 mg/m <sup>3</sup> fume	TWA: 0.1 mg/m <sup>3</sup> fume TWA: 1 mg/m <sup>3</sup> dust and mist (vacated) TWA: 0.1 mg/m <sup>3</sup> Cu dust, fume, mist	IDLH: 100 mg/m <sup>3</sup> dust, fume and mist TWA: 1 mg/m <sup>3</sup> dust and mist TWA: 0.1 mg/m <sup>3</sup> fume
Aluminum 7429-90-5	TWA: 1 mg/m <sup>3</sup> respirable fraction	TWA: 15 mg/m <sup>3</sup> total dust TWA: 5 mg/m <sup>3</sup> respirable fraction (vacated) TWA: 15 mg/m <sup>3</sup> total dust (vacated) TWA: 5 mg/m <sup>3</sup> respirable fraction	TWA: 10 mg/m <sup>3</sup> total dust TWA: 5 mg/m <sup>3</sup> respirable dust
Antimony 7440-36-0	TWA: 0.5 mg/m <sup>3</sup>	TWA: 0.5 mg/m <sup>3</sup> (vacated) TWA: 0.5 mg/m <sup>3</sup>	IDLH: 50 mg/m <sup>3</sup> TWA: 0.5 mg/m <sup>3</sup>
Arsenic 7440-38-2	TWA: 0.01 mg/m <sup>3</sup>	TWA: 10 µg/m <sup>3</sup> As Action Level: 5 µg/m <sup>3</sup> As (vacated) TWA: 0.5 mg/m <sup>3</sup>	IDLH: 5 mg/m <sup>3</sup> Ceiling: 0.002 mg/m <sup>3</sup> 15 min
Beryllium 7440-41-7	TWA: 0.00005 mg/m <sup>3</sup> inhalable fraction S*	TWA: 2 µg/m <sup>3</sup> (vacated) TWA: 2 µg/m <sup>3</sup> (vacated) STEL: 25 µg/m <sup>3</sup> 30 min (vacated) Ceiling: 5 µg/m <sup>3</sup> Ceiling: 5 µg/m <sup>3</sup> Be	IDLH: 4 mg/m <sup>3</sup> Ceiling: 0.0005 mg/m <sup>3</sup>
Cadmium and compounds (as Cd) 7440-43-9	TWA: 0.01 mg/m <sup>3</sup> TWA: 0.002 mg/m <sup>3</sup> respirable fraction	TWA: 0.1 mg/m <sup>3</sup> fume applies to any operations or sectors for which the Cadmium standard is stayed or otherwise not in effect TWA: 0.2 mg/m <sup>3</sup> dust applies to any operations or sectors for which the Cadmium standard is stayed or otherwise not in effect TWA: 5 µg/m <sup>3</sup> Action Level: 2.5 µg/m <sup>3</sup> (vacated) STEL: 0.3 ppm fume Ceiling: 0.3 mg/m <sup>3</sup> fume applies to any operations or sectors for which the Cadmium standard is stayed or otherwise not in effect Ceiling: 0.6 mg/m <sup>3</sup> dust applies to any operations or sectors for which the Cadmium standard is stayed or otherwise not in effect	IDLH: 9 mg/m <sup>3</sup> dust
Cobalt 7440-48-4	TWA: 0.02 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup> dust and fume (vacated) TWA: 0.05 mg/m <sup>3</sup> dust and fume	IDLH: 20 mg/m <sup>3</sup> dust and fume TWA: 0.05 mg/m <sup>3</sup> dust and fume
Lead 7439-92-1	TWA: 0.05 mg/m <sup>3</sup>	TWA: 50 µg/m <sup>3</sup> Action Level: 30 µg/m <sup>3</sup> Poison, See 29 CFR 1910.1025	IDLH: 100 mg/m <sup>3</sup> TWA: 0.050 mg/m <sup>3</sup>
Iron oxide 1309-37-1	TWA: 5 mg/m <sup>3</sup> respirable fraction	TWA: 10 mg/m <sup>3</sup> fume (vacated) TWA: 10 mg/m <sup>3</sup> fume (vacated) TWA: 1 mg/m <sup>3</sup> fume (vacated) STEL: 3 mg/m <sup>3</sup> fume (vacated) Ceiling: 5 mg/m <sup>3</sup> Ceiling: 5 mg/m <sup>3</sup> fume	IDLH: 2500 mg/m <sup>3</sup> Fe dust and fume TWA: 5 mg/m <sup>3</sup> Fe dust and fume
Manganese 7439-96-5	TWA: 0.2 mg/m <sup>3</sup>	TWA: 10 mg/m <sup>3</sup> fume (vacated) TWA: 1 mg/m <sup>3</sup> fume (vacated) STEL: 3 mg/m <sup>3</sup> fume (vacated) Ceiling: 5 mg/m <sup>3</sup> Ceiling: 5 mg/m <sup>3</sup> fume	IDLH: 500 mg/m <sup>3</sup> TWA: 1 mg/m <sup>3</sup> fume STEL: 3 mg/m <sup>3</sup>
Silicon 7440-21-3		TWA: 15 mg/m <sup>3</sup> total dust TWA: 5 mg/m <sup>3</sup> respirable fraction (vacated) TWA: 10 mg/m <sup>3</sup> total dust (vacated) TWA: 5 mg/m <sup>3</sup> respirable fraction	TWA: 10 mg/m <sup>3</sup> total dust TWA: 5 mg/m <sup>3</sup> respirable dust
Nickel 7440-02-0	TWA: 1.5 mg/m <sup>3</sup>	TWA: 1 mg/m <sup>3</sup> (vacated) TWA: 1 mg/m <sup>3</sup>	IDLH: 10 mg/m <sup>3</sup> TWA: 0.015 mg/m <sup>3</sup>
Zinc oxide 1314-13-2	STEL: 10 mg/m <sup>3</sup> respirable fraction TWA: 2 mg/m <sup>3</sup> respirable fraction	TWA: 5 mg/m <sup>3</sup> fume TWA: 15 mg/m <sup>3</sup> total dust TWA: 5 mg/m <sup>3</sup> respirable fraction (vacated) TWA: 5 mg/m <sup>3</sup> fume (vacated) TWA: 10 mg/m <sup>3</sup> total dust (vacated) TWA: 5 mg/m <sup>3</sup> respirable fraction (vacated) STEL: 10 mg/m <sup>3</sup> fume	IDLH: 500 mg/m <sup>3</sup> Ceiling: 15 mg/m <sup>3</sup> dust TWA: 5 mg/m <sup>3</sup> dust and fume STEL: 10 mg/m <sup>3</sup> fume

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Tellurium 13494-80-9	TWA: 0.1 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup> (vacated) TWA: 0.1 mg/m <sup>3</sup>	IDLH: 25 mg/m <sup>3</sup> TWA: 0.1 mg/m <sup>3</sup>
Silver 7440-22-4	TWA: 0.1 mg/m <sup>3</sup> dust and fume	TWA: 0.01 mg/m <sup>3</sup> (vacated) TWA: 0.01 mg/m <sup>3</sup>	IDLH: 10 mg/m <sup>3</sup> dust TWA: 0.01 mg/m <sup>3</sup> dust
Thallium 7440-28-0	TWA: 0.02 mg/m <sup>3</sup> inhalable fraction S*	(vacated) TWA: 0.1 mg/m <sup>3</sup> (vacated) S*	
Tin 7440-31-5	TWA: 2 mg/m <sup>3</sup>	TWA: 2 mg/m <sup>3</sup> Sn except oxides (vacated) TWA: 2 mg/m <sup>3</sup>	IDLH: 100 mg/m <sup>3</sup> TWA: 2 mg/m <sup>3</sup>
Zirconium 7440-67-7	STEL: 10 mg/m <sup>3</sup> TWA: 5 mg/m <sup>3</sup>	TWA: 5 mg/m <sup>3</sup> Zr (vacated) TWA: 5 mg/m <sup>3</sup> (vacated) STEL: 10 mg/m <sup>3</sup>	IDLH: 50 mg/m <sup>3</sup> TWA: 5 mg/m <sup>3</sup> STEL: 10 mg/m <sup>3</sup>
Sulfur dioxide 7446-09-5	STEL: 0.25 ppm	TWA: 5 ppm TWA: 13 mg/m <sup>3</sup> (vacated) TWA: 2 ppm (vacated) TWA: 5 mg/m <sup>3</sup> (vacated) STEL: 5 ppm (vacated) STEL: 15 mg/m <sup>3</sup>	IDLH: 100 ppm TWA: 2 ppm TWA: 5 mg/m <sup>3</sup> STEL: 5 ppm STEL: 13 mg/m <sup>3</sup>
Phosphorus 7723-14-0		TWA: 0.1 mg/m <sup>3</sup> (vacated) TWA: 0.1 mg/m <sup>3</sup>	IDLH: 5 mg/m <sup>3</sup> TWA: 0.1 mg/m <sup>3</sup>

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

**Other Exposure Guidelines**

Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992). Hexavalent chrome may be formed during welding.

**Engineering Measures**

Showers  
Eyewash stations  
Ventilation systems

**Personal Protective Equipment****Eye/Face Protection**

Safety glasses with side-shields.

**Skin and Body Protection**

Impervious clothing. Impervious gloves.

**Respiratory Protection**

If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

**Hygiene Measures**

Do not breathe vapors/dust. When using, do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. Keep away from food, drink and animal feeding stuffs.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Appearance</b>	Silver or yellow to red.	<b>Odor</b>	Odorless.
<b>Odor Threshold</b>	No information available	<b>Physical State</b>	Solid
<b>pH</b>	No information available.		
<b>Flash Point</b>	Not applicable.	<b>Autoignition Temperature</b>	No information available.
<b>Decomposition Temperature</b>	No information available.	<b>Boiling Point/Boiling Range</b>	No information available
<b>Melting Point/Range</b>	1290 - 2260°F		
<b>Flammability Limits in Air</b>	No information available.		
<b>Specific Gravity</b>	2.5-2.9	<b>Water Solubility</b>	Insoluble in water.
<b>Solubility</b>	No information available.	<b>Evaporation Rate</b>	No information available
<b>Vapor Pressure</b>	No data available.	<b>Vapor Density</b>	No data available.

**10. STABILITY AND REACTIVITY**

<b>Stability</b>	Stable under recommended storage conditions.
<b>Incompatible Products</b>	Acids. Alkalies. Water. Moisture. Metal oxides.
<b>Conditions to Avoid</b>	Dust formation. Heat, flames and sparks.
<b>Hazardous Decomposition Products</b>	Metal fume. Copper compounds. Lead oxides. Lead and chromium compounds.
<b>Hazardous Polymerization</b>	Hazardous polymerization does not occur.

## 11. TOXICOLOGICAL INFORMATION

### Acute Toxicity

#### Product Information

#### Inhalation

May cause irritation of respiratory tract. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count.

#### Eye Contact

Dust contact with the eyes can lead to mechanical irritation.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Antimony	= 7 g/kg ( Rat )		
Arsenic	= 763 mg/kg ( Rat )		
Cadmium and compounds (as Cd)	= 2330 mg/kg ( Rat )		= 8 mg/L ( Rabbit ) 4 h
Bismuth	= 5 g/kg ( Rat )		
Cobalt	= 6170 mg/kg ( Rat )		> 10 mg/L ( Rat ) 1 h
Iron oxide	> 10000 mg/kg ( Rat )		
Magnesium	= 230 mg/kg ( Rat )		
Manganese	= 9 g/kg ( Rat )		
Silicon	= 3160 mg/kg ( Rat )		
Nickel	> 9000 mg/kg ( Rat )		
Zinc oxide	> 5000 mg/kg ( Rat )		
Tellurium	= 83 mg/kg ( Rat )		> 2420 mg/m <sup>3</sup> ( Rat ) 4 h
Silver	2000 mg/kg ( Rat )		
Sulfur dioxide		-	Per CGA P-20: 2500 ppm/1hr ( Rat )
Phosphorus	= 3.03 mg/kg ( Rat )	= 100 mg/kg ( Rat )	= 4.3 mg/L ( Rat ) 1 h

### Chronic Toxicity

#### Chronic Toxicity

Repeated contact may cause allergic reactions in very susceptible persons. Avoid repeated exposure. Prolonged exposure may cause chronic effects. Repeated or prolonged skin contact may cause skin irritation and/or dermatitis and sensitization of susceptible persons. May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination. May cause adverse effects on the bone marrow and blood-forming system. May cause adverse liver effects.

Elevated temperature processing such as welding and plasma arc cutting may release hazardous fumes. Inhalation of beryllium dust or fume may cause chronic beryllium disease (CBD) and is a cancer hazard. Overexposure to metal fumes may cause pulmonary edema (fluid in the lungs) and methemoglobinemia. May also cause pulmonary fibrosis and lung cancer. Lead compounds may be absorbed by ingestion, by inhalation and through the skin. Lead may damage kidney function, the blood forming system and the reproductive system. Inorganic lead compounds can cause developmental damage.

#### Carcinogenicity

This product contains one or more substances which are classified by IARC as carcinogenic to humans (Group I), probably carcinogenic to humans (Group 2A) or possibly carcinogenic to humans (Group 2B).

Chemical Name	ACGIH	IARC	NTP	OSHA
Nickel		Group 2B Group 1	Reasonably Anticipated	X
Lead	A3	Group 2A	Reasonably Anticipated	X
Iron oxide		Group 3		
Cobalt	A3	Group 2A Group 2B		X
Beryllium	A1	Group 1	Known	X
Cadmium and compounds (as Cd)	A2	Group 1	Known	X
Arsenic	A1	Group 1	Known	X
Sulfur dioxide		Group 3	-	-



**ACGIH: (American Conference of Governmental Industrial Hygienists)**

A3 - Animal Carcinogen

**IARC: (International Agency for Research on Cancer)**

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

**NTP: (National Toxicity Program)**

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

**OSHA: (Occupational Safety & Health Administration)**

X - Present

**Target Organ Effects**

Blood. Central nervous system (CNS). Eyes. Kidney. Liver. Lungs. Nasal cavities. Respiratory system. Skin.

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Copper	EC50 96 h: 0.031 - 0.054 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: 0.0426 - 0.0535 mg/L static (Pseudokirchneriella subcapitata)	LC50 96 h: 0.0068 - 0.0156 mg/L (Pimephales promelas) LC50 96 h: < 0.3 mg/L static (Pimephales promelas) LC50 96 h: = 0.052 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 0.112 mg/L flow-through (Poecilia reticulata) LC50 96 h: = 0.2 mg/L flow-through (Pimephales promelas) LC50 96 h: = 0.3 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 0.8 mg/L static (Cyprinus carpio) LC50 96 h: = 1.25 mg/L static (Lepomis macrochirus)	-	EC50 48 h: = 0.03 mg/L Static (Daphnia magna)
Zinc oxide	Selenastrum capricornutum 72-hour EC50: 0.14 mg/l	Oncorhynchus mykiss 96-hour LC50: 0.14 mg/l		Daphnia magna 48-hour EC50: 0.07 mg/l
Nickel	EC50 96 h: 0.174 - 0.311 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 0.18 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 1.3 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 10.4 mg/L static (Cyprinus carpio) LC50 96 h: > 100 mg/L (Brachydanio rerio)	-	EC50 48 h: = 1 mg/L Static (Daphnia magna) EC50 48 h: > 100 mg/L (Daphnia magna)
Lead		LC50 96 h: = 0.44 mg/L semi-static (Cyprinus carpio) LC50 96 h: = 1.17 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 1.32 mg/L static (Oncorhynchus mykiss)		EC50 48 h: = 600 µg/L (water flea)
Cobalt	-	LC50 96 h: > 100 mg/L static (Brachydanio rerio)	-	-
Cadmium and compounds (as Cd)		LC50 96 h: 0.0004-0.003 mg/L (Pimephales promelas) LC50 96 h: = 0.002 mg/L (Cyprinus carpio) LC50 96 h: = 0.003 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 0.006 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 0.016 mg/L (Oryzias latipes) LC50 96 h: = 0.24 mg/L static (Cyprinus carpio) LC50 96 h: = 21.1 mg/L flow-through (Lepomis macrochirus) LC50 96 h: = 4.26 mg/L semi-static (Cyprinus carpio)		EC50 48 h: = 0.0244 mg/L Static (Daphnia magna)

**13. DISPOSAL CONSIDERATIONS**

**Waste Disposal Methods** Dispose of in accordance with local regulations.

**Contaminated Packaging** Do not re-use empty containers.

**US EPA Waste Number**  
 D006  
 D007  
 D008  
 D011

Chemical Name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Nickel - 7440-02-0	(hazardous constituent - no waste number)	Included in waste streams: F006, F039		
Lead - 7439-92-1	(hazardous constituent - no waste number)	Included in waste streams: F035, F037, F038, F039, K002, K003, K005, K046, K048, K049, K051, K052, K061, K062, K064, K065, K066, K069, K086, K100, K176	= 5.0 mg/L regulatory level	
Thallium - 7440-28-0		Included in waste streams: F039, K178		
Beryllium - 7440-41-7	P015	Included in waste stream: F039		
Cadmium and compounds (as Cd) - 7440-43-9		Included in waste streams: F006, F039, K061, K069, K100	1.0 mg/L regulatory level	
Arsenic - 7440-38-2		Included in waste streams: F032, F034, F035, F039, K031, K060, K084, K101, K102, K161, K171, K172, K176	5.0 mg/L regulatory level	

Chemical Name	RCRA - Halogenated Organic Compounds	RCRA - P Series Wastes	RCRA - F Series Wastes	RCRA - K Series Wastes
Beryllium - 7440-41-7		P015		

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste
Copper	Toxic
Zinc oxide	Toxic
Nickel	Toxic powder Ignitable powder
Lead	Toxic
Aluminum	Ignitable powder
Manganese	Ignitable powder
Cobalt	Toxic powder Ignitable powder
Zirconium	Ignitable powder

## 14. TRANSPORT INFORMATION

<u>DOT</u>	Not regulated
<u>TDG</u>	Not regulated
<u>MEX</u>	Not regulated

## 15. REGULATORY INFORMATION

### International Inventories

TSCA	Complies
DSL	Complies
EINECS	Complies
ENCS	Complies
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

### Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory  
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

### U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372:

Chemical Name	CAS-No	Weight %	SARA 313 - Threshold Values %
Copper	7440-50-8	99.99	1.0
Aluminum	7429-90-5	13.5	1.0
Arsenic	7440-38-2	0.5	0.1
Beryllium	7440-41-7	2	0.1
Cadmium and compounds (as Cd)	7440-43-9	1	0.1
Chromium	7440-47-3	4	1.0
Cobalt	7440-48-4	2.7	0.1
Lead	7439-92-1	16	0.1
Manganese	7439-96-5	5	1.0
Nickel	7440-02-0	33	0.1
Thallium	7440-28-0	3.4	1.0
Zinc oxide	1314-13-2	40	1.0

### SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

**Clean Water Act**

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42):

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Copper		X	X	
Antimony		X	X	
Arsenic		X	X	
Beryllium		X	X	
Cadmium and compounds (as Cd)		X	X	
Lead		X	X	
Nickel		X	X	
Silver		X	X	
Thallium		X	X	
Phosphorus	1 lb			X

**CERCLA**

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Copper	5000 lb		RQ 5000 lb final RQ RQ 2270 kg final RQ
Antimony	5000 lb		RQ 5000 lb final RQ RQ 2270 kg final RQ
Arsenic	1 lb		RQ 1 lb final RQ RQ 0.454 kg final RQ
Beryllium	10 lb		RQ 10 lb final RQ RQ 4.54 kg final RQ
Chromium			RQ 5000 lb final RQ RQ 2270 kg final RQ
Cadmium and compounds (as Cd)	10 lb		RQ 10 lb final RQ RQ 4.54 kg final RQ
Lead	10 lb		RQ 10 lb final RQ RQ 4.54 kg final RQ
Nickel	100 lb		RQ 100 lb final RQ RQ 45.4 kg final RQ
Silver	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ
Thallium	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ
Sulfur dioxide		500 lb	
Phosphorus	1 lb	1 lb	RQ 1 lb final RQ RQ 0.454 kg final RQ

**U.S. State Regulations****California Proposition 65**

This product contains the following Proposition 65 chemicals:

Chemical Name	CAS-No	California Prop. 65
Arsenic	7440-38-2	Carcinogen
Beryllium	7440-41-7	Carcinogen
Cadmium and compounds (as Cd)	7440-43-9	Carcinogen Developmental Male Reproductive
Cobalt	7440-48-4	Carcinogen
Lead	7439-92-1	Carcinogen Developmental Female Reproductive Male Reproductive
Nickel	7440-02-0	Carcinogen

**U.S. State Right-to-Know Regulations**

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Copper	X	X	X	X	X
Aluminum	X	X	X		X
Antimony	X	X	X	X	X
Arsenic	X	X	X	X	X
Beryllium	X	X	X	X	X
Chromium		X			X
Cadmium and compounds (as Cd)	X	X	X	X	X
Cobalt	X	X	X	X	X
Lead	X	X	X	X	X
Iron oxide	X	X	X		X
Magnesium	X	X	X		X
Manganese	X	X	X	X	X
Silicon	X	X	X		X
Nickel	X	X	X	X	X
Zinc oxide	X	X	X		X
Tellurium	X	X	X		X
Silver	X	X	X		X
Thallium	X	X	X		X
Tin	X	X	X		X
Zirconium	X	X	X		X
Sulfur dioxide	X	X	X		X
Phosphorus	X	X	X	X	X

**International Regulations**

Chemical Name	Carcinogen Status	Exposure Limits
Copper		Mexico: TWA= 1 mg/m <sup>3</sup> Mexico: TWA= 0.2 mg/m <sup>3</sup> Mexico: STEL= 2 mg/m <sup>3</sup>
Aluminum		Mexico: TWA= 10 mg/m <sup>3</sup>
Antimony		Mexico: TWA 0.5 mg/m <sup>3</sup>
Arsenic	A1	Mexico: TWA 0.01 mg/m <sup>3</sup>
Beryllium	A2	Mexico: TWA 0.002 mg/m <sup>3</sup>
Chromium		Mexico: TWA 0.5 mg/m <sup>3</sup>
Cadmium and compounds (as Cd)	A2	Mexico: TWA 0.01 mg/m <sup>3</sup> Mexico: TWA 0.002 mg/m <sup>3</sup>
Cobalt	A3	Mexico: TWA= 0.1 mg/m <sup>3</sup>
Lead	A3	Mexico: TWA= 0.15 mg/m <sup>3</sup>
Iron oxide		Mexico: TWA 5 mg/m <sup>3</sup> Mexico: STEL 10 mg/m <sup>3</sup>
Manganese		Mexico: TWA 0.2 mg/m <sup>3</sup> Mexico: TWA 1 mg/m <sup>3</sup> Mexico: STEL 3 mg/m <sup>3</sup>
Silicon		Mexico: TWA 10 mg/m <sup>3</sup> Mexico: STEL 20 mg/m <sup>3</sup>
Nickel		Mexico: TWA 1 mg/m <sup>3</sup>
Zinc oxide		Mexico: TWA 5 mg/m <sup>3</sup> Mexico: TWA 10 mg/m <sup>3</sup> Mexico: STEL 10 mg/m <sup>3</sup>
Tellurium		Mexico: TWA 0.1 mg/m <sup>3</sup>
Silver		Mexico: TWA 0.1 mg/m <sup>3</sup>
Tin		Mexico: TWA 2 mg/m <sup>3</sup> Mexico: STEL 4 mg/m <sup>3</sup>
Zirconium		Mexico: TWA 5 mg/m <sup>3</sup> Mexico: STEL 10 mg/m <sup>3</sup>
Sulfur dioxide		Mexico: TWA 2 ppm Mexico: TWA 5 mg/m <sup>3</sup> Mexico: STEL 5 ppm Mexico: STEL 10 mg/m <sup>3</sup>
Phosphorus		Mexico: TWA 0.1 mg/m <sup>3</sup> Mexico: STEL 0.3 mg/m <sup>3</sup>

**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**WHMIS Hazard Class**

Non-controlled

Chemical Name	NPRI
Aluminum	X
Arsenic	X
Chromium	X
Cadmium and compounds (as Cd)	X
Cobalt	X
Lead	X
Nickel	X
Sulfur dioxide	X
Phosphorus	X

**Legend**

NPRI - National Pollutant Release Inventory

## 16. OTHER INFORMATION

**Prepared By** Product Stewardship  
23 British American Blvd.  
Latham, NY 12110  
1-800-572-6501

**Issuing Date** 23-Nov-2011

**Revision Date**

**Revision Note** Initial Release.

**General Disclaimer**

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

**Copper Alloy Composite Sheet**  
 ThyssenKrupp Materials NA, Inc.  
 22355 West Eleven Mile Road  
 Southfield, MI 48034  
 248.233.5681

**Rem = Remaining Percent**  
**Nominal Amount Identified When Available**  
**Percent Maximum, unless shown as Range or Minimum**

Issued November 23, 2011		Ag	Al	As	Be	Bi	Cd	Co	Cr	Fe	Mg	Mn	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Te	Ti	Zn	Zr	
Copper Alloy	UNS No.	Copper %	Silver %	Aluminum %	Arsenic %	Beryllium %	Bismuth %	Cadmium %	Cobalt %	Chromium %	Iron %	Magnesium %	Manganese %	Nickel %	Oxygen %	Phosphorus %	Lead %	Sulfur %	Antimony %	Selenium %	Silicon %	Tin %	Tellurium %	Titanium %	Zinc %	Zirconium %
C10100 Oxygen Free Electronic Copper		99.99 min.																								
C10200 OF Copper		99.95 min. (a)																								
C10300 Oxygen Free Extra Low Phosphorus		99.95 min. (a), (b)																								
C10400 Silver Bearing OFHC Copper		99.95 min. (a)	0.027																							
C10700 Silver Bearing OFHC Copper		99.95 min. (a)	0.085																							
C10800 Oxygen Free Low Phosphorus		99.95 min. (a), (b)																								
C11000 Electrolytic Tough Pitch Copper		99.90 min. (a)												0.04												
C11020 FRHC		99.90 min. (a)																								
C11300 Silver Bearing Copper		99.90 min. (a)	0.027 min																							
C11400 Silver Bearing Copper		99.90 min. (a)	0.034 min																							
C11500 Silver Bearing Copper		99.90 min. (a)	0.064 min																							
C11600 Silver Bearing Copper		99.90 min. (a)	0.085 min																							
C12000 Phosphorized Copper DLP		99.90 min. (a)																								
C12100 Phosphorized Copper DLP		99.90 min. (a)	.014 min																							
C12200 Phosphorized Copper		99.90 min. (a)																								
C12900 FRSTP		99.89 min. (a)	0.054																							
C14200 Arsenical Copper DPA		99.40 min. (a)				0.003																				
C14420 Cadmium Copper Deoxidized		99.90 min. (c)																								
C14500 Tellurium Copper		99.90 min. (a), (d)																								
C14520 DPTE		99.90 min. (a), (d)																								
C14530 DPTE		99.90 min. (e)																								
C14700 OFHC Sulfur copper		99.90 min. (a), (b), (f)																								
C15000 Amzinc/Zirconium CuJAMPCCO 910 EXTR		Rem (Nominal 99.9%) (a)																								
C15500 DPTE		99.75 min. (a)	0.027-.10																							
C16200 Cadmium Copper		Rem (Nominal 99.0%) (a)					7-12			0.02																
C16500 Cadmium Copper		Rem (Nominal 98.6%) (a)					6-10			0.02																
C17000 Beryllium Copper (g)		Rem (Nominal 98.3%) (a)		0.2	1.60-1.85			2 min (g)																		
C17200 Beryllium Copper (g)		Rem (Nominal 98.1%) (a)		0.2	1.80-2.00			2 min (g)																		
C17300 Beryllium Copper (g)		Rem (Nominal 97.7%) (a)		0.2	1.80-2.00			2 min (g)																		
C17410 Beryllium Copper		Rem (Nominal 98.6%) (a)		0.2	.15-.50			.35-.6		0.2																
C17500 Beryllium Copper		Rem (Nominal 96.9%) (a)		0.2	.4-.7			2.4-2.7		0.1																
C17510 Beryllium Copper		Rem (Nominal 97.8%) (a)		0.2	2-6			0.3		0.1																
C18000 Ni Chromium Cop. AMPCCO 940 EXTR.		Remaining (Rem) (a)							10-80	0.15																
C18135 High Copper Alloy		Rem (Nominal 99.2%) (a)					20-6		20-60																	
C18140 High Copper Alloy		Remaining (Rem) (a)							15-45																	
C18150 High Copper AMPCCO 972 EXTR.		Rem (Nominal 99.9%) (a)							50-1.5																	
C18200 Chromium Copper AMPCCO 97 EXTR.		Rem (Nominal 99.1%) (a)							6-1.2	0.1																
C18700 Leaded Copper		99.5 min. (a) & (f)																								
C19100 Chromium Copper		Rem (Nominal 98.2%) (a)								0.2																
C19150 High Copper Alloy		Rem (Nominal 97.4%) (a)								0.05																
C19400 High Copper Alloy		97.0 min.								2.1-2.6																
C19500 High Copper Alloy		96.0 min.		0.02					1.0-2.0																	
C19700 High Copper Alloy		Remaining (Rem)								30-1.2	0.1-20	0.05														
C19800 High Copper Alloy		Remaining (Rem)																								
C21000 Gilding		94.0-96.0								0.05																
C22000 Commercial Bronze		89.0-91.0								0.05																



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Copper Alloy	Ag	Al	As	Be	Bi	Cd	Co	Cr	Fe	Mg	Mn	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Te	Ti	Zn	Zr
UNS No.	Silver %	Aluminum %	Arsenic %	Beryllium %	Bismuth %	Cadmium %	Cobalt %	Chromium %	Iron %	Magnesium %	Manganese %	Nickel %	Oxygen %	Phosphorus %	Lead %	Sulfur %	Antimony %	Selenium %	Silicon %	Tin %	Tellurium %	Titanium %	Zinc %	Zirconium %
C22600									0.05						0.05									Rem
C23000									0.05						0.05									Rem
C24000									0.05						0.05									Rem
C26000									0.05						0.07									Rem
C26800									0.05						0.09									Rem
C27000									0.07						0.09									Rem
C27200									0.07						0.07									Rem
C27400									0.05						0.09									Rem
C28000									0.07						0.09									Rem
C31400									0.1			0.7			1.3-2.5									Rem
C31600									0.1			7-1.2		.04-1.0	1.3-2.5									Rem
C32000									0.1			0.25			1.5-2.2									Rem
C33000									0.07						.25-7									Rem
C33200									0.07						1.5-2.5									Rem
C33500									0.15 (f)						.25-7									Rem
C34000									0.15 (f)						8-1.5									Rem
C34200									0.15 (f)						1.5-2.5									Rem
C34500									0.15						1.5-2.5									Rem
C35000									0.15 (f)						8-2.0									Rem
C35300									0.15 (f)						1.5-2.5									Rem
C35600									0.15 (f)						2.0-3.0									Rem
C36000									0.04-0.30						2.5-3.0									Rem
C36500									0.15						.25-7					0.25				Rem
C37000									0.15						8-1.5									Rem
C37700									0.3						1.5-2.5									Rem
C38000									0.35						1.5-2.5					0.3				Rem
C38500									0.35						2.5-3.5									Rem
C40400									0.05															2.0-3.0
C40500									0.05						0.05									Rem
C41100									0.05						0.09									Rem
C42500									0.05						0.35									Rem
C43500									0.05						0.09									Rem
C44300									0.06						0.07									Rem
C44400									0.06						0.07									Rem
C44500									0.06						0.07									Rem
C46200									0.1						0.2									Rem
C46400									0.1						0.2									Rem
C46500									0.1						0.2									Rem
C48200									0.1						40-1.0									Rem
C48500									0.1						1.3-2.2									Rem
C50500									0.1						.03-35									0.3
C51000									0.1						.03-35									0.3
C51100									0.1						.03-35									0.3
C52100									0.1						.03-35									0.2
C52400									0.1						.03-35									0.2
C53400									0.1						.03-35									0.3
C54400									0.1						.01-50									1.5-4.5
C61000									6.0-8.5						Rem (Nominal 92.0%) (a)									0.2
C61300									6.0-7.5						Rem (Nominal 90.3%) (a)									0.1 (f)
C61400									6.0-8.0						Rem (Nominal 91.0%) (a)									0.2
C62300									8.5-10.0						Rem (Nominal 87.0%) (a)									0.2

**Copper Alloy Composite Sheet**  
**ThyssenKrupp Materials NA, Inc.**  
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Issued November 23, 2011

Copper Alloy UNS No.	Name	Ag	Al	As	Be	Bi	Cd	Co	Cr	Fe	Mg	Mn	Ni	O	P	S	Sb	Se	Si	Sn	Te	Ti	Zn	Zr	
		Silver %	Alum. num %	Arsenic %	Beryllium %	Bismuth %	Cadmium %	Cobalt %	Chromium %	Iron %	Magnesium %	Manganese %	Nickel %	Oxygen %	Phosphorus %	Sulfur %	Antimony %	Selenium %	Silicon %	Tin %	Tellurium %	Titanium %	Zinc %	Zirconium %	
C62400	Aluminum Bronze AMPCO 18 EXTR.		10.0-11.5							2.0-4.5		0.3							0.25	0.2					
C62500	Aluminum Bronze		12.5-13.5							3.5-5.5		2.0							0.25	0.2					
C63000	Nickel Bronze AMPCO 45		9.0-11.0							2.0-4.0		1.5	4.0-5.5 (h)						0.25	0.2					
C64200	Aluminum Bronze		6.3-7.6	0.09						0.3		0.1	.25 (h)						1.5-2.2	0.2					0.5
C65100	Low Silicon Bronze (B)									0.8		0.7							.8-2.0						1.5
C65500	High Silicon Bronze (A)									0.8		.50-1.3	.6 (h)						2.8-3.8						1.5
C66100	High Silicon Bronze A									0.25		1.5							2.8-3.5						1.5
C66700	Manganese Brass									0.1		.8-1.5							0.07						Rem
C66800	Manganese Brass		0.25							0.35		2.0-3.5	.25 (h)						.50-1.5	0.3					Rem
C67300	Manganese Bronze (B)		0.25							0.5		2.0-3.5	.25 (h)						.50-1.5	0.3					Rem
C67400	Manganese Bronze (B)		50-2.0							0.35		2.0-3.5	.25 (h)						.50-1.5	0.3					Rem
C68100	Bronze, Low Furning		0.01							.25-1.2		.01-.50							.04-.15	.75-1.1					Rem
C68700	Aluminum Brass-Arsenical		1.8-2.5	.02-.06						0.06									0.07						Rem
C69400	Silicon Red Brass									0.2		0.4	2.0-3.0 (h)						3.5-4.5						Rem
C70200	Silicon Red Brass									0.1			0.1												1.0
C70600	Cupro Nickel, 10%									1.0-1.8		1.0	9-11.0 (h)												1.0
C71000	Cupro Nickel, 20%									1		1.0	19-23 (h)												1
C71500	Curpo Nickel, 30%									4-1.0		1.0	29-33 (h)												1
C71681	Copper-Nickel, 30%									4-7		1.0	29-32 (h)							1.8-2.5					0.5
C72500	Curpo Nickel, 6%									0.6		0.2	8.5-10.5 (h)												0.5
C73500	Copper-Nickel, 30%		70.5-73.5 (a)							0.25		0.5	16.5-19.5 (h)												Rem
C74000	Copper-Nickel, 30%		69.0-73.5 (a)							0.25		0.5	9-11 (h)												Rem
C74500	Nickel Silver, 10%		63.5-66.5 (a)							0.25		0.5	9-11 (h)												Rem
C75200	Nickel Silver, 18%		63.5-66.5 (a)							0.25		0.5	16.5-19.5 (h)												Rem
C75700	Nickel Silver, 12%		57.0-61.0 (a)							0.25		0.5	11-13 (h)												Rem
C76200	Nickel Silver, 12%		53.5-56.5 (a)							0.25		0.5	11-13.5 (h)												Rem
C77000	Nickel Silver, 18%		46.0-50.0 (a)	0.01						0.25		0.5	16.5-19.5 (h)						.04-.25						Rem
C77300	Nickel Silver									0.35		0.5	7-9 (h)												Rem
C78200	Leaded Nickel Silver		63.0-67.0 (a)							0.25		0.5	11-13 (h)												Rem
C79200	Leaded Nickel Silver, 12%		50.0-66.5 (a)							0.25		1.5-2.5	9-11 (h)												Rem
C79600	Leaded Nickel Silver, 10%		43.5-46.5 (a)							0.25		1.5-2.5	9-11 (h)												Rem
C86300	Manganese Bronze Leaded MB (Alloy)		5.0-7.5							0.2		2.5-5.0	1.0 (h)							0.2					22-28
C90500	Copper Tin Alloys		66.0-89.0 (n)							0.2			1.0 (h)						0.005	9.0-11.0					1.0-3.0
C92200	Copper Tin Lead Alloys		86.0-90.0 (n)	0.005						0.25			1.0 (h)						0.005	5.5-6.5					3.0-5.0
C92500	Copper Tin Lead Alloys		86.0-88.0 (n)	0.005						0.3		.8-1.5 (h)							0.005	10.0-12.0					0.5
C93200	Bearing Bronze		81.0-85.0 (n)	0.005						0.2			1.0 (h)						0.005	6.3-7.5					1.0-4.0
C94000	Lead Tin Bronze		69.0-72.0	0.005						0.25			.5-1.0 (h)						0.005	12-14					0.5
C95200	Aluminum Bronze		86.0 min							2.5-4.0															
C95400	Aluminum Bronze AMPCO 18 Cast		83.0 min							3.0-5.0		0.50	1.5 (h)												0.30
C95510	Aluminum Bronze		97-10.9							2.0-3.5		1.5	4.5-5.5 (h)							0.20					
C95900	Aluminum Bronze		12-13.5							3.0-5.0		1.5	.50 (h)												
C97300	Copper Nickel Zinc Alloys		53.0-58.0							1.5		0.50	11-14 (h)						0.15	1.5-3.0					17.0-25.0

**FOOTER NOTES:**

- (a) Cu value includes Ag
- (b) Cu value includes Pb
- (c) Cu value includes Te + Sn
- (d) Cu value includes Te + P
- (e) Cu value includes Ag + Sn + Te + Se
- (f) Cu value includes S
- (g) Ni + Co, 0.20% min.; Ni + Fe + Co, 0.6% max.
- (h) Ni includes Co
- (i) Includes Pb
- (j) Fe 0.10% max. for flat products
- (k) Sn 0.90% min for tubular products
- (l) When the product is for subsequent welding applications and is so specified by the purchaser, Cr, Cd, Zr, and Zn shall each be 0.05%
- (m) Pb .05% max for rod, wire and tube
- (n) Cu min., Cu may be calculated as Cu + Ni
- (o) P 1.5% max for continuous castings
- (p) S .25% max for continuous castings