

**SAN DIEGO COUNTY AIR POLLUTION CONTROL DISTRICT
RULE 1210 RISK REDUCTION AUDIT AND PLAN**

for

**Pacific Ship
Repair & Fabrication Inc.**
1625 Rigel Street
San Diego, CA 92113

**San Diego Air Pollution Control District
Facility ID# 7067**

Submitted to:

**San Diego Air Pollution Control District
Air Toxics Engineering Division**
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TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 FACILITY INFORMATION	2
3.0 RISK REDUCTION AUDIT AND PLAN	3
4.0 RISK REDUCTION DEMONSTRATION	19
5.0 RISK REDUCTION SCHEDULE.....	20
6.0 CONCLUSIONS.....	21

TABLES

Table 1 Pacific Ship Annual Welding Rod Usage	9
Table 2 Pacific Ship Emissions Previously Reported and Recalculated Welding and Abrasive Blast Emissions	14
Table 3 Pacific Ship Solvent Use and Paint Booth Sources Reported Emissions in 2015 and 2019.....	19
Table 4 Pacific Ship Risk Results Before and After Risk Reduction Measures (RRM)	20
Table 5 Pacific Ship Schedule of Risk Reduction Measures Implementation.....	20

APPENDICES

Appendix A:	HEPA Filters and Portable Fume Extractor Manufacturer Specifications
Appendix B:	Welding Rod SDSs

1.0 INTRODUCTION

On November 16, 2021, Pacific Ship Repair & Fabrication Inc. (PacShip) (SDAPCD Facility #7067) received a letter from the San Diego County Air Pollution Control District (SDAPCD or District) that notified PacShip of the need for a risk reduction audit and plan (RRAP) based on the health risk assessment (HRA) approved by the District.¹ The approved HRA was based on the emission inventory year 2015 Toxic Emissions Inventory Report (TEIR).

On January 20, 2022, PacShip received a letter from the District that notified PacShip of the need for a RRAP based on the HRA for emission inventory year 2019.²

The 2015 RRAP was submitted to the District on May 12, 2022. After review of the 2015 RRAP, the District sent an "Incomplete Letter" to PacShip on June 14, 2022, asking for a number of revisions and updates to be made to the RRAP.³ In this letter, the District stated the following:

"In the January 20, 2022 District letter, Pacific Ship Repair was requested to submit an application for the risk reduction and audit plan for reducing the health risk associated with Pacific Ship Repair's 2019 emissions. However, since Rule 1210(e)(2)(v) requires the demonstration to include any foreseeable emissions in the risk reduction measures, Pacific Ship Repair is not required to submit another application for risk reduction audit and plan for 2019 emissions, and the same risk reduction audit and plan application submitted by Pacific Ship Repair (APCD2022-RRP-990008) will be used to reduce the health risks below significant thresholds for both 2015 and 2019 emissions. Therefore, the risk reduction audit and plan must be revised to include risk reduction measures to address all cancer risks above ten in one million that have occurred in 2019 or are known to occur in future years."

This revised RRAP is in response to the June 14, 2022 letter. The emissions from 2015 and 2019, as well as any emissions that are known to occur in the foreseeable future, are addressed in this revised RRAP.

2015 HRA Risk Results

The HRA results for 2015 indicated that maximum worker chronic non-cancer Health Hazard Index (HHI), the maximum worker 8-hour chronic non-cancer HHI, and the maximum worker acute non-cancer HHI exceed the risk reduction levels specified in District Rule 1210, section (e)(1). Although the Maximum Individual Worker (MEIW) cancer risk exceeded the public notification level of 10 in one million specified in District Rule 1210(d)(1), it did not exceed the risk reduction level of 100 in one million specified in District Rule 1210(e)(1)(ii) for emissions inventory years prior to 2018.

¹ 2015_Pacific Ship HRA Approval final, SDAPCD, Dated November 16, 2021.

² 2019-Pacific-Ship-HRA-Approval-Public-Notice, SDAPCD, Dated January 20, 2022.

³ Pacific Ship Incomplete Letter_2015 RRAP_061422, SDAPCD, Dated June 14, 2022.

The chronic, 8-hour chronic, and acute non-cancer results from the HRA based on the emission inventory year 2015 are listed below:

Maximum Worker Chronic Non-Cancer HHI: 2.01

Maximum Worker 8-hour Chronic Non-Cancer HHI: 1.84

Maximum Worker Acute Non-Cancer HHI: 2.75

2019 HRA Risk Results

The HRA results for 2019 indicated that the MEIR cancer risk, the MEIW cancer risk, and the maximum worker acute non-cancer HHI exceed the risk reduction levels specified in District Rule 1210, sections (d)(1) and (e)(1).

The cancer and acute non-cancer results from the HRA based on the emission inventory year 2019 are listed below:

Maximum Worker Cancer Risk: 121.5 in one million

Maximum Resident Cancer Risk: 48.2 in one million

Maximum Worker Acute Non-Cancer HHI: 3.00

This risk reduction audit and plan for reporting years 2015 and 2019 and future years will address proposed risk reduction measures for resident and worker cancer risk, chronic, 8-hour chronic, and acute non-cancer worker impacts from the HRAs.

2.0 FACILITY INFORMATION

2.1 Address and Contacts

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SDAPCD Facility #7067
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San Diego, CA 92113

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2.2 Description of Operations

The PacShip facility in San Diego conducts sheet metal product fabrication, coating, and master ship repair for the US Navy and a variety of other military and commercial maritime clients. These services may require welding, precision water-jet cutting, powder coating, sheet metal repair and fabrication, fabrication of water-tight closures such as doors, hatches and manholes for the shipbuilding and repair industry, and ship preservation (blasting and painting). Equipment at the facility includes welding equipment, an abrasive blasting room, and coating booths. The facility is located in a mostly industrial setting approximately a half mile from the ship docks in San Diego Bay. Figure 1 shows the locations of the welding and abrasive blast exhaust stacks and operation areas.

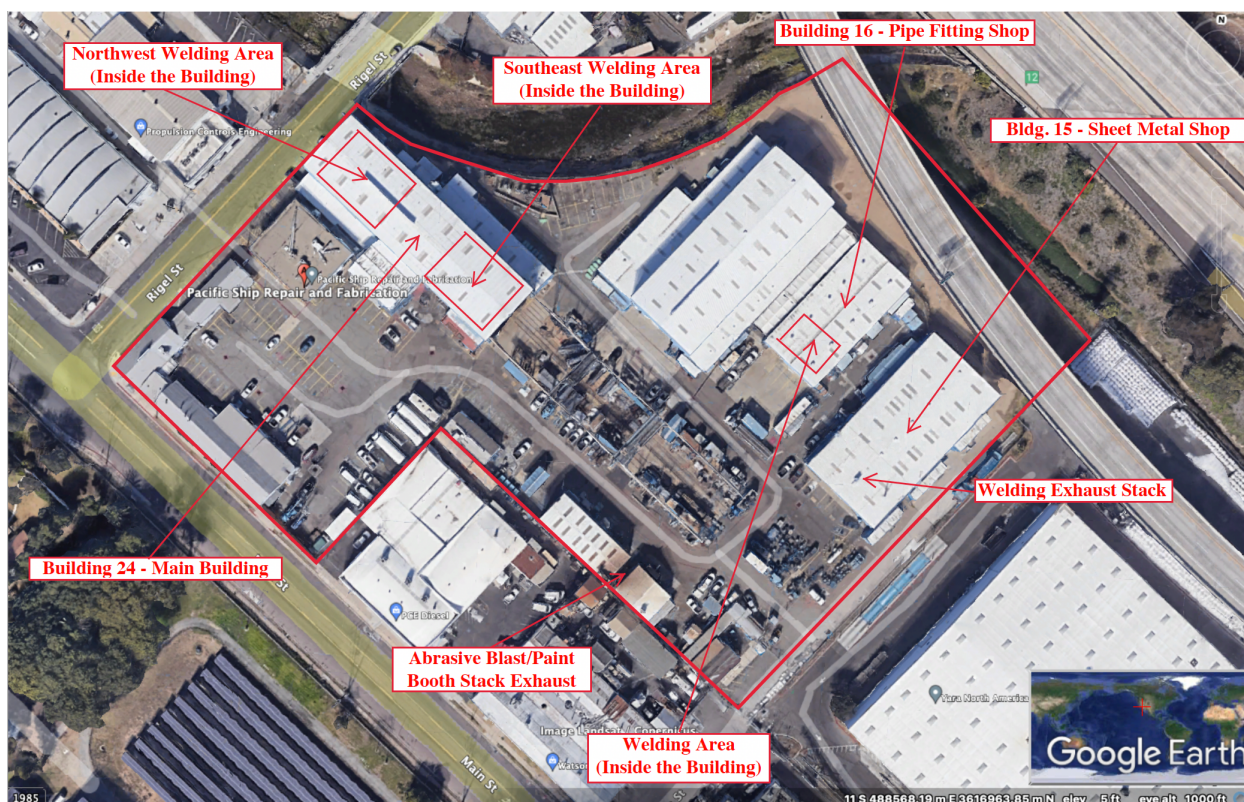


Figure 1 – Pacific Ship Repair & Fabrication Welding and Abrasive Blast Stack and Operation Areas

3.0 RISK REDUCTION AUDIT AND PLAN

3.1 Risk Reduction Audit and Plan Summary

To reduce risks below the Rule 1210 thresholds, the following Plan is proposed:

Abrasive Blasting

1. Install a HEPA filter with 99.97% control of 0.3-micron size particles onto the blasting booth exhaust stack. This will be in addition to the filters currently installed in the blasting booth.
2. Improve documentation of blasting operations, including recording the estimated amount of blast media used per hour/day/year, the duration that blasting occurs, and a description of the materials blasted.

Welding

1. Utilize the District's updated uncontrolled welding toxic air contaminant (TAC) emission factors from July 2022⁴ for health risk impact assessments, except lower uncontrolled emission factors for CrVI and nickel are selected in this Plan for welding rods FCAW 309, 316, and 71T. Demonstration of lower CrVI and nickel emission factors will not be conducted under this Plan, pending the demonstration of fume capture efficiency in welding areas, and the assessment of future usage of these welding rod types based upon actual recordkeeping.
2. Indoor Welding in Building 15 (Sheet Metal Shop) – Install a HEPA filter with a 99.97% control of 0.3-micron size particles onto each of the three intakes to the exhaust stack.
3. Indoor Welding in Building 16 (Pipe Fitting Shop) – Continue to enclose welding areas with flexible curtains, and utilize portable fume extractors during welding operations, to capture at least 80% of welding fumes. Vent welding fumes through MERV 15 and HEPA filters with an overall 99.97% control of 0.3-micron size particles.
4. Welding Areas in Building 24 (north and south areas) – Continue to enclose welding areas with flexible curtains during welding operations, and utilize portable fume extractors during welding operations, to capture at least 80% of welding fumes. Vent welding fumes through MERV 15 and HEPA filters with an overall 99.97% control of 0.3-micron particles.
5. Demonstrate welding fume emissions capture efficiency is at least 80% in each welding area using a test method approved by the District.
6. Documentation – Record the following at each welding location: welding rod usage in lbs per hour/day/year, by type of welding rod (E316, 309, etc.), and by welding operation type (FCAW, GMAW, etc.). Retain the current Safety Data Sheet (SDS) or other specifications of the welding rods. Confirm for each hour of operation that the welding area is completely enclosed with flexible curtain, fume extractors used, and emissions vented to operated filters.

⁴ SDAPCD Calculation Methods for Welding Rods, Historical Methods, J01-F15-v1 and March 2022 welding emission factors. For 309 FCAW, used Nickel and CrVI emission factors for 309 MIG.

Toxic emission welding areas are defined for this Plan as any areas utilizing welding rods with non-trace, or 0.1% by weight or more of CrVI, nickel, cadmium, or lead as shown by the material SDS or other specifications. Based upon the Risk Reduction demonstration provided in Section 4.0. This plan will be sufficient to reduce acute, chronic, and cancer risk impacts below the Rule 1210 thresholds.

3.2 Risk Reduction Evaluation

This section presents the evaluation of proposed risk reduction measures in the abrasive blast and welding operations areas.

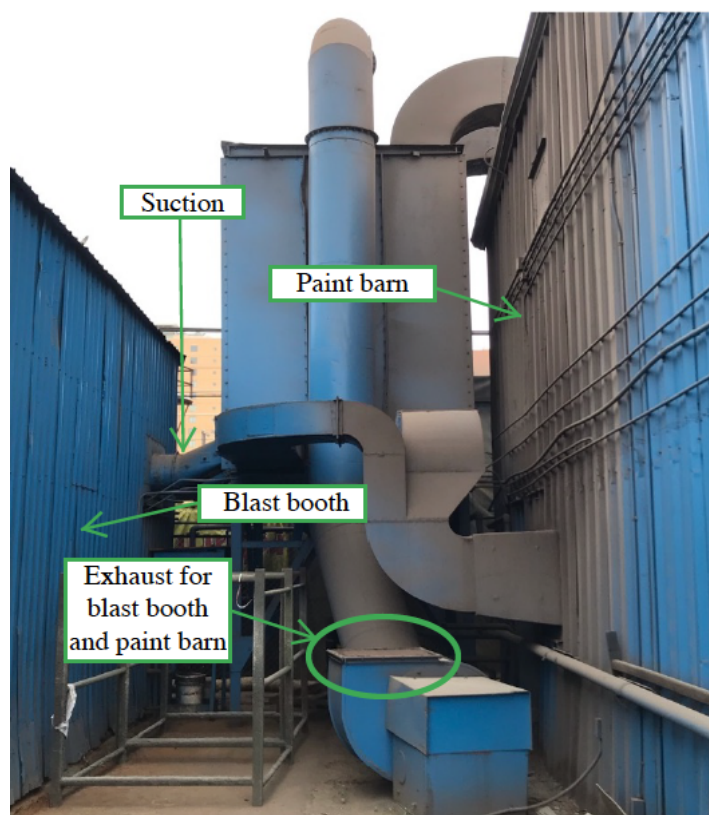
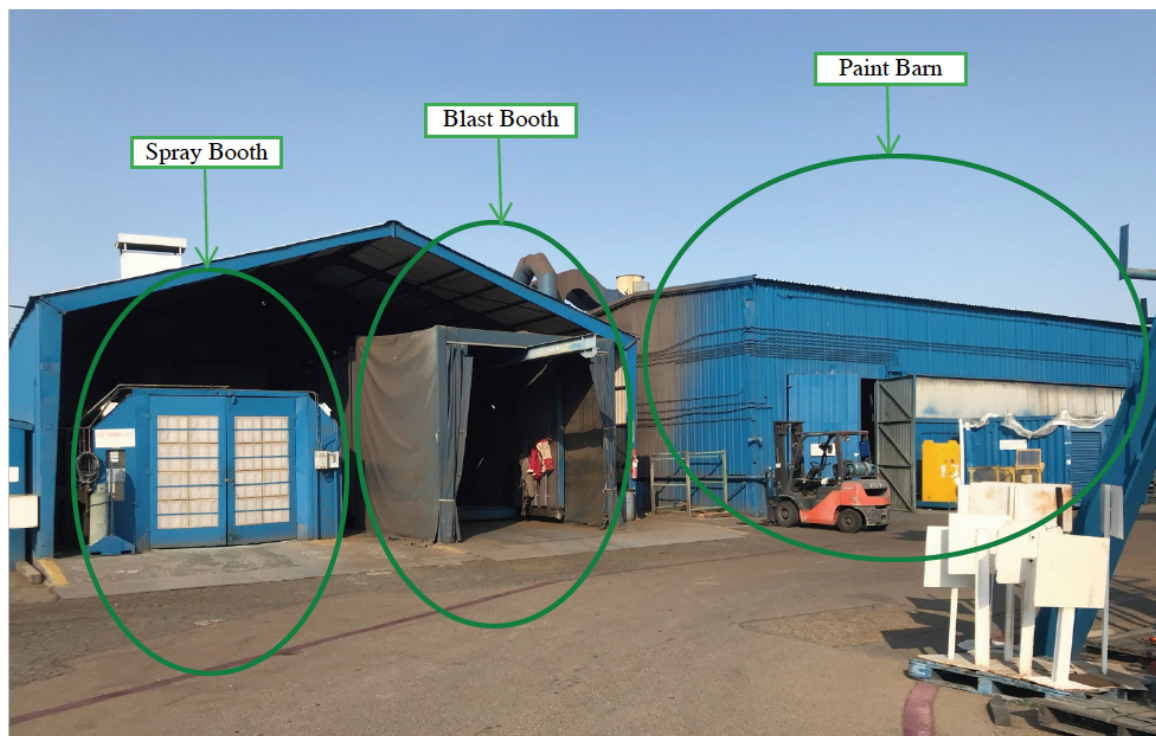
For the 2015 emissions inventory reporting year, the PacShip facility's abrasive blasting operations, followed by the welding operations, were the biggest contributors to the worker chronic, 8-hour chronic, and acute non-cancer impacts. The chronic HHI is mainly due to nickel (94%) and cadmium (6%); the 8-hour chronic HHI is due entirely to nickel (100%); and the acute HHI is entirely due to nickel (100%). Nickel is emitted from both abrasive blasting and welding operations; cadmium is emitted from abrasive blasting operations only.

For the 2019 emissions inventory reporting year, the PacShip facility's welding operations were the biggest contributor to the worker cancer and acute non-cancer risk impacts and resident cancer risk impacts. The cancer risk at the MEIW and MEIR is mainly due to hexavalent chromium (CrVI) (99.8%) from welding operations. Acute HHI at the worker location is entirely due to nickel (100%) from welding.

In both the 2015 and 2019 reporting years, health risk impacts due to solvent usage and the paint booth and barn are negligible, compared to impacts due to the welding and blasting operations. Therefore, the focus of this RRAP will be to reduce health risk impacts from abrasive blasting and welding operations at the PacShip facility. However, maximum hourly and average annual emissions from these two sources are included in the modeling for the risk reduction demonstration presented in Section 4.0.

3.2.1 Abrasive Blasting Operations

PacShip's abrasive blasting operations are performed in only one location at the facility: Building 12 (Blast Booth). This building is directly adjacent the off-site worker location to the southwest of the Blast Booth that has high risk impacts. Blasting operations are entirely enclosed in the Blast Booth and emissions from blasting are collected with 100% capture efficiency. Blasting emissions are then directed to a filter system with 95% control efficiency. The filtered emissions are vented through a stack with a height of approximately 4 ft off the ground and located between the Blast Booth building and the Paint/Spray Booth. Because 100% of the blasting emissions are captured in the enclosed booth, there are no fugitive emissions. Pictures of the abrasive blast booth and exhaust stack are below.



According to PacShip, the only blasting material used is steel shot, which emits 0.00475 lbs cadmium and 0.048 lbs nickel per ton of steel shot blasted based upon APCD default emission factors.⁵

Emissions of nickel (and to a lesser degree, cadmium) from blasting as reported for 2015 were the primary cause of acute, 8-hr chronic, and chronic non-cancer health risk. A reporting error for 2015 annual blasting usage of steel shot was discovered in July 2022 (after the public notification and meeting). The annual steel shot usage reported for 2015 should have been 0.325 tons/year (not 650 tons/year). This error was due to the usage of the wrong units (should have been converted from 650 lbs/yr to units of tons/year). This error has been corrected to determine the highest annual amount of steel shot that could be used in future years. A review of annual steel shot usage reported in past years shows that the highest usage was in 2007, when PacShip used 3 tons/yr. This value is used as the highest amount used in future years for the risk reduction demonstration presented in Section 4.0. Maximum hourly steel shot usage that is used for the risk reduction demonstration is 0.25 tons/hr (as reported in 2015 and 2019).

Installation of a 99.97% particulate control efficiency HEPA filter on the existing exhaust stack for the blasting booth will reduce acute, worker chronic, and worker 8-hr chronic risks to below the 1.0 HHI threshold. The HEPA filter will be installed at the exit location of the exhaust stack and sealed so that all emissions from the blast booth and paint barn are directed through it. Because the emissions from the blast/paint booths will be released at a height of approximately 5 ft. between 2 buildings, this stack was modeled as a volume source in the original 2015 and 2019 HRAs and will continue to be modeled as a volume source for the risk reduction demonstration in Section 4.0. Manufacturer specifications for the proposed HEPA filter to be installed on the existing exhaust stack for the blast and paint booths are listed below and included in Appendix A.

HEPA Filters for Abrasive Blast Booth:

- Make: BioMax
- Model: HC HEPA Filter, 99.97% efficiency on 0.3-micron particle size
- Serial Number: TBD
- Size: 24" x 30" x 11.5"
- Intake Flow Rate: 4,743 CFM
- Release height from stack into space between buildings: 5 ft.
- Volume source release height: 14 ft.
- Volume source length of side: 11 ft.
- Volume source initial vertical dimension: 6.51 ft.

The facility will continue to operate the filters inside the blasting booth, with a total overall particulate emissions factor of 99.97% including the new HEPA filter assumed.

⁵ SDAPCD Abrasive Blasting, Steel Shot, Uncontrolled Emission Factors, Method A08.
<https://www.sdapcd.org/content/dam/sdapcd/documents/permits/emissions-calculation/abrasive-blasting/APCD%20Steel%20Shot%20blast%20Medium%20Site%20Specific%20Controls.pdf>

3.2.2 Welding Operations

PacShip's welding operations are performed in multiple locations throughout the facility, but the majority of the welding operations take place in the northwest and southeast ends of Building 24 (Welding Shop). Facility staff estimate that 60% of welding operations occur in the northwest portion of Building 24, 20% of welding operations occur in the southeast portion of Building 24, 15% of welding operations occur in Building 16 (Pipe Fitting Shop), and 5% of welding operations occur in Building 15 (Sheet Metal Shop). PacShip proposes installation of filters with higher manufacturer-guaranteed particulate emission control efficiency, on all welding operations using rods that emit hexavalent chromium (CrVI) and nickel, as well as cadmium and lead. PacShip will also improve air flow capture into the filter controls on the enclosures in Building 15, and on the portable fume extractor units used in Buildings 16 and 24, with a demonstrated 80% capture efficiency on these types of welding operations.

In 2015 and 2019, both controlled and uncontrolled welding operations were reported for the TEIR. Controls assumed for controlled welding were based on their use of portable control devices equipped with HEPA filters. Capture and control efficiencies of 80% capture/80% control were assumed for the portable devices in the calculation of controlled welding emissions, with 20% of emissions as fugitive emissions. No capture and control efficiencies were assumed for uncontrolled welding emissions, with 100% of the emissions as fugitive emissions. It is important to note that, in 2015 and 2019, the HEPA filters particulate emission controls with 99.97% control efficiency filters were used for all controlled welding operations in Buildings 16 and 24, but there was no documentation proving this. So, a lower 80% control efficiency for particulate filters was assumed for controlled welding emissions calculations for 2015 and 2019.

3.2.2.1 Future Welding Emissions

The June 14, 2022 letter from the District states:

"Therefore, the risk reduction audit and plan must be revised to include risk reduction measures to address all cancer risks above ten in one million that have occurred in 2019 or are known to occur in future years."

In a virtual meeting with the District on June 30, 2022, David Bain of PacShip stated it is difficult to estimate the welding work that is scheduled to be done beyond the next 6 months. Therefore, it's very difficult to determine the maximum potential-to-emit in future years. The District staff responded that estimating maximum emissions from reasonable projections based upon scheduled work are acceptable.

The welding work performed in the first 6 months of 2022, and the welding work that is expected in the next 6 months of 2022 was evaluated; and the 2020 and 2021 emission inventories (along with the 2015 and 2019 inventories) were also evaluated to determine the maximum rod usage amounts to use as possible future welding rod

usages for the risk reduction demonstration. Table 1 below shows welding rod usages reported in 2015, 2019, 2020, 2021, and estimated 2022 usages.

TABLE 1 PACIFIC SHIP ANNUAL WELDING ROD USAGE					
Welding Rod/Type	2015 (lbs/yr)	2019 (lbs/yr)	2020 (lbs/yr)	2021 (lbs/yr)	2022 (Projected) (lbs/yr)
Welding Rods with >20% CrVI and/or >10% Ni Content					
309 MIG	230	0	0	0	0
309 TIG	99	21.5	52.75	50	40
309 FCAW	0	1061	1026	840	600
309 SMAW	0	8	0	0	20
308 MIG	0	0	11	0	0
308 TIG	25	29	1	3	0
316 MIG	0	0	0	30	0
316 TIG	0	58.5	38.875	38	25
316 FCAW	0	191	172	295	80
316 SMAW	0	16	6	20	0
RN 82 TIG*	0	0	1	1	2
RN 60 TIG	0	21	12.5	3.5	4
RN 67 TIG	68	25	33.5	42.775	11
Total High CrVI/Ni:	422	1,431	1,355	1,323	782
Welding Rods with <10% CrVI and/or <10% Ni Content					
6011 SMAW*	0	0	0	1	2
101 TC FCAW	0	60	75	30	0
SILVER BRAZING	1	6.1	16.89	1	1
ALUMINUM BRONZE*	0	0	0	0	60
11018 SMAW	286	11	114	50	0
5356 TIG	11	0	8	8.5	10
71 T FCAW	340	2,376	2,775	2,430	1,800
5356 MIG	80	16	0	0	0
5556 TIG	36	73	58	4	2
70 S MIG	580	106	0	0	10
70 S TIG	74	43	59.5	62	50
7018 SMAW	321	40	102	120	95
Total Low CrVI/Ni:	1,729	2,731	3,208	2,707	2,030
Total All Rods:	2,151	4,162	4,563	4,030	2,812

*NOTE: Safety Data Sheets (SDSs) for welding rods that were/will be used in 2021, 2022, and projected to be used in the foreseeable future, but were not used in reporting years 2015 and 2019, are included in Appendix B.

Table 1 demonstrates that welding rod usages vary greatly from year to year. In some cases, the projected usage of welding rods in 2022 are less than past usages of the same rods/welding types. For the risk reduction demonstration presented in Section 4.0, the 2019 annual usage amounts of welding rods with high CrVI/Ni content; and the 2020 annual usage amounts of welding rods with low CrVI/Ni (in

bold type) were chosen as representative of the annual maximum welding rod usage amounts.

Calculations of annual emissions from welding rods were performed using current District emission factors for each rod/welding type,⁶ except for the following rods/welding types and pollutants:

- 309 FCAW
 - Nickel EF = 7.65E-04 lbs/lb rod (District Method G104 – 309 GMAW)
 - CrVI EF = 8.01E-05 lbs/lb rod (District Method G104 – 309 GMAW)
- 316 FCAW
 - Nickel EF = 9.30E-05 lbs/lb rod (District Method F45 – E316LT FCAW, March 2022)
 - CrVI EF = 7.48E-05 lbs/lb rod (District Method F45 – E316LT FCAW, March 2022)
- 71T FCAW
 - Nickel EF = 4.00E-06 lbs/lb rod (District Method F15 – E71T FCAW)

3.2.2.2 Hourly Welding Operations

In the 2015 and 2019 inventory reporting years, PacShip reported maximum hourly welding rod usages varying from 0.5 lbs/hr to 3 lbs/hr, depending on the rod and welding type. After a review of welding records from 2011 to 2021, and discussions with the on-site welding departments regarding welder capabilities and possible future use, a maximum hourly usage of 1 lb/hr is the best estimate for calculating future hourly emissions from most welding. A lower maximum hourly rate of 0.75 lbs/hr has been assumed for specific welding rods with nickel emissions: Silver Brazing, RN 60 TIG, 309 FCAW, and RN 67 TIG. These values are used for calculating maximum hourly emissions of TACs from welding rods included in the risk reduction demonstration presented in Section 4.0.

3.2.2.3 Welding Operations in Building 15, Sheet Metal Shop

PacShip estimates that 5% of the welding at the facility occurs in Building 15. The building is currently equipped with a fully enclosed welding booth with curtains, and three hood terminals that vent to one stack through the roof of the building. These hood terminals are equipped with a vacuum hood with 2,716 CFM vacuum flow at each terminal. Welding fumes are captured by the vacuum hood with at least an 80% capture efficiency and then vented to particulate filters with a 99% control efficiency. PacShip proposes adding a HEPA filter with 99.97% particulate control efficiency to each existing hood terminal stack (total of three HEPA filters). Manufacturer specifications for the proposed HEPA filters are shown below, and included in

⁶ Reference SDAPCD welding emissions calculation methods, updated on July 7, 2022 at: <https://www.sdapcd.org/content/sdapcd/permits/toxics-emissions/calculation-procedures.html>

Appendix A. A drawing of the exhaust stack and filter configuration, as well as the site map with the stack location are also included in Appendix A.

HEPA Filters for Building 15 Welding Booths:

- Make: BioMax
- Model: HC HEPA Filter, 99.97% efficiency on 0.3-micron particle size
- Serial Numbers: TBD
- Size: 24" x 30" x 11.5" per filter
- Vacuum Hood Intake Flow Rate: 2,716 CFM
- Gas Exit Flow Rate: 1,500 CFM
- Stack Height: 21 ft.
- Stack Diameter: 1.5 ft.
- Vertical Stack, Capped

The welding booth and terminals in Building 15 are shown in the picture below.



3.2.2.4 Welding Operations in Building 16, Pipe Fitting Shop

PacShip estimates that 15% of the welding at the facility occurs in Building 16. Welding operations in this building are performed in curtained areas and using

portable fume extractor capture devices (80% capture efficiency) equipped with 99% control efficiency particulate filters. This welding operations setup is similar to that in Building 24, Main Building (see below). One new fume extractor unit, fitted with a primary MERV 15 filter and secondary 99.97% control efficiency HEPA filter, will be purchased for use in the pipe fitting shop. The exhaust from the HEPA filter is released in the building, instead of a stack on the roof, so the welding operations in this building are best modeled as a volume source in AERMOD. Manufacturer specifications for the proposed HEPA filters and fume extractors are shown in the Building 24 section below, and included in Appendix A.

3.2.2.5 Welding Operations in Building 24, Main Building

PacShip estimates that 60% of the welding at the facility occurs in the northwest portion of Building 24 and 20% of the welding at the facility occurs in the southeast portion of Building 24. This building is equipped with 2 large overhead rails that cover the length of the building. These rails are used to hoist the larger ship parts into the building for welding repairs and construction. This design makes an entirely enclosed welding booth impossible within this building. However, the welding operations in Building 24 are currently controlled with curtains that surround the entire part and welding area. There are three portable fume extractors that have been in use in Building 24. The fume extractors, each with an estimated 80% capture efficiency, are placed very close to the locations of welding operations. Two of the three portable fume extractors currently in use are equipped with particulate filters with HEPA filters with 99.97% control efficiency. The third fume extractor is not equipped with a HEPA filter and will be retired. Five new fume extractor units, each fitted with MERV 15 primary filters and secondary HEPA filters with 99.97% control efficiency will be purchased for use in Building 24 welding operations. An overall particulate control efficiency of 99.97% is assumed. The exhaust from the filters is then released in the building, instead of through a stack on the roof. Because of this, these operations are modeled in AERMOD as volume sources, instead of point sources. Manufacturer specifications for the proposed HEPA filters and fume extractors for Buildings 16 and 24 are shown below, and included in Appendix A.

Portable Weld Fume Extractors:

- Make: FumeDog
- Model: FD-PT-CW-87S
- Serial Numbers: TBD
- Size: 40.5" x 26" x 31.5"
- Fume Intake Flow Rate: 1,200 CFM

MERV 15 Primary Filters:

- Make: NXT Nano (or equivalent)
- Model: MERV 15 Nanofiber filter
- Serial Numbers: TBD
- Size: 18" x 13.84" OD x 9.48" ID per cylindrical filter
- Filter Control Efficiency: ≥85% on 0.3-micron particle size

HEPA Secondary Filters:

- Make: Magna (distributed by Glasfloss Industries)
- Model: 1000 Series (Base Model #2424B5, Box Style)
- Serial Numbers: TBD
- Size: 24" x 24" x 11.5" per filter
- Media Square Feet: 210.00 ft² per filter
- Filter Control Efficiency: 99.97% on 0.3-micron particle size

NOTE: The facility already uses shielding gas for many of the welding operations. Shielding gases used are CO₂, Argon, and/or a CO₂/Argon mixture. PacShip will continue using shielding gases for welding operations using rods with non-trace, or 0.1% by weight or more of CrVI, nickel, cadmium, or lead as shown by the material safety data sheet (SDS) or other specifications. The use of shielding gases may improve control efficiencies at welding operations areas, but they are not accounted for in the uncontrolled welding TAC emissions calculations, therefore making the welding TAC emissions calculations even more conservative.

To demonstrate a minimum 80% capture efficiency with the portable units used in Buildings 16 and 24, and the vacuum hood in Building 15, a District-approved efficiency test will be performed. The District was consulted on the appropriate method to demonstrate capture efficiency (email Nick Horres, San Diego APCD July 21, 2022). It is expected EPA Method 204 "Criteria for Verification if a Permanent or Temporary Total Enclosure" can be used, as modified for a partial enclosure and particulate emissions. This Plan includes further consultation with the District to ascertain an approved method once equipment installation is complete.

The District July 2022 welding emissions factors are proposed for this Plan, except for uncontrolled CrVI and nickel emissions from specific welding rods 309 FCAW, 316 FCAW, and 71T FCAW. PacShip expects that future CrVI and nickel emissions from use of these welding rods will be much lower than the District emission factors, once the demonstrated capture efficiency in welding areas (expected to be higher than 80%) and actual welding rod usage net of waste has been accounted. Therefore, this Plan does not propose demonstration of lower selected CrVI and nickel emissions for specific welding rods at this time.

Health risk impacts due to CrVI and nickel emissions from welding operations can be reduced by performing welding operations only in enclosed and partially enclosed welding booths with 80% capture, with a fume extractor to direct welding fumes to a filter system fitted with HEPA filters with 99.97% particulate control efficiency. There will be no uncontrolled welding of welding rods with non-trace, or 0.1% by weight or more of CrVI, nickel, cadmium, or lead as shown by the SDS or other specifications.

TABLE 2
PACIFIC SHIP EMISSIONS PREVIOUSLY REPORTED
AND RECALCULATED WELDING AND ABRASIVE BLAST EMISSIONS

AERMOD Source ID	Pollutant	Annual Emissions			Maximum Hourly Emissions		
		2015 Previously Reported Annual Emissions (lb/yr)	2019 Previously Reported Annual Emissions (lb/yr)	Recalculated Annual Emissions (lb/yr)	2015 Previously Reported Hourly Emissions (lb/hr)	2019 Previously Reported Hourly Emissions (lb/hr)	Recalculated Hourly Emissions (lb/hr)
WELD_1	Silica, Crystalline	0	0	3.92E-03	0	0	3.44E-05
	Aluminum	5.20E-02	0	4.05E-02	4.47E-03	0	1.24E-03
	Cadmium	0	0	9.05E-04	0	0	6.40E-07
	Chromium (hexavalent)	6.05E-03	1.40E-02	2.70E-02	4.31E-05	1.38E-04	9.38E-05
	Cobalt	0	0	2.29E-05	0	0	3.60E-07
	Copper	6.88E-03	1.98E-03	5.37E-02	4.66E-05	1.75E-05	1.96E-03
	Lead	0	0	1.04E-01	0	0	4.04E-05
	Manganese	7.40E-02	3.70E-01	5.53E+00	3.18E-04	8.51E-04	3.81E-03
	Nickel	5.79E-02	1.50E-02	1.31E-01	4.26E-04	2.49E-04	1.18E-03
	Phosphorus	1.93E-04	4.40E-05	0	1.18E-06	2.95E-07	0
	Zinc	1.06E-04	2.15E-04	2.04E-02	5.90E-06	1.48E-06	9.03E-04
WELD_2	Silica, Crystalline	0	0	1.31E-03	0	0	1.15E-05
	Aluminum	1.73E-02	0	1.35E-02	1.49E-03	0	4.15E-04
	Cadmium	0	0	3.02E-04	0	0	2.13E-07
	Chromium (hexavalent)	2.02E-03	4.57E-03	9.01E-03	1.44E-05	4.62E-05	3.13E-05
	Cobalt	0	0	7.63E-06	0	0	1.20E-07
	Copper	2.29E-03	6.62E-04	1.79E-02	1.55E-05	5.84E-06	6.52E-04
	Lead	0	0	3.47E-02	0	0	1.35E-05
	Manganese	2.47E-02	1.23E-01	1.84E+00	1.06E-04	2.34E-04	1.27E-03
	Nickel	1.93E-02	4.86E-03	4.37E-02	1.42E-04	8.28E-05	3.92E-04
	Phosphorus	6.43E-05	1.47E-05	0	3.93E-07	9.84E-08	0
	Zinc	3.54E-05	7.18E-05	6.80E-03	1.97E-06	4.92E-07	3.01E-04

TABLE 2
PACIFIC SHIP EMISSIONS PREVIOUSLY REPORTED
AND RECALCULATED WELDING AND ABRASIVE BLAST EMISSIONS

AERMOD Source ID	Pollutant	Annual Emissions			Maximum Hourly Emissions		
		2015 Previously Reported Annual Emissions (lb/yr)	2019 Previously Reported Annual Emissions (lb/yr)	Recalculated Annual Emissions (lb/yr)	2015 Previously Reported Hourly Emissions (lb/hr)	2019 Previously Reported Hourly Emissions (lb/hr)	Recalculated Hourly Emissions (lb/hr)
WELD_3	Silica, Crystalline	0	0	9.81E-04	0	0	8.61E-06
	Aluminum	1.30E-02	0	1.01E-02	1.12E-03	0	3.11E-04
	Cadmium	0	0	2.26E-04	0	0	1.60E-07
	Chromium (hexavalent)	1.51E-03	3.42E-03	6.76E-03	1.08E-05	3.46E-05	2.34E-05
	Cobalt	0	0	5.72E-06	0	0	9.01E-08
	Copper	1.72E-03	4.96E-04	1.34E-02	1.17E-05	4.38E-06	4.89E-04
	Lead	0	0	2.61E-02	0	0	1.01E-05
	Manganese	1.85E-02	9.25E-02	1.38E+00	7.95E-05	2.13E-04	9.53E-04
	Nickel	1.45E-02	3.65E-03	3.28E-02	1.07E-04	6.21E-05	2.94E-04
	Phosphorus	4.82E-05	1.10E-05	0	2.95E-07	7.38E-08	0
	Zinc	2.66E-05	5.38E-05	5.10E-03	1.48E-06	3.69E-07	2.26E-04
WELD_STK	Silica, Crystalline	0	0	3.92E-07	0	0	3.44E-09
	Aluminum	4.34E-03	0	4.05E-06	3.73E-04	0	1.24E-07
	Cadmium	0	0	9.05E-08	0	0	6.40E-11
	Chromium (hexavalent)	5.04E-04	1.14E-03	2.70E-06	3.59E-06	1.15E-05	9.38E-09
	Cobalt	0	0	2.29E-09	0	0	3.60E-11
	Copper	5.73E-04	1.65E-04	5.37E-06	3.88E-06	1.46E-06	1.96E-07
	Lead	0	0	1.04E-05	0	0	4.04E-09
	Manganese	6.17E-03	3.08E-02	5.53E-04	2.65E-05	7.09E-05	3.81E-07
	Nickel	4.83E-03	1.22E-03	1.31E-05	3.55E-05	2.07E-05	1.18E-07
	Phosphorus	1.61E-05	3.66E-06	0	9.84E-08	2.46E-08	0
	Zinc	8.85E-06	1.79E-05	2.04E-06	4.92E-07	1.23E-07	9.03E-08

TABLE 2
PACIFIC SHIP EMISSIONS PREVIOUSLY REPORTED
AND RECALCULATED WELDING AND ABRASIVE BLAST EMISSIONS

AERMOD Source ID	Pollutant	Annual Emissions			Maximum Hourly Emissions		
		2015 Previously Reported Annual Emissions (lb/yr)	2019 Previously Reported Annual Emissions (lb/yr)	Recalculated Annual Emissions (lb/yr)	2015 Previously Reported Hourly Emissions (lb/hr)	2019 Previously Reported Hourly Emissions (lb/hr)	Recalculated Hourly Emissions (lb/hr)
WELD_1U	Aluminum	2.44E-01	0	0	3.05E-03	0	0
	Barium	0	4.13E-03	0	0	3.44E-05	0
	Chromium (hexavalent)	3.21E-03	5.87E-01	0	1.52E-05	5.42E-04	0
	Cobalt	0	0	0	0	0	0
	Copper	1.67E-01	1.63E-01	0	5.62E-03	6.50E-03	0
	Manganese	4.36E-01	1.42E-01	0	2.69E-03	9.88E-04	0
	Nickel	8.59E-02	6.41E-01	0	2.35E-03	3.51E-03	0
	Phosphorus	0	0	0	0	0	0
	Zinc	6.26E-03	3.67E-02	0	6.03E-04	3.00E-03	0
WELD_2U	Aluminum	8.13E-02	0	0	1.02E-03	0	0
	Barium	0	1.38E-03	0	0	1.15E-05	0
	Chromium (hexavalent)	1.07E-03	1.96E-01	0	5.06E-06	1.81E-04	0
	Cobalt	0	0	0	0	0	0
	Copper	5.58E-02	5.42E-02	0	1.87E-03	2.17E-03	0
	Manganese	1.45E-01	4.74E-02	0	8.96E-04	3.29E-04	0
	Nickel	2.86E-02	2.14E-01	0	7.85E-04	1.17E-03	0
	Phosphorus	0	0	0	0	0	0
	Zinc	2.09E-03	1.22E-02	0	2.01E-04	1.00E-03	0

TABLE 2
PACIFIC SHIP EMISSIONS PREVIOUSLY REPORTED
AND RECALCULATED WELDING AND ABRASIVE BLAST EMISSIONS

AERMOD Source ID	Pollutant	Annual Emissions			Maximum Hourly Emissions		
		2015 Previously Reported Annual Emissions (lb/yr)	2019 Previously Reported Annual Emissions (lb/yr)	Recalculated Annual Emissions (lb/yr)	2015 Previously Reported Hourly Emissions (lb/hr)	2019 Previously Reported Hourly Emissions (lb/hr)	Recalculated Hourly Emissions (lb/hr)
WELD_3U	Aluminum	6.10E-02	0	0	7.62E-04	0	0
	Barium	0	1.03E-03	0	0	8.60E-06	0
	Chromium (hexavalent)	8.01E-04	1.47E-01	0	3.80E-06	1.35E-04	0
	Cobalt	0	0	0	0	0	0
	Copper	4.18E-02	4.06E-02	0	1.40E-03	1.63E-03	0
	Manganese	1.09E-01	3.56E-02	0	6.72E-04	2.47E-04	0
	Nickel	2.15E-02	1.60E-01	0	5.89E-04	8.77E-04	0
	Phosphorus	0	0	0	0	0	0
	Zinc	1.57E-03	9.16E-03	0	1.51E-04	9.50E-04	0
WELD_4U	Silica, Crystalline	0	0	3.27E-04	0	0	2.87E-06
	Aluminum	2.03E-02	0	3.37E-03	2.54E-04	0	1.04E-04
	Barium	0	3.44E-04	0	0	2.87E-06	0
	Cadmium	0	0	7.53E-05	0	0	5.32E-08
	Chromium (hexavalent)	2.67E-04	4.90E-02	2.25E-03	1.27E-06	4.52E-05	7.81E-06
	Cobalt	0	0	1.90E-06	0	0	3.00E-08
	Copper	1.39E-02	1.35E-02	4.47E-03	4.68E-04	5.42E-04	1.63E-04
	Lead	0	0	8.68E-03	0	0	3.36E-06
	Manganese	3.63E-02	1.19E-02	4.61E-01	2.24E-04	8.23E-05	3.17E-04
	Nickel	7.16E-03	5.34E-02	1.09E-02	1.96E-04	2.92E-04	9.78E-05
	Phosphorus	0	0	0	0	0	0
	Zinc	5.22E-04	3.05E-03	1.70E-03	5.03E-05	2.50E-04	7.51E-05

TABLE 2
PACIFIC SHIP EMISSIONS PREVIOUSLY REPORTED
AND RECALCULATED WELDING AND ABRASIVE BLAST EMISSIONS

AERMOD Source ID	Pollutant	Annual Emissions			Maximum Hourly Emissions		
		2015 Previously Reported Annual Emissions (lb/yr)	2019 Previously Reported Annual Emissions (lb/yr)	Recalculated Annual Emissions (lb/yr)	2015 Previously Reported Hourly Emissions (lb/hr)	2019 Previously Reported Hourly Emissions (lb/hr)	Recalculated Hourly Emissions (lb/hr)
BLST_STK	Arsenic	0	5.10E-08	0	0	2.13E-08	0
	Barium	0	3.81E-07	0	0	1.59E-07	0
	Beryllium	0	4.50E-10	0	0	1.88E-10	0
	Cadmium	1.54E-01	1.65E-07	4.28E-06	5.94E-05	6.86E-08	3.56E-07
	Cobalt	0	1.46E-07	0	0	6.10E-08	0
	Copper	1.40E-01	6.03E-06	3.87E-06	5.38E-05	2.51E-06	3.23E-07
	Lead	1.40E-01	7.08E-08	3.87E-06	5.38E-05	2.95E-08	3.23E-07
	Manganese	1.56E+00	1.44E-03	4.32E-05	6.00E-04	6.00E-04	3.60E-06
	Nickel	1.56E+00	1.97E-06	4.32E-05	6.00E-04	8.23E-07	3.60E-06
	Vanadium	0	3.39E-07	0	0	1.41E-07	0
	Zinc	0	2.46E-06	0	0	1.03E-06	0

4.0 RISK REDUCTION DEMONSTRATION

To demonstrate that the risk reduction measures proposed in Section 3.0 will decrease acute, 8-hr chronic, and chronic health risk impacts on nearby off-site workers, the emissions reported for the maximum annual rod usages chosen as representative (see Section 3.2.2.1) were recalculated using the proposed capture and control efficiencies for each type of operation, updated District welding emission factors (July 2022), and selected lower uncontrolled emission factors for CrVI and nickel emissions from welding. Table 2 shows the reported emissions and the recalculated emissions for each of the welding sources and for the abrasive blasting source.

Although the solvent use and paint booth source contributions to the risk impacts are negligible, compared to welding and abrasive blast sources, these two sources are included in the risk reduction demonstration. Table 3 below shows the TAC emissions reported for Solvent Use and the Paint Booth in 2015 and 2019. The maximum emissions reported between the two years for each TAC, shown in **bold** type, were chosen for the risk reduction demonstration modeling.

TABLE 3 PACIFIC SHIP SOLVENT USE AND PAINT BOOTH SOURCES REPORTED EMISSIONS IN 2015 AND 2019					
AERMOD Source ID	Pollutant	2015 Emissions		2019 Emissions	
		Annual (lb/yr)	Hourly (lb/hr)	Annual (lb/yr)	Hourly (lb/hr)
SOLV_USE	n-Butyl Alcohol	41.08	0.158	114.97	0.057
PNT_STK	Xylenes	8.51	0.036	2.97	0.033
	n-Butyl Alcohol	493.9	14.0	78.5	1.55
	1,2,4-Trimethylbenzene	16.8	0.22	103.5	0.88
	Ethylene Benzene	1.46	0.052	0	0
	Barium	0.90	0.004	1.52	0.005

Table 3 demonstrates that solvent and paint booth emissions vary from year to year. The values shown in **bold** type are used in the modeling for the risk reduction demonstration.

Table 4 shows the previously modeled health risk results for reporting years 2015 and 2019 and the recalculated health risk results using the more controlled emissions.

TABLE 4 PACIFIC SHIP RISK RESULTS BEFORE AND AFTER RISK REDUCTION MEASURES (RRM)				
Risk Type	Risk at PMI		Risk at MEIW/MEIR	
	Before RRM	After RRM	Before RRM	After RRM
2015 HRA				
Acute Risk	3.64	1.31	2.75 (MEIW)	0.98 (MEIW)
Worker Chronic Risk	2.68	0.25	2.01	0.13
Worker 8-hr Chronic Risk	2.46	0.55	1.84	0.29
2019 HRA				
Acute Risk	3.98	1.31	3.00 (MEIW)	0.98 (MEIW)
Worker Cancer Risk	278 in one million	13.3 in one million	121.5 in one million	6.98 in one million
Resident Cancer Risk	868 in one million	39.6 in one million	48.2 in one million	1.50 in one million

Acute, Chronic, and 8-hr Chronic risks are expressed in units of Health Hazard Index (HHI). Cancer risks are expressed as chances in one million.

After the proposed risk reduction measures are put into place, acute risk, worker chronic risk, and worker 8-hr chronic risk are all reduced to below the Rule 1210 1.0 HHI threshold; and worker cancer risk and resident cancer risk are reduced to below the Rule 1210 10 in one million cancer risk threshold.

5.0 RISK REDUCTION SCHEDULE

Rule 1210(e)(2)(iv) and (vi) state that the proposed airborne toxic risk reduction measures must be completed within five years, with interim progress reports provided to the District no less frequently than 12 months from when the plan is approved, and annually thereafter. PacShip plans to comply with these rules, with the goal to complete these proposed risk reduction measures by the end of 2022. Table 5 shows the schedule for the implementation of the proposed risk reduction measures:

TABLE 5 PACIFIC SHIP SCHEDULE OF RISK REDUCTION MEASURES IMPLEMENTATION	
Risk Reduction Measure	Implementation Date
Submittal of fume exhaust capture efficiency source test protocol to the District	September 30, 2022
Updates to equipment usage logs for welding and abrasive blast operations to include documentation details outlined in Section 3.1	September 30, 2022
Installation of a 99.97% particulate control efficiency HEPA filter on the abrasive blast/paint barn exhaust stack	October 28, 2022

TABLE 5 PACIFIC SHIP SCHEDULE OF RISK REDUCTION MEASURES IMPLEMENTATION	
Risk Reduction Measure	Implementation Date
Installation of 99.97% particulate control efficiency HEPA filters onto Building 15 exhaust stacks, and Buildings 16 and 24 portable welding emissions control equipment	November 18, 2022
Fume exhaust capture efficiency source testing to be performed after District approval	December 16, 2022

6.0 CONCLUSIONS

PacShip has included all of the required information from Rule 1210(e) regarding the RRAP. The risk reduction activities detailed in this permit modification application serve to update the current permit and show that PacShip is taking all necessary steps to reduce health risk from the facility.

APPENDIX A

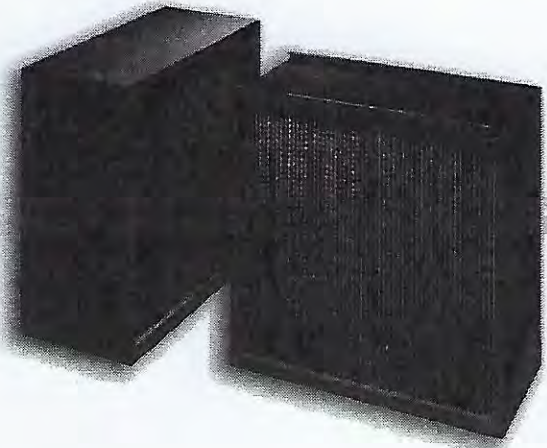
HEPA FILTERS AND PORTABLE FUME EXTRACTORS MANUFACTURING SPECIFICATIONS AND DRAWINGS

APPENDIX A-1

PROPOSED ABRASIVE BLAST CONTROL EQUIPMENT MANUFACTURING SPECIFICATIONS AND DRAWING

BioMAX™

HEPA Filters for Hospital, Commercial and Industrial Applications



Features

- Available in three efficiencies on 0.3 micron size particles: 99.97%, 99.99% (High Efficiency Particulate Air Filters) and 99.999%
- Standard and high capacity models
- Multiple cell side options
- Factory tested for efficiency and performance
- Specially-designed polyurethane foam bond sealant eliminates leaks
- Available in high temperature and 95% DOP models

BioMAX HEPA Filters

Koch Filter **BioMAX HEPA** Filters are designed to provide the highest level of filtration available for commercial and industrial applications. They are widely used in hospitals, clean rooms, pharmaceutical plants, and in hundreds of other systems where clean air is critical in the protection of people, processes and equipment.

BioMAX HEPA Filters are constructed using the highest quality components available and are available in efficiencies of 99.97%, 99.99% and 99.999% on 0.3 micron size particles. Standard construction **BioMAX HEPA** Filters are manufactured with galvanized steel cell sides or particle board cell sides. Multiple cell side options are also available.

BioMAX Performance Testing

Prior to shipment, BioMAX HEPA Filters are tested individually for efficiency utilizing non-toxic polyalphaolefin (PAO) to insure that every filter meets the customer's required efficiency specifications.

Following the individual efficiency test, depending on the acceptance criteria chosen by the customer, BioMAX filters may also be scanned for pinhole leaks with the use of a specialized high intensity light or a custom-built laser photometer.

After testing to the customer's criteria, each filter is certified and labeled with its own serial number. All data is recorded and retained internally.

BioMAX Construction

Standard **BioMAX HEPA** Filters are constructed with a choice of either 18 gauge galvanized steel or durable particle board cell sides. For more specialized applications, multiple cell side options are available including stainless steel, aluminum, and aluminized steel. **BioMAX** media is produced from sub-micron glass fibers formed into a water-resistant, high efficiency, high density wet-laid paper mat. The media is fire retardant to 1000°F (538°C). Standard **BioMAX HEPA** Filters are furnished with neoprene gaskets. The gasket is installed on the downstream side of the filter to prevent leakage between the filter and the frame upon installation in the filter housing. Precision-crafted corrugated aluminum separators maintain exact pleat spacing and ensure proper airflow throughout the filter's life cycle. The leading edge of each separator is rolled over to create a separator that is twice as strong to avoid damage to the air filter media.

Actual Size	Airflow Capacity (CFM)						Media Area (sq. ft.)						Initial Resistance	
	95.00%		99.97%		99.99%		95.00%		99.97%		99.99%			
	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC
24x24x11.50	1050	2000	1050	2000	1050	2000	154	188	168	282	168	282	1.0"	1.5"
23.38x23.38x11.50	1000	1900	1000	1900	1000	1900	145	178	164	275	164	275	1.0"	1.5"
24x12x11.50	525	1050	525	1050	525	1050	67	93	85	140	85	140	1.0"	1.5"
12x12x11.50	250	500	250	500	250	500	31	37	32	56	32	56	1.0"	1.5"
24x18x11.50	750	1500	750	1500	750	1500	100	127	109	210	109	210	1.0"	1.5"
24x30x11.50	1250	2500	1250	2500	1250	2500	172	219	186	320	186	320	1.0"	1.5"
24x24x5.88	550	1100	550	1100	550	1100	79	85	77	129	77	129	1.0"	1.5"
24x12x5.88	275	550	275	550	275	550	37	41	38	64	38	64	1.0"	1.5"

Notes:

- Underwriter's Laboratories Classifications: a: Metal framed BioMAX HEPA Filters and Wood framed BioMAX HEPA Filters: UL Classified
- Sizes listed above are actual filter sizes, excluding gaskets • Manufacturing tolerance: +0", -0.125". • Install BioMAX filters with pleats in vertical position.

BioMAX High Temperature HEPA Filters

Several models are available for use in systems with above-normal operational temperatures.

BioMAX HC High Capacity

Designed to operate in applications with higher airflows up to 500 FPM (Feet per Minute). Constructed with approximately 50% more filter media than Standard Capacity Filters, High Capacity BioMAX HC Filters can operate at velocities up to 2000 CFM with only a slight increase in pressure drop.

Cell Sides

Standard BioMAX HEPA Filters are constructed with a choice of either 18 gauge galvanized steel or durable particle board cell sides. For more specialized applications, multiple cell side options are available including stainless steel, aluminum, and aluminized steel.

High Efficiency Filter Media

BioMAX media is produced from submicron glass fibers formed into a water-resistant, high efficiency, high density wet-laid paper mat. The media is fire retardant to 1000°F (538°C).

BioMAX Construction

Gaskets

Standard BioMAX HEPA Filters are furnished with neoprene gaskets $\frac{1}{4}'' \times \frac{11}{16}''$. The gasket is installed on the downstream side of the filter to prevent leakage between the filter and the frame upon installation in the filter housing (High temperature silicone and other gasket materials are also available).

Rolled Double-Edge Aluminum Separators

Precision-crafted corrugated aluminum separators maintain exact pleat spacing and ensure proper airflow throughout the filter's lifecycle. The leading edge of each separator is rolled over to create a separator that is twice as strong to avoid damage to the air filter media (Vinyl-coated separators are available for applications with corrosive environments).

Adhesive Sealant

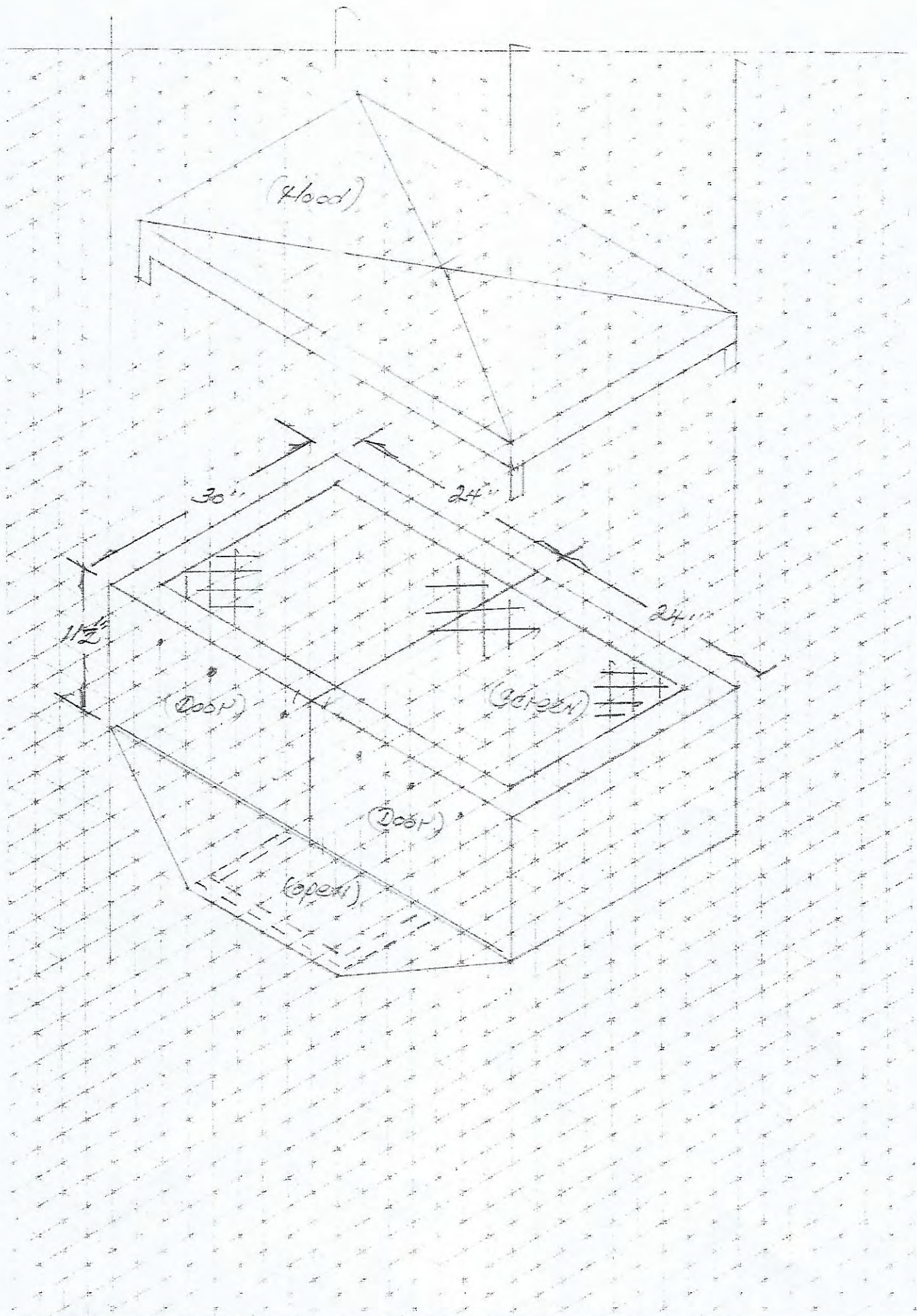
The media pack in BioMAX HEPA filters is completely sealed to the cell side frame with a specially-designed polyurethane foam bond. As the adhesive cures, the material expands into the media pack eliminating leaks.

KOCH FILTER
PURE PERFORMANCE

8401 Air Commerce Drive, Louisville, KY 40219

toll free: 800.757.5624 | phone: 502.634.4796 | Fax: 502.969.2364

info@kochfilter.com | www.kochfilter.com



APPENDIX A-2

EXISTING WELDING CONTROL EQUIPMENT MANUFACTURING SPECIFICATIONS



Sentry Air Systems, Inc.

USA: 1-800-799-4609

INTL: 1-713-699-2153

www.sentryair.com

6999 West Little York Road, Suite P1

Houston, TX 77040

Series 300

Operations and Maintenance Manual

U.S. PATENT #5,843,197

Model Numbers: SS-300-PFS, SS-300-FSD, SS-300-FSQ, SS-300-PYT, SS-300-WS, SS-300-WSL, SS-300-TS, SS-300-SKY, SS-300-MS, SS-300-MSS, SS-300-MSP, SS-300-PRAC, SS-300-MIST, SS-300-WFE, SS-300-MSD, SS-300-MSQ



NOTICE

**Read this manual before operating and servicing your unit.
Please call us if you have questions.**

Print this document in color.




TABLE OF CONTENTS

SAFETY SIGNAL WORDS AND SYMBOLS USED	3
USE OF THIS MANUAL	3
ABOUT SENTRY AIR SYSTEMS	3
GENERAL SAFETY PRECAUTIONS	4
IMPORTANT SAFETY INSTRUCTIONS	5
DISCLAIMER	5
OPERATION/INSTALLATION	6
MAINTENANCE	6
FLEX HOSE ASSEMBLY	7
FILTER INSTALLATION/REPLACEMENT	8
MODEL 300 REPLACEMENT FILTERS	8
FILTER INSTALLATION/REPLACEMENT PROCEDURE	9
OPTIONS	9
SPECIFICATIONS	9
WARRANTY	15

SAFETY SIGNAL WORDS AND SYMBOLS USED IN SENTRY AIR SYSTEMS DOCUMENTATION

Following ISO 3864-2 guidelines, when applying safety signal words to our documentation, we consider both the likelihood and the severity of events that could occur if instructions in this manual are not followed.

Our definitions are noted in the following table:

 DANGER	If an accident occurs, serious injury or death is almost certain.
 WARNING	If a hazardous situation occurs, serious injury or death is possible.
 CAUTION	Personal injury and/or property injury is a credible possibility.
NOTICE	Notes practices not related to personal injury.

USE OF THIS MANUAL

This operation and maintenance manual provides the user with the basic knowledge to operate and maintain Sentry Air Systems Series 300 equipment.

This manual may not be copied in whole and/or in part without written permission of Sentry Air Systems, Inc.

ABOUT SENTRY AIR SYSTEMS

Sentry Air Systems, Inc. is a Houston-based designer and manufacturer of high-quality fume extractors and air purification devices.

Our mission is continued engagement in the development air purification systems that improve your quality of life, at work and at home.

We are proud to have worked with and supplied air purification systems to industry leaders in government, space aeronautics, education, welding, environmental protection, computer technology, medical, pharmaceutical, construction, and entertainment.

We invite you to explore our website, www.sentryair.com, or give us a call at 800-799-4609 (International: 713-690-2153). We’re happy to work with you to develop an air purification solution that meets your specific needs.



Simple Solutions for Cleaner Air™

GENERAL SAFETY PRECAUTIONS**NOTICE**

- Read and understand all rules and instructions in safety manual before operating.
- To ensure the highest level of performance, use only SAS replacement filters in your SAS Extraction System.

CAUTION

- Before attempting or starting any maintenance or service on any equipment, the equipment must be unplugged from electrical outlet (power supply)
- All filters must be in place whenever the equipment is in operation. Do not operate the equipment with one or more filters missing and/or filters incorrectly installed.
- DO NOT substitute any other filters (particulate or chemical) for the filters supplied by SAS.
- Failure to supply the correct voltage to the unit will result in damage to the motor and/or individual.
- Do not attempt to clean any SAS Extraction Systems filters for reuse. Cleaning the filters will severely damage the filter media and, consequently, the filters performance. This will result in unfiltered, contaminated air being returned to the working environment.
- Do not use with inappropriate chemicals or substances. Failure to provide regular maintenance or other misuse of your SAS Extraction System may result in contaminated air being re-circulated into the work environment.
- Due to the modular nature of SAS Extraction Systems, SAS products provide a variety of mounting options to accommodate the requirements of various applications. Heavy-Duty reinforced mounting sections are an integral part of SAS Series 300 units. Responsibility for safely and securely mounting SAS units is the sole responsibility of the purchaser.

WARNING

- DIRTY FILTERS MAY BE CONTAMINATED. Use Personal Protective Equipment (PPE) during filter changes.
- Sentry Air Systems Fume, Gas, and Particulate Extractors are not intended to be used as a substitute for devices such as personal protective respirators which are designed to remove poorly adsorbed substances including carbon monoxide, methane, hydrogen, acetylene and other gases. Risk of serious injury, death, fire or explosion may result from improper use. If in doubt, consult with your industrial hygienist.
- Never use SAS Extraction Systems to extract fumes from highly flammable liquids and gases such as ether, gasoline and others. Risk of serious injury, death, fire or explosion may result.
- No part of SAS units or components may come into direct contact with fire or flame, smoking is prohibited.

DANGER

- Failure to comply with the operations and maintenance guidelines, filter replacement schedules, monitoring recommendations and safety guidelines contained herein, and in other relevant product safety literature provided with the substances and equipment producing the fumes to be extracted, could result in risk of serious injury, fire or explosion.
- Not intended for use in highly flammable or explosive environments, i.e. where the Lower

Flammability Limit for any chemical may be exceeded. Consult the specific Material Safety Data Sheet for questions regarding flammability limits and/or handling guidelines. DO NOT LEAVE EQUIPMENT UNATTENDED

IMPORTANT SAFETY INSTRUCTIONS

When using an electrical appliance, basic precautions should always be followed.



TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK, OR INJURY:

1. Do not leave unit unattended while turned on.
2. Use only manufacturer's recommended attachments and filters.
3. Do not use with damaged cord or plug.
4. Do not use in rain or other wet environment. Store indoors.
5. Do not pull or carry by flex arm or other attachment not intended for portability use.
6. Do not pull or carry by cord. To unplug, grasp the plug, not the cord.
7. Do not handle plug or unit with wet hands.
8. Do not put any objects into openings. Avoid loose clothing and jewelry near openings with moving parts.
9. Do not service unit while turned on. Disconnect power before servicing.
10. Do not change filters without Personal Protective Equipment (PPE).
11. Used filters must be changed periodically and disposed of correctly.
12. Do not use unit with missing or damaged filters.
13. Do not use unit to vacuum, or pick up, objects that are burning or smoking.
14. Do not smoke near unit.
15. Do not use to vacuum, or pick up, flammable or combustible liquids such as gasoline.
16. Do not vacuum toxic, combustible, carcinogenic or other hazardous materials such as arsenic, beryllium, lead or other health endangering materials.

Keep this manual in a safe place as its content are important for proper operations and maintenance.

Throughout the manual, make sure to understand the procedures for filter installation, removal, and replacement.

ALL SAS EQUIPMENT MUST BE STORED AND OPERATED INDOORS.

DISCLAIMER

Sentry Air Systems, Inc. disclaims all responsibility for any personal injury, property damage, fine, citation or penalty imposed by any government, private entity, or any other entity which results from any use, misuse or mis-application of any SAS products, failure of the user to properly use or to regularly maintain the product according to the recommended guidelines, or failure to adequately monitor fume extraction exhaust air and the ambient workplace air for the presence of harmful levels of gases, fumes, and particulates.

Compliance with all applicable environmental and personnel safety regulations is the sole responsibility of the user and adequate self-monitoring of exhaust air released into the atmosphere or the workplace as well as monitoring of the ambient workplace air is strongly recommended. To ensure continued effective performance, the following guidelines must be followed.

- General Safety Precautions
- Filter Safety Precautions
- Operation and Installation
- Maintenance
- Filter Installation and Replacement

OPERATION/INSTALLATION

GENERAL INSTALLATION PROCEDURES:

I. Placement of Equipment

- Unit: SAS Equipment should be positioned so that it will not block aisle ways or impede normal operating traffic or material handling pathways. It is important to position SAS Equipment to allow for proper clearance to remove the filter screws and replace the filter cartridges as needed.
- Exhaust: Typical systems will exhaust air out through the filters. When positioning the unit make sure that the exhaust area is not blocked or that airflow from the exhaust is not restricted in any way.
- Work Area: SAS Equipment should be positioned as close to the application/ work area as possible to maximize fume/dust capture. When using a flex hose, the suction point must be adequately placed in close proximity to the source of the contaminant. DO NOT create kinks or obstructions in the flex hose, as this will create a negative impact in the effectiveness of the equipment.



II. Power to Equipment

- FAILURE TO SUPPLY THE CORRECT INPUT POWER TO THE SAS EQUIPMENT MAY RESULT IN INJURY OR DAMAGE TO PERSONNEL AND /OR EQUIPMENT.
- **SAS EQUIPMENT PLUGS INTO A STANDARD 115 VOLT, 60 HZ, SINGLE PHASE GROUNDED ELECTRICAL OUTLET.**

III. Filter

- Before operating any unit, make sure all filters are correctly positioned, as filters may have shifted during shipment. All filters gaskets should be sufficiently compressed to accomplish filter sealing. Thumb screws must be well secured, but NOT over tightened.
- All filters are clearly marked with the filter type and direction of airflow. Identify which way the filters are installed to understand the direction of airflow.
- Refer to Assembly Instructions provided with equipment for further instructions.

MAINTENANCE



Motor: SAS supplied motors are nearly maintenance free. The motors do not require significant routine maintenance. Occasionally monitor air inlet perforations, fan blades, and motor to ensure excessive

particulate build up has not occurred. If there is a noticeable amount of fan vibration, inspect fan and cabinet for particulate build up. Contact factory if additional assistance is required.

Accessories: Cleaning of parts and accessories should be cleaned with non-aggressive cleaning solvent or detergent only. Make sure after cleaning that all parts are dry before using.

WARNING BIOHAZARD: DIRTY FILTERS MAY BE CONTAMINATED. Use Personal Protective Equipment (PPE) during filter changes.

Filter: Filter must be changed out regularly. Filter changes will vary by application and usage. SAS is not held liable for proper and/or timely filter changes.

Operating and Storage Environmental Conditions: ALL SAS EQUIPMENT MUST BE USED AND STORED INDOORS

Ambient Operating Temperature:
33°F to 110°F

Storage Temperature:
33°F to 100°F

Ambient Operating Humidity:
90% Relative humidity maximum non-condensing

Storage Humidity:
90% Relative humidity maximum non-condensing

FLEX HOSE ASSEMBLY

GENERAL INFORMATION:

PARTS: SAS Flex Hose Assembly comes equipped with a semi self-supporting round hose, round or square capture hood and hose clamp(s).

- a. Flex hose may come in 3" and 4" Diameters.
- b. Length of flex will vary by Model. Most flex arms are approximately 45"L, fully compressed.

USE: SAS provides flex hose to create a convenient and easy to use device for source capture. The flex hose must be placed adequately in close proximity to the source of the contaminant. DO NOT create kinks or obstructions in the flex hose, as this will create a negative impact in the effectiveness of the equipment.

NOTE: If your unit comes with a flex arm be sure to stretch (elongate) the arm vertically before bending it to avoid the arm snapping.

Occasionally, due to over-extension the flex hose may "pop apart." When this happens DO NOT change the diameter of the flex hose by twisting the flex at the open sections. Simply, realign open ends and snap together. Although simple, this procedure may take two operators to complete. Contact SAS for further assistance. **See Diagrams on following page to fix Flex Hose**



FILTER INSTALLATION/REPLACEMENT

GENERAL INFORMATION:

- **Pre-Filter/Carbon Pre-Filter:** This filter removes coarse particles and dust from the ambient air. The pre-filter/carbon pre-filter must be changed regularly. Depending on your application and usage, it may need to be changed more or less frequently. Setting up a regular filter maintenance schedule is recommended.
- **HEPA Filter:** This filter removes particulates from the air. The HEPA Filter is up to 99.97% efficient on particles down to .3 microns in size. Filter replacement may vary due to application and usage.
- **Carbon Filter:** This filter reduces certain odors and gases that can be noxious to an operator or work area. See the Carbon Adsorption chart at the back of this manual. Filter replacement may vary due to application and usage.
- **Specialty Filters:** These filters are blended with different types of filter media to reduce certain odors and gases that are not suitable to a standard carbon filter. Filter replacement may vary due to application and usage.

<i>MODEL 300 REPLACEMENT FILTERS</i>	
SS-300-PFP	MODEL 300 PRE-FILTER PADS – (Pkg. of 12)
SS-300-CFP	MODEL 300 ACTIVATED CARBON Pre-filter Pads – (Pkg. of 12)
SS-300-P65	MODEL 300-PRE-FILTER 65A 65% ASHRAE Pre filter Pads (Pkg. of 8)
SS-300-HF	MODEL 300 HEPA – Up to 99.97% Efficient on particles down to .3 in size.
SS-300-HFC	MODEL 300 HEPA FILTER – CERTIFIED
SS-300-UFC	MODEL 300 ULPA FILTER – CERTIFIED
SS-304-CF	MODEL 300 CARBON – 4 lb. Heavy-Duty Activated Carbon
SS-310-CF	MODEL 300 CARBON – 10 lb. Heavy-Duty Activated Carbon
SS-304-AGF	MODEL 300 ACID GAS FILTER – 4 lb. Heavy-Duty Acid Gas Filter
SS-310-AGF	MODEL 300 ACID GAS FILTER – 10 lb. Heavy-Duty Acid Gas Filter
SS-304-B50	MODEL 300 BLENDED FILTER – 4 lb. Heavy-Duty Special Blended Filter
SS-310-B50	MODEL 300 BLENDED FILTER – 10 lb. Heavy-Duty Special Blended Filter
SS-304-ASRB	MODEL 300 AMMONIASORB FILTER – 4 lb. Heavy-Duty Ammoniasorb Filter
SS-310-ASRB	MODEL 300 AMMONIASORB FILTER – 10 lb. Heavy-Duty Ammoniasorb Filter
SS-304-FORM	MODEL 300 FORMALDEHYDE FILTER – 4 lb. Heavy-Duty Formaldehyde Filter
SS-310-FORM	MODEL 300 FORMALDEHYDE FILTER – 10 lb. Heavy-Duty Formaldehyde Filter
SS-304-MERC	MODEL 300 MERCURY FILTER – 4lb. Heavy-Duty Mercury Filter
SS-310-MERC	MODEL 300 MERCURY FILTER- 10lb. Heavy-Duty Mercury Filter

FILTER INSTALLATION/REPLACEMENT PROCEDURE



REPLACEMENT PROCEDURE:

1. DISCONNECT POWER SUPPLY.
2. USE PERSONAL PROTECTIVE EQUIPMENT BEFORE HANDLING FILTERS OR OTHER ITEMS THAT MAY BE CONTAMINATED.
3. Position the fan/filter unit gently on its side.
4. Loosen all thumb screws until the base of the screws are flush with the inside of the filter cabinet. (Thumb screws must be flush with filter cabinet to avoid potential damage to the filters during removal or replacement).
5. Always follow local and national codes for disposal.
6. Replace filter as needed, making sure that the gasket faces toward the fan inlet.
7. Re-tighten all thumb screws until filter gasket is sufficiently compressed to accomplish filter sealing.
8. DO NOT over tighten.
9. Resume normal operation.

OPTIONS

Your unit may come equipped with an electronic hour counter and/or mini-helic gauge. These devices are options and intended to assist with the timing of filter changes and/or filter maintenance. Please contact your SAS rep with any questions regarding their usage.

*NOTE: These devices are provided to augment information and are not firm indicators of filter condition. Filter changes will vary by application and usage and are the sole responsibility of the user. Compliance with all applicable environmental and personnel safety guidelines is the sole responsibility of the user and strongly recommended. A reliable filter maintenance schedule is the responsibility of the user. Sentry Air Systems, Inc. will not be held liable for lack of proper and/or timely filter changes.

SPECIFICATIONS

MODEL	SS-300-MS
DESCRIPTION	Mounted Sentry
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 13.75" H w/ 6" Diameter Inlet Collar ~or~ 13" D x 13" W x 15.88" w/ 4" Diameter Inlet Collar
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
MOUNTING BRACKETS	(Qty.4) Epoxy Coated "L" shaped mounting brackets
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)

WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-MSP
DESCRIPTION	Mounted Sentry with Outlet Plenum
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 13.75" H (Unit), 14" D x 10.5" W x 15" H (Plenum), 6" Dia. (Outlet)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
MOUNTING BRACKETS	(Qty.4) Epoxy Coated "L" shaped mounting brackets
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-MSS
DESCRIPTION	Mounted Sentry Single
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 13.75" H w/ 6" Diameter Inlet Collar ~or~ 13" D x 13" W x 15.88" H w/ 4" Diameter Inlet Collar
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
MOUNTING BRACKETS	(Qty.4) Epoxy Coated "L" shaped mounting brackets
FLEX HOSE	4"Dia. Flex Arm : (32" L x 4" Dia. Flex Hose w/ round hood and hose clamp) ~or~ 6" Dia. Flex Arm: (32" L x 6" Dia. Flex Hose w/ round hood and hose clamp)
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-MSD
DESCRIPTION	Mounted Sentry Double
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.

CABINET DIMS.	13" D x 13"W x 15.88" H w/ (Qty.2)-4"Diameter Inlet Collars
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
MOUNTING BRACKETS	(Qty.4) Epoxy Coated "L" shaped mounting brackets
FLEX HOSE	(Qty.2)-4"Dia. Flex Arms:48"L x 4"Dia. Flex Hose w/ round hood and hose clamp
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter) (175 CFM per arm), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-MSQ
DESCRIPTION	Mounted Sentry Quad
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13"W x 15.88" H w/ (Qty.4)-3"Diameter Inlet Collars
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
MOUNTING BRACKETS	(Qty.4) Epoxy Coated "L" shaped mounting brackets
FLEX HOSE	(Qty.4)-3"Dia. Flex Arms:48"L x 3"Dia. Flex Hose w/ round hood and hose clamp
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter) (88 CFM per arm), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-PFS
DESCRIPTION	Portable Floor Sentry
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 15.75" H w/ 6" Diameter Inlet Collar (with casters) ~or~ 13" D x 13" W x 17.88" H w/ 4" Diameter Inlet Collar (with casters)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
FLEX HOSE	4"Dia. Flex Arm : (45"L x 4"Dia. Flex Hose w/ round hood and hose clamp) ~or~ 6" Dia. Flex Arm: (45" L x 6" Dia. Flex Hose w/ 10.5" square hood and hose clamp)
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)

WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-FSD
DESCRIPTION	Floor Sentry Double
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13"W x 17.88" H w/ (Qty.2) 4" Diameter Inlet Collars (with casters)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
FLEX HOSE	(Qty.2)-4"Dia. Flex Arms:48"L x 4"Dia. Flex Hose w/ round hood and hose clamp
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter) (175 CFM per arm), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter) (150 CFM per arm)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-FSQ
DESCRIPTION	Floor Sentry Quad
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13"W x 17.88" H w/ (Qty.4) 3" Diameter Inlet Collars (with casters)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
FLEX HOSE	(Qty.4)-3"Dia. Flex Arms:48"L x 3"Dia. Flex Hose w/ round hood and hose clamp
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter) (88 CFM per arm), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter) (75 CFM per arm)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-WFE
DESCRIPTION	Welding Fume Extractor
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 15.75" H w/ 6" Diameter Inlet Collar (with casters) ~or~ 13" D x 13" W x 17.88" H w/ 4" Diameter Inlet Collar (with casters)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
FLEX HOSE	4"Dia. Flex Arm : (45"L x 4"Dia. Flex Hose w/ round hood and hose clamp) ~or~ 6" Dia. Flex Arm: (45" L x 6" Dia. Flex Hose w/ 10.5" square hood and hose clamp)

ACCESSORIES	Magnehelic Gauge and Portability Handle
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-WS
DESCRIPTION	Winged Sentry
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13.75" D x 13" W x 13" H (cabinet only), 14" D x 30" W, 30" H (work area), Width will vary with hinged side flaps.
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-WSL
DESCRIPTION	Winged Sentry w/ acrylic lid
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13.75" D x 13" W x 13" H (cabinet only), 14" D x 30" W x 12" H (work area with acrylic lid)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-TS
DESCRIPTION	Table Sentry w/ 1" Slot Hood ~or~ 4" Slot Hood
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 14.75" H (with 2" slot hood), 13" D x 13" W x 17.75" H (with 4" slot hood)

BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-PRAC
DESCRIPTION	Portable Room Air Cleaner
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50LBS.
CABINET DIMS.	13" D x 13" W x 15.75" H (with casters)
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	58 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-PYT
DESCRIPTION	Python Portable Floor Sentry
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 40LBS.
CABINET DIMS.	15.5"L x 13"W x 16.5"H
ARM DIMENSIONS	4" Round x 12 ft. Flame Retardant Hose w/ Magnetic Capture Hood and Handle, Optional 25 ft. Hose Available. Upgraded Python HD hood w/ inlet grill & dual magnets available.
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	61 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-MIST
DESCRIPTION	Mist Collector
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 55-60 LBS.

CABINET DIMS.	15.5”L x 13”W x 21.25”H
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	61 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-300 CFM, Low-50 CFM
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

MODEL	SS-300-SKY
DESCRIPTION	Wall Mounted Sky Sentry
ELECTRICAL	115/1/60, Approx. 2 amps
WEIGHT	Approx. 50-80 LBS.
CABINET DIMS.	13”L x 13”W x 16.5”H
ARM DIMENSIONS	4” Round x 32” Long fire retardant flex hose 62.5” Swivel Radius when unit is mounted 52” above work surface
BLOWER MATERIAL	16 ga. carbon steel w/ polyester epoxy coating on all surfaces.
SOUND LEVEL	61 to 66 dba Variable Speed Controller (Low to High)
AIRFLOW	High-350 CFM, Low-50 CFM (Pre-Filter and HEPA Filter), High-300 CFM, Low-50 CFM (Pre-Filter and 10 lb. Carbon Filter)
WARRANTY	Limited two-year warranty from date of shipment on defects due to materials or workmanship
PATENTED DESIGN	U.S. PATENT #5,843,197

****All specifications are nominal and subject to change without notice.****

WARRANTY

DISCLAIMER:

Sentry Air Systems, Inc. disclaims all responsibility for any personal injury, property damage, fine, citation or penalty imposed by any government, private entity or any other entity which results from any use, misuse or mis-application of any SAS products, failure of the user to properly use or to regularly maintain the product according to the recommended guidelines, or failure to adequately monitor fume extraction exhaust air and the ambient workplace air for the presence of harmful levels of gases, fumes, and particulates.

Compliance with all applicable environmental and personnel safety regulations is the sole responsibility of the user and adequate self-monitoring of exhaust air released into the atmosphere or the workplace as well as monitoring of the ambient workplace air is strongly recommended. To ensure continued effective performance, the fore mentioned guidelines must be followed.

LIMITED WARRANTY:

Sentry Air Systems, Inc. warrants to the first user that this equipment will be free of defects in materials and workmanship for a period of two (2) years from the date of shipment.

This warranty does not cover repair or replacement required as a result of misuse, mishandling or

improper storage. Failure to perform recommended routine maintenance, alterations, or repairs made other than in accordance with Sentry Air System's directions, or removal or alteration of identification plates in any way will void this warranty. This warranty is available to the first user, but the exclusions and limitations herein apply to all persons and entities.

This warranty does not apply to consumable items such as filters, hoses or electrical components.

SENTRY AIR SYSTEMS, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Within the warranty period, Sentry Air Systems, Inc. will, at its option, repair or replace any defective equipment or parts at its facility or other locations approved by it at no charge to user or provide parts with charge for installation by qualified technicians in the field at user's expense and risk. User will be responsible for all costs of shipping and handling of equipment to Sentry Air Systems or other location for warranty service.

EXCEPT FOR THE REMEDY ABOVE DESCRIBED, UNLESS OTHERWISE REQUIRED BY APPLICABLE LAW, SENTRY AIR SYSTEMS WILL HAVE NO OTHER OBLIGATION WITH REGARD TO ANY BREACH OF WARRANTY OR OTHER CLAIM WITH RESPECT TO THE EQUIPMENT, OR LIABILITY FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL LOSS OR DAMAGE CAUSED BY OR OCCURRING IN CONNECTION WITH ANY OF THE EQUIPMENT.

Portable Floor Sentry

The Portable Floor Sentry fume extractor is a safety engineering control used for the capture and filtration of airborne contaminants. This source-capture fume extractor features heavy-duty casters for easy mobility, a flame-retardant and self-supportive flex arm, a small footprint, and high-quality filtration media.

Several filter media options are available for this unit and include: HEPA filtration [up to 99.97% efficient on particles 0.3 microns and larger, ASHRAE filtration [up to 95% efficient on particles 0.5 microns and larger], Activated Carbon, and specialty-blended filter media [i.e. Acid Gas, Mercury, Aldehyde, Ammonia]. The Portable Floor Sentry Fume Extractor allows multiple filter media to be housed inside the filter chamber for applications that emit both particulates and fumes.

300 Series

Model # SS-300-PFS



Features and Benefits

- Variable Speed Controller Included (115V only)
- Portability Handle Included
- Quiet Operation
- Reliable, Low Maintenance Operation
- Low Power Consumption
- Simple, Quick "No Tool" Filter Change
- Long Filter Life
- Optional Magnehelic Gage
- Optional Hour Counter

Available Filters

- HEPA Filter

Up to 99.97% efficient on particles down to 0.3 microns

- ASHRAE Filter
Up to 95% efficient on particles down to 0.5 microns
- ULPA Filter
Up to 99.9995% efficient on particles down to 0.12 microns
- Activated Carbon & Specialty-Blended Filters

300 Series

Cabinet Dimensions:

- 15.5"L x 13"W x 16.5"H

Arm Dimension:

- 5" Diameter x 68" Long

Motor:

Fractional Horsepower

Weight:

Approx. 40 lbs.

Air Volume:

350 CFM High, Down to 50 CFM Low

Electrical:

115/1/60, 2 amps

220/1/50, .75 amps

Sound Level:




61 to 66 dba (Blower Speed: Low to High)


Warranty:

Limited two-year warranty from date of shipment on defects due to materials or workmanship.

300 Series

Quick Compare

	 200 Series	 300 Series	 400 Series	 500 Series	 Rugged Air	 PAO
Cabinet Dimensions:	10.5"L x 8"W x 10.5"H	15.5"L x 13"W x 16.5"H	22.5"L x 20"W x 19.5"H	30" D x 30" W x 42.5" H	30" diameter 27" height, with plenum attached	13" D x 13" W x 13" H
CFM:	Up to 100 CFM	Up to 350 CFM	400 Series: Up to 700 CFM 450 Series: Up to 950 CFM	500 Series: Up to 869 CFM	Up to 530 CFM	Up to 290 CFM
Filter Sizes:	Small	Medium	Large	Extra Large <i>Cleanable</i>	Extra Large <i>Cleanable</i>	Medium
Weight:	Approx. 10 lbs.	Approx. 40 lbs.	50 lbs. to 100 lbs.	Approx. 225lbs w/out Filters Approx. 317lbs w/ Filters	Approx. 100 lbs.	Approx. 50 lbs.

	 200 Series	 300 Series	 400 Series	 500 Series	 Rugged Air	 PAO
Electrical	115/1/60, .3 amps 220/1/50, .2 amps	115/1/60, 2 amps 220/1/50, .75 amps	<i>400 Series:</i> 115/1/60, 2 amps 220/1/50, .75 amps <i>450 Series:</i> 115/1/60, 10.7 amps 220/1/50, 5.35 amps	<i>500 Series:</i> 115/1/60, 5.2 amps 220/1/50, 1.5 amps	115/1/60, 2 amps 220/1/50, .75 amps	115/1/60, 2 amps
Sound Level	56 dba @ 3 ft. from hood inlet	61 to 66 dba (Blower Speed: Low to High)	60 dba @ 3 ft.	72 dba @ 3 ft. from hood inlet	Approximately 74 dba (High), 48 dba on (low). 3' from inlet	43 to 68 dba (Blower Speed: Low to High)

PRED750

PREDATOR® PORTABLE AIR SCRUBBER

Lightweight and Portable

The Best & Most Mobile HEPA Filtration Device in its Class

With next-generation technology, the PRED750 features a unique, updated double-wall polymer cabinet and design that produces exceptional airflow and durability to make your jobs easier and more profitable.

FEATURES & BENEFITS

- Variable speed airflow, with maximum rated airflow as high as 750cfm
- Ultra-compact, light weight cabinetry, integral ergonomic lift handle and perfect weight balance
- Roto-molded body components are made from UL94HB flame retardant resin with EPA-registered microbial growth and UV inhibitors
- Safely daisy-chain up to five units on one 15 amp circuit
- "Zero Bypass" cabinet design
- Easy access for fast pre-filter and HEPA filter replacement
- Custom colors available
- The PRED750 has been independently tested and certified in accordance with applicable UL and CSA safety requirements

TECHNICAL SPECIFICATIONS

DESCRIPTION	UNIT	PRED750
Net Weight	lbs. (kg)	35 (15.88)
Dimensions (L x W x H)	in. (cm)	25.5 x 19.5 x 20.5 (64.77 x 49.53 x 52.07)
Electrical Rating	V, Hz, A	110-120 VAC, 60 Hz, 15 A
Airflow, max. with clean filters	CFM	750 on High, 200 on Low
Normal Operating Amps	amps	1.9 or less
Motorized Impeller		258 watt, auto reset, 60 Hz, single phase
Sound Level @ 5 Feet	dba	65 on high speed
HEPA Filter Efficiency	-	99.97% @ 0.3 microns
Cabinet Material	-	Polyethylene Cabinet Made From UL94HB Flame Retardant Resin
Pre-filter Access	-	Hinged "no tools" access door
First Stage Prefilter	1 ea.	F621, 1" deep coarse particulate
Second Stage Prefilter	1 ea.	H502, 2" deep pleated particulate
Optional Second Stage	1 ea.	VL1002, 2" deep high capacity carbon
HEPA Filter	1 ea.	H161606-99

Specifications and details are subject to change without prior notice.

Note: Airflow ratings estimates are based on factory and independent testing @ 120 VAC with an air straightener and a traverse of readings taken with a computing vane-anemometer. Actual results may vary for various reasons, including motor and blower and HEPA filter tolerances. Factors such as filter loading, reduced voltage to the motor, and inlet and outlet ducting will reduce airflow. Use these ratings as a general guideline only.



US Patent No. 9,868,082

U.S. Patent No. D742495 / Abatement Technologies, Inc.
Canadian Patent No. 156184 / Abatement Technologies, Inc.

THE PRED750 IS BEST SUITED FOR:



HEALTH CARE CONSTRUCTION



CRITICAL ENVIRONMENT PROTECTION



ABATEMENT & REMEDIATION



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- [Home](#)
- Final Stage 99.97% HEPA Filter

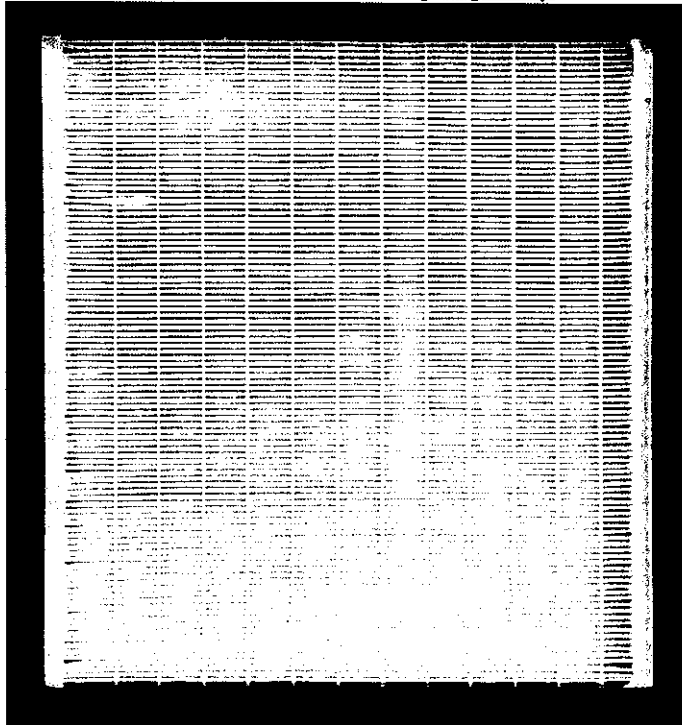
Final Stage 99.97% HEPA Filter

H161606-99

- **Filter Type:** HEPA Mini Pleat
- **Efficiency Rating:** 99.97% minimum @ 0.3 μ m
- **Media Type:** Microglass
- **Gasket Type:** Seamless Urethane Foam on Face of Header

[Skip to the end of the images gallery](#)

[Skip to the beginning of the images gallery](#)



[Specs](#)

Maximum Accessible Ceiling Height

Pleated

Air Changes per Hour

Die Cut Beverage Board

APPENDIX A-3

PROPOSED WELDING CONTROL EQUIPMENT MANUFACTURING SPECIFICATIONS AND DRAWING

Portable Weld Fume Extractor

Specifications



Description

A 1,200 CFM Portable fume extractor with filter cleaning system.

- Fume Arm included.
- Can be converted from ground mount to wall mount out of the box with no additional accessories.
- The unique Air Stream Filter Cleaner allows for 5-6 times the filter life over traditional reverse pulse systems depending on application.
- Steel construction, not plastic.

Warranty

As the original purchaser, we guarantee that your Fume Dog extraction system will remain free from defects in material within one year of its original purchase. If such defects appear under normal usage, we will repair or replace your product at no cost to you. Please refer to the Owners Manual for more information about our One Year Limited Warranty.



(FumeDog-PT)

Specifications

Airflow: 1200 CFM
Motor: 1.5 HP
Power: 120v 1/ph
Dimensions (in): 40.5" x 26" x 31.5"
Weight: 215 lbs(no arm)
Arm Diameter: 8"

Fume Dog: Portable Fume Extractor Quote

FD-PT-CW-87S
FD-PT-CW-87S

Fume Dog - Portable Weld Fume Extractor - (FumeDog-PT)

- Ships From Georgia
- 1,200 CFM
- Includes Fume Arm
- Air Stream Filter Cleaner which extends filter life 5-6 times
- Can be converted from ground mounted to wall mounted out of the box with no additional accessories required (Video: <https://youtu.be/m8Am8YVcGwo?t=56>)
- Designed for 1-2 Shifts a day, Stick, MIG, or TIG

Performance Video: https://www.youtube.com/watch?v=nQZGO-h_L0A



[fume-dog-portable-ddt comp](#)

[Doc# CAA-00130.R005 Fume Dog Unit Manual Feb 2021](#)

✓ FD-HEPA-FR
FD-HEPA-FR

HEPA after filter and frame to hold the HEPA filter.

HEPA filter and frame will be mounted on the exhaust. Dirty air will pass through the MERV 15 Nanofiber primary filter and then through the HEPA filter before being exhausted into the environment.

Freight Charge

Freight/ Shipping charges - LTL to 92113

Options selected 1 of 1
Subtotal, includes discount of _
Total

Terms

Credit Card or NET 30 (with credit approval)

[321 W-9 2022](#)

[Fume Dog Credit App](#)



FROM
Richard King
321 Teknik
7 Superior Drive SE
Rome, GA
30161
www.fumedog.com

PHONE
1-800-980-3481

SHIP
Pacific Ship Repair and
Fabrication

BY
Brent Moore

QUANTITY
543

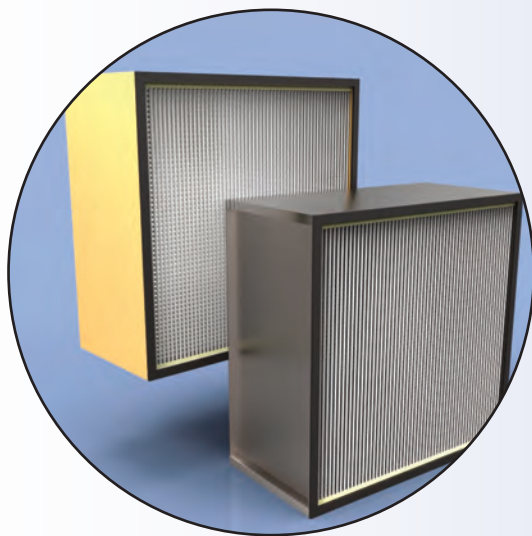
DATE
June 23, 2022

VALID UNTIL
July 23, 2022 at 4:00PM

Lead Time

24 to 48 Hours, plus transit.

2-4 Weeks with optional HEPA and frame.



MAGNA

950, 1000, 1100 & 1200 Series

- High Efficiency Glass Microfiber
- Heavy-Duty 3/4" Particleboard or Galvanized Metal Frames
- Two Part Polyurethane Sealant
- Standard Neoprene Gasketing
- High Capacity Filters Available

FEATURES

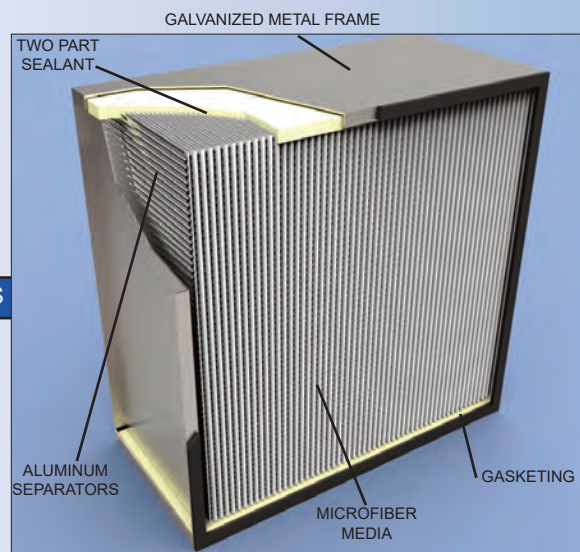


The Glasfloss Magna Series HEPA grade air filters are designed for high-efficiency commercial and industrial applications. Magna Series efficiency ranges include: 950 Series - 95% (MERV 16), 1000 Series - 99.97%, 1100 Series - 99.99% and 1200 Series - 99.999%, all based on a .30 micron particle. Glasfloss Magna filters are produced in a wide range of sizes, frame types and header combinations and are ideal for converting or upgrading existing systems. As an option, Glasfloss High-Capacity Magna filter models are also available for higher velocity applications and incorporate more media area for lower resistance.

The frame shall be made of a rigid high-density 3/4" particleboard or 18-gauge galvanized metal (26-gauge galvanized metal frame is used for the Magna 950 Series - 95% MERV 16). A 26-gauge galvanized steel header is available on the metal frame on 950 Series. The media shall be constructed of a water-resistant, inorganic glass microfiber. For quality assurance, the glass microfiber media rolls are randomly tested and certified to meet minimum efficiency requirements by the media manufacturer. The media pack shall consist of a continuous sheet of the pleated glass microfiber. The pleated media pack is separated with multiple rolled-edge corrugated aluminum separators. The media cartridge shall be sealed with a fire-retarding, rubber base, two-part sealant that bonds the media and separators to the interior of the frame. A 1/4" thick closed cell neoprene gasket shall be applied on the filter. The filter shall be rated to withstand temperatures at a continuous 180° Fahrenheit. The 95% (MERV 16), 99.97%, 99.99% and 99.999% Magna filters shall be Classified under U. L. Std. 900.



SPECIFICATIONS





THE CLEAR CHOICE SINCE 1936

BASE MODEL NUMBER	SIZE H x W x D EXACT	RATED VELOCITY FPM			INITIAL RESIST. IN. W.G.			MEDIA SQUARE FEET			INITIAL RESIST. IN. W.G.			MEDIA SQUARE FEET		
		Std	HC	SHC	Std	HC	SHC	Std	HC	SHC	Std	HC	SHC	Std	HC	SHC
950 Series - 95% (MERV 16)					Box Style											
0808A4	8 x 8 x 5-7/8	175	-	-	0.50	-	-	13.06	-	-	-	-	-	-	-	-
1212A4	12 x 12 x 5-7/8	175	-	-	0.50	-	-	29.75	-	-	-	-	-	-	-	-
2412A4	24 x 12 x 5-7/8	175	-	-	0.50	-	-	58.75	-	-	-	-	-	-	-	-
2418A4	24 x 18 x 5-7/8	175	-	-	0.50	-	-	88.13	-	-	-	-	-	-	-	-
2424A4	24 x 24 x 5-7/8	175	-	-	0.50	-	-	117.50	-	-	-	-	-	-	-	-
2430A4	24 x 30 x 5-7/8	175	-	-	0.50	-	-	146.88	-	-	-	-	-	-	-	-
2436A4	24 x 36 x 5-7/8	175	-	-	0.50	-	-	176.00	-	-	-	-	-	-	-	-
2448A4	24 x 48 x 5-7/8	175	-	-	0.50	-	-	235.00	-	-	-	-	-	-	-	-
1212B4	12 x 12 x 11-1/2	275	500	-	0.50	0.60	-	57.50	69.00	-	-	-	-	-	-	-
23F11FB4	23-3/8 x 11-3/8 x 11-1/2	275	500	-	0.50	0.60	-	106.17	127.40	-	-	-	-	-	-	-
2412B4	24 x 12 x 11-1/2	275	500	-	0.50	0.60	-	115.00	138.00	-	-	-	-	-	-	-
2418B4	24 x 18 x 11-1/2	275	500	-	0.50	0.60	-	172.50	207.00	-	-	-	-	-	-	-
23F23FB4	23-3/8 x 23-3/8 x 11-1/2	275	500	-	0.50	0.60	-	218.18	261.82	-	-	-	-	-	-	-
2424B4	24 x 24 x 11-1/2	275	500	-	0.50	0.60	-	230.00	276.00	-	-	-	-	-	-	-
2430B4	24 x 30 x 11-1/2	275	500	-	0.50	0.60	-	287.50	345.00	-	-	-	-	-	-	-
1000 Series - 99.97%, 1100 Series - 99.99%					Box Style						Flush Box Style					
0808A5	8 x 8 x 5-7/8	175	-	-	0.79	-	-	7.87	-	-	0.75	-	-	9.72	-	-
1212A5	12 x 12 x 5-7/8	175	-	-	0.79	-	-	20.93	-	-	0.75	-	-	23.92	-	-
1818A5	18 x 18 x 5-7/8	175	-	-	0.79	-	-	51.68	-	-	0.75	-	-	56.38	-	-
2412A5	24 x 12 x 5-7/8	175	-	-	0.79	-	-	70.47	-	-	0.75	-	-	75.17	-	-
2418A5	24 x 18 x 5-7/8	175	-	-	0.79	-	-	44.84	-	-	0.75	-	-	47.83	-	-
2424A5	24 x 24 x 5-7/8	175	-	-	0.79	-	-	96.09	-	-	0.75	-	-	102.50	-	-
2430A5	24 x 30 x 5-7/8	175	-	-	0.79	-	-	123.32	-	-	0.75	-	-	129.73	-	-
2436A5	24 x 36 x 5-7/8	175	-	-	0.79	-	-	148.95	-	-	0.75	-	-	155.35	-	-
2448A5	24 x 48 x 5-7/8	175	-	-	0.79	-	-	200.20	-	-	0.75	-	-	206.60	-	-
2460A5	24 x 60 x 5-7/8	175	-	-	0.79	-	-	253.05	-	-	0.75	-	-	397.83	-	-
*2472A5	24 x 72 x 5-7/8	175	-	-	0.79	-	-	304.30	-	-	0.75	-	-	476.41	-	-
1212B5	12 x 12 x 11-1/2	275	500	500	0.79	1.3	1.2	49.00	57.75	64.75	0.75	1.25	1.15	56.00	66.50	73.50
23F11FB5	23-3/8 x 11-3/8 x 11-1/2	275	500	500	0.79	1.3	1.2	97.87	116.12	129.39	0.75	1.25	1.15	104.51	122.76	137.68
2412B5	24 x 12 x 11-1/2	275	500	500	0.79	1.3	1.2	105.00	126.00	141.75	0.75	1.25	1.15	112.00	133.00	148.75
2418B5	24 x 18 x 11-1/2	275	500	500	0.79	1.3	1.2	157.50	189.00	212.63	0.75	1.25	1.15	168.00	199.50	223.13
23F23FB5	23-3/8 x 23-3/8 x 11-1/2	275	500	500	0.79	1.3	1.2	201.12	238.62	265.89	0.75	1.25	1.15	214.76	252.26	282.93
2424B5	24 x 24 x 11-1/2	275	500	500	0.79	1.3	1.2	210.00	252.00	283.50	0.75	1.25	1.15	224.00	266.00	297.50
2430B5	24 x 30 x 11-1/2	275	500	500	0.79	1.3	1.2	269.50	318.50	357.00	0.75	1.25	1.15	283.50	336.00	371.00

For 1100 Series - 99.99% replace 5 with 6 in the base part number.








1200 Series - 99.999%					Box Style					Flush Box Style						
1212B7	12 x 12 x 11-1/2	275	500	-	0.90	1.54	-	49.00	57.75	-	0.85	1.49	-	56.00	66.50	-
23F11FB7	23-3/8 x 11-3/8 x 11-1/2	275	500	-	0.90	1.54	-	97.87	116.12	-	0.85	1.49	-	104.51	122.76	-
2412B7	24 x 12 x 11-1/2	275	500	-	0.90	1.54	-	105.00	126.00	-	0.85	1.49	-	112.00	133.00	-
2418B7	24 x 18 x 11-1/2	275	500	-	0.90	1.54	-	157.50	189.00	-	0.85	1.49	-	168.00	199.50	-
23F23FB7	23-3/8 x 23-3/8 x 11-1/2	275	500	-	0.90	1.54	-	201.12	238.62	-	0.85	1.49	-	214.76	252.26	-
2424B7	24 x 24 x 11-1/2	275	500	-	0.90	1.54	-	210.00	252.00	-	0.85	1.49	-	224.00	266.00	-
2430B7	24 x 30 x 11-1/2	275	500	-	0.90	1.54	-	269.50	318.50	-	0.85	1.49	-	283.50	336.00	-

*Available in particle board only. Tolerances shall be +/- 1/16" for height and width. The frame depth shall not exceed 5-7/8" and 11-1/2".
Hi Capacity contains approx. 20% more media, Super High Capacity contains approx. 35% more media.

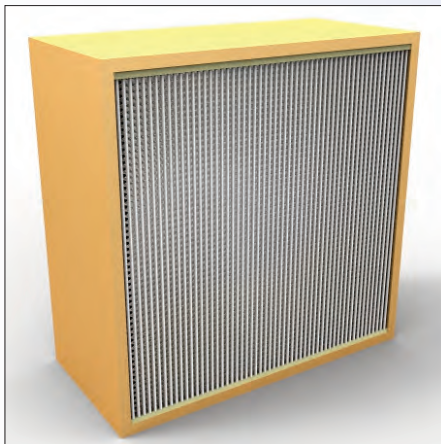
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PART NUMBER CONFIGURATION

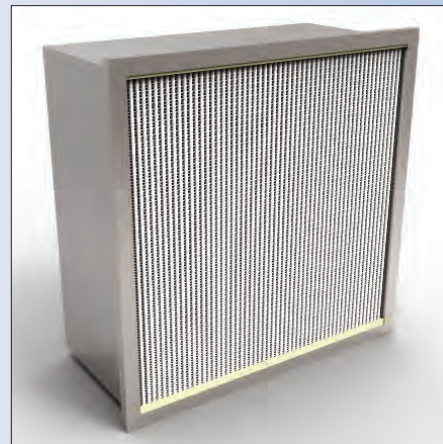
PREFIX	FRAME MATERIAL	FRAME STYLE	BASE MODEL NUMBER	GASKET LOCATION	FACE GUARDS	CAPACITY
						
MAG	P = PARTICLE BOARD G = GALVANIZED METAL	B = BOX STYLE H = SINGLE HEADER D = DOUBLE HEADER FX = FLUSH BOX	SELECT BASE MODEL NO. FROM CHART FOR DESIRED SIZE AND EFFICIENCY OR INSERT EXACT SIZE AND EFFICIENCY FOR SPECIAL SIZE MAGNA FILTERS	O = NO GASKET BOX STYLE A = AIR EXIT B = AIR ENTRY C = AIR EXIT/ENTRY D = SIDE LOAD SINGLE HEADER E = AIR ENTRY/EXIT F = AIR ENTRY H = AIR EXIT J = SIDE LOAD S = ONE VERTICAL SIDE	DOUBLE HEADER K = AIR ENTRY / EXIT M = AIR ENTRY P = AIR EXIT Q = SIDE LOAD	X = NONE 1 = BACK SIDE 2 = FRONT SIDE 3 = BOTH SIDES BLANK = REGULAR CAPACITY L = LOW CAPACITY H = HIGH CAPACITY S = SUPER HIGH CAPACITY.

PARTICLE BOARD BOX 950 (MERV 16), 1000 and 1100 Series



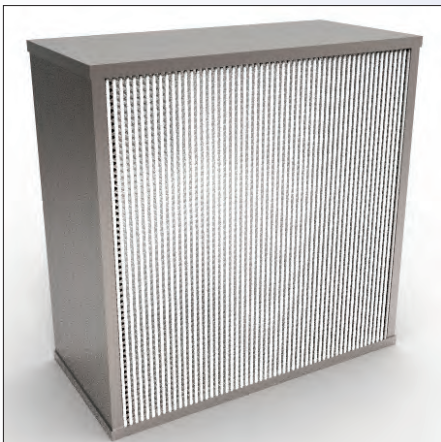
Air Flow
←
Side View

METAL SINGLE HEADER 950 Series (MERV 16)



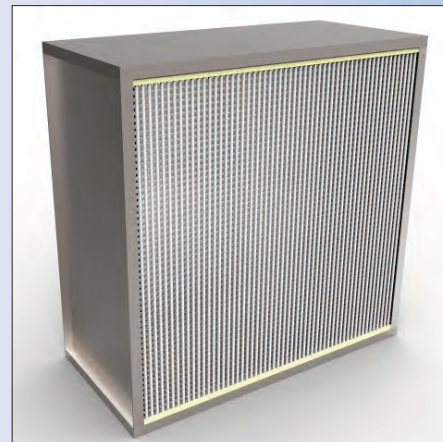
Air Flow
←
Side View

METAL FLUSH BOX - 1000, 1100 & 1200 Series METAL BOX - 950 Series (MERV 16)



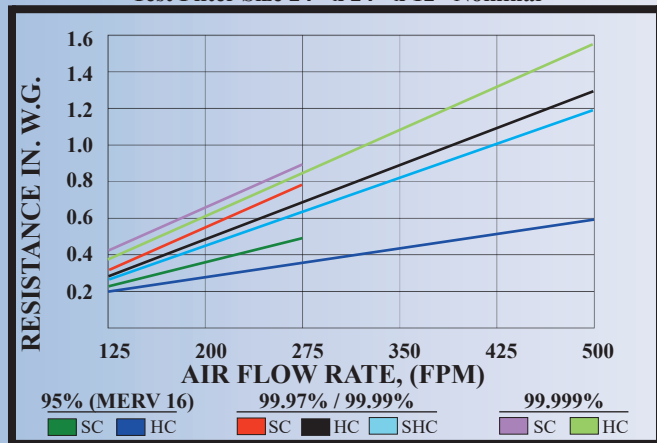
Air Flow
←
Side View

METAL BOX 1000, 1100 & 1200 Series

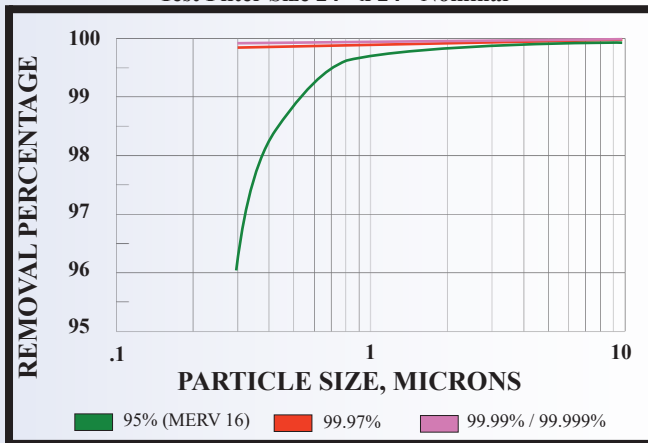


Air Flow
←
Side View

STANDARD PRESSURE DROP
Test Filter Size 24" x 24" x 12" Nominal



MINIMUM PARTICLE SIZE EFFICIENCY
Test Filter Size 24" x 24" Nominal



Features:

- Quality Assurance - the Magna 950 Series - 95% (MERV 16), 1000 Series - 99.97%, 1100 Series - 99.99% and 1200 Series - 99.999% filters incorporate glass microfiber media rolls that are randomly tested and certified to meet minimum efficiency requirements by the media manufacturer. In addition, Glasfloss randomly selects and tests filters for leaks under a rigorous quality control program.
- Media produced from glass microfibers is moisture-resistant and will not support microbial growth.
- Magna 99.99% and 99.999% filters are tested for leaks based on near-monodispersed .30 micron size particles.
- Frame is available in either 3/4" particleboard or 18 gauge galvanized metal for the 1000 Series - 99.97%, and 1100 Series - 99.99%. The 1200 Series - 99.999% is available in metal frame only. A 26-gauge galvanized metal frame is used for the Magna 950 Series - 95% (MERV 16).
- Aluminum separators incorporate rolled edges that help prevent media chaffing and damage in handling.
- The filter cartridge is bonded within the frame using a two-part sealant that isolates the filter from external shock and prevents air bypass.
- Neoprene closed-cell gasket is standard on each filter.

Optional Features:

- Upon request, the Magna 950 Series - 95% (MERV 16), 1000 Series - 99.97% shall be individually tested for leaks based on near-monodispersed .30 micron size particles; additional charges apply.
- An expanded metal wire lath face guard can be placed on the air-entry and/or the air-exit side of the filter.
- High-capacity and turbine-style filters are available.



SPECIFICATIONS FOR MAGNA SERIES

The filter element shall be factory-constructed by pleating a continuous sheet of glass microfiber media into uniform spaced pleats which are separated by rolled-edge corrugated aluminum. The efficiency shall be 95% (MERV 16), 99.97%, 99.99% or 99.999% based on a near-monodispersed .30 micron size particle. This filter pack shall be encased in a rigid frame of 3/4" particleboard or 18-gauge galvanized steel for the 1000 Series - 99.97%, 1100 Series - 99.99% and 1200 Series - 99.999% (metal frame only) efficiencies (26-gauge galvanized metal frame is used for the 950 Series - 95% MERV 16). The frame shall not exceed 5-7/8" or 11-1/2" in depth, and standard tolerances shall be +/- 1/16" on height and width. A closed-cell neoprene gasket shall be applied to the filter. Each filter shall be packaged into a heavy-duty carton. Filters shall be Classified under U. L. Std. 900.



Glasfloss manufactures a variety of medium and high efficiency air filters which can be specified for LEED certification applications. For specific information on these products, please contact your local Glasfloss Sales Representative.



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Technical Data Sheet



- **Part Number:** Dust Collection Filter Element – NFFR Cylindrical Filter.
- **Description:** MERV 15 – Flame retardant blended cellulose/polyester w/nanofiber - pulsed cartridge filter.
- **Application :** Fume welding and extraction systems



Filter Construction		Cylindrical
Dimensions	Height/OD/ID	18.0" x 13.84" OD x 9.480" ID
Filter Media	Area	170 ft ² (15.80 m ²)
	Description	NC007 – FR blended cellulose polyester media w/nanofiber
Outer & Inner Liners		G60 Galvanized Expanded Steel)
End Caps		G60 Galvanized Expanded Steel
Gasket		Expanded Neoprene Blended Rubber per ASTM D1056-2C2

Filter Performance (Cylindrical & Conical as a Pair)

Filtration Rating	n/a	EN779-2012 (Post IPA Neutralization)
	MERV 15	ASHRAE 52.2 - 2017
Dust Holding Capacity	500g at final resistance of 4.00" H2O - ASHRAE 52.2 - 2017	
Burst Strength	Breach Test > 25.0" H2O Final Resistance	

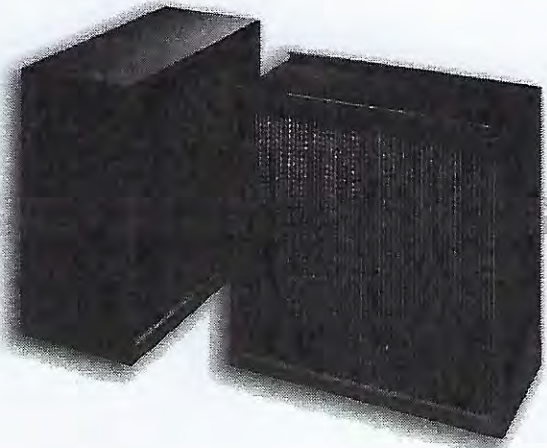
Air Flow vs Resistance (Clean Device) per EN779-2012/ASHRAE 52.2 - 2017

New Filter Initial Resistance	Airflow (cfm)	Resistance (w.g.)	
	@ 600 cfm	0.58"	
	@ 660 cfm	0.69"	
	@ 730 cfm	0.79"	
	@ 800 cfm	0.90"	
	@ 900cfm	1.02"	

The above data is nominal and provided for information purpose only. This data is not to be construed as manufacturing specifications and is subject to change. It is recommended all applications be discussed with NXTNANO prior to purchase, to ensure the correct product is provided.

BioMAX™

HEPA Filters for Hospital, Commercial and Industrial Applications



Features

- Available in three efficiencies on 0.3 micron size particles: 99.97%, 99.99% (High Efficiency Particulate Air Filters) and 99.999%
- Standard and high capacity models
- Multiple cell side options
- Factory tested for efficiency and performance
- Specially-designed polyurethane foam bond sealant eliminates leaks
- Available in high temperature and 95% DOP models

BioMAX HEPA Filters

Koch Filter **BioMAX HEPA** Filters are designed to provide the highest level of filtration available for commercial and industrial applications. They are widely used in hospitals, clean rooms, pharmaceutical plants, and in hundreds of other systems where clean air is critical in the protection of people, processes and equipment.

BioMAX HEPA Filters are constructed using the highest quality components available and are available in efficiencies of 99.97%, 99.99% and 99.999% on 0.3 micron size particles. Standard construction **BioMAX HEPA** Filters are manufactured with galvanized steel cell sides or particle board cell sides. Multiple cell side options are also available.

BioMAX Performance Testing

Prior to shipment, BioMAX HEPA Filters are tested individually for efficiency utilizing non-toxic polyalphaolefin (PAO) to insure that every filter meets the customer's required efficiency specifications.

Following the individual efficiency test, depending on the acceptance criteria chosen by the customer, BioMAX filters may also be scanned for pinhole leaks with the use of a specialized high intensity light or a custom-built laser photometer.

After testing to the customer's criteria, each filter is certified and labeled with its own serial number. All data is recorded and retained internally.

BioMAX Construction

Standard **BioMAX HEPA** Filters are constructed with a choice of either 18 gauge galvanized steel or durable particle board cell sides. For more specialized applications, multiple cell side options are available including stainless steel, aluminum, and aluminized steel. **BioMAX** media is produced from sub-micron glass fibers formed into a water-resistant, high efficiency, high density wet-laid paper mat. The media is fire retardant to 1000°F (538°C). Standard **BioMAX HEPA** Filters are furnished with neoprene gaskets. The gasket is installed on the downstream side of the filter to prevent leakage between the filter and the frame upon installation in the filter housing. Precision-crafted corrugated aluminum separators maintain exact pleat spacing and ensure proper airflow throughout the filter's life cycle. The leading edge of each separator is rolled over to create a separator that is twice as strong to avoid damage to the air filter media.

Actual Size	Airflow Capacity (CFM)						Media Area (sq. ft.)						Initial Resistance	
	95.00%		99.97%		99.99%		95.00%		99.97%		99.99%			
	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC	SC	HC
24x24x11.50	1050	2000	1050	2000	1050	2000	154	188	168	282	168	282	1.0"	1.5"
23.38x23.38x11.50	1000	1900	1000	1900	1000	1900	145	178	164	275	164	275	1.0"	1.5"
24x12x11.50	525	1050	525	1050	525	1050	67	93	85	140	85	140	1.0"	1.5"
12x12x11.50	250	500	250	500	250	500	31	37	32	56	32	56	1.0"	1.5"
24x18x11.50	750	1500	750	1500	750	1500	100	127	109	210	109	210	1.0"	1.5"
24x30x11.50	1250	2500	1250	2500	1250	2500	172	219	186	320	186	320	1.0"	1.5"
24x24x5.88	550	1100	550	1100	550	1100	79	85	77	129	77	129	1.0"	1.5"
24x12x5.88	275	550	275	550	275	550	37	41	38	64	38	64	1.0"	1.5"

Notes:

- Underwriter's Laboratories Classifications: a: Metal framed BioMAX HEPA Filters and Wood framed BioMAX HEPA Filters: UL Classified
- Sizes listed above are actual filter sizes, excluding gaskets • Manufacturing tolerance: +0", -0.125". • Install BioMAX filters with pleats in vertical position.

BioMAX High Temperature HEPA Filters

Several models are available for use in systems with above-normal operational temperatures.

BioMAX HC High Capacity

Designed to operate in applications with higher airflows up to 500 FPM (Feet per Minute). Constructed with approximately 50% more filter media than Standard Capacity Filters, High Capacity BioMAX HC Filters can operate at velocities up to 2000 CFM with only a slight increase in pressure drop.

Cell Sides

Standard BioMAX HEPA Filters are constructed with a choice of either 18 gauge galvanized steel or durable particle board cell sides. For more specialized applications, multiple cell side options are available including stainless steel, aluminum, and aluminized steel.

High Efficiency Filter Media

BioMAX media is produced from submicron glass fibers formed into a water-resistant, high efficiency, high density wet-laid paper mat. The media is fire retardant to 1000°F (538°C).

BioMAX Construction

Gaskets

Standard BioMAX HEPA Filters are furnished with neoprene gaskets $\frac{1}{4}" \times \frac{11}{16}"$. The gasket is installed on the downstream side of the filter to prevent leakage between the filter and the frame upon installation in the filter housing (High temperature silicone and other gasket materials are also available).

Rolled Double-Edge Aluminum Separators

Precision-crafted corrugated aluminum separators maintain exact pleat spacing and ensure proper airflow throughout the filter's lifecycle. The leading edge of each separator is rolled over to create a separator that is twice as strong to avoid damage to the air filter media (Vinyl-coated separators are available for applications with corrosive environments).

Adhesive Sealant

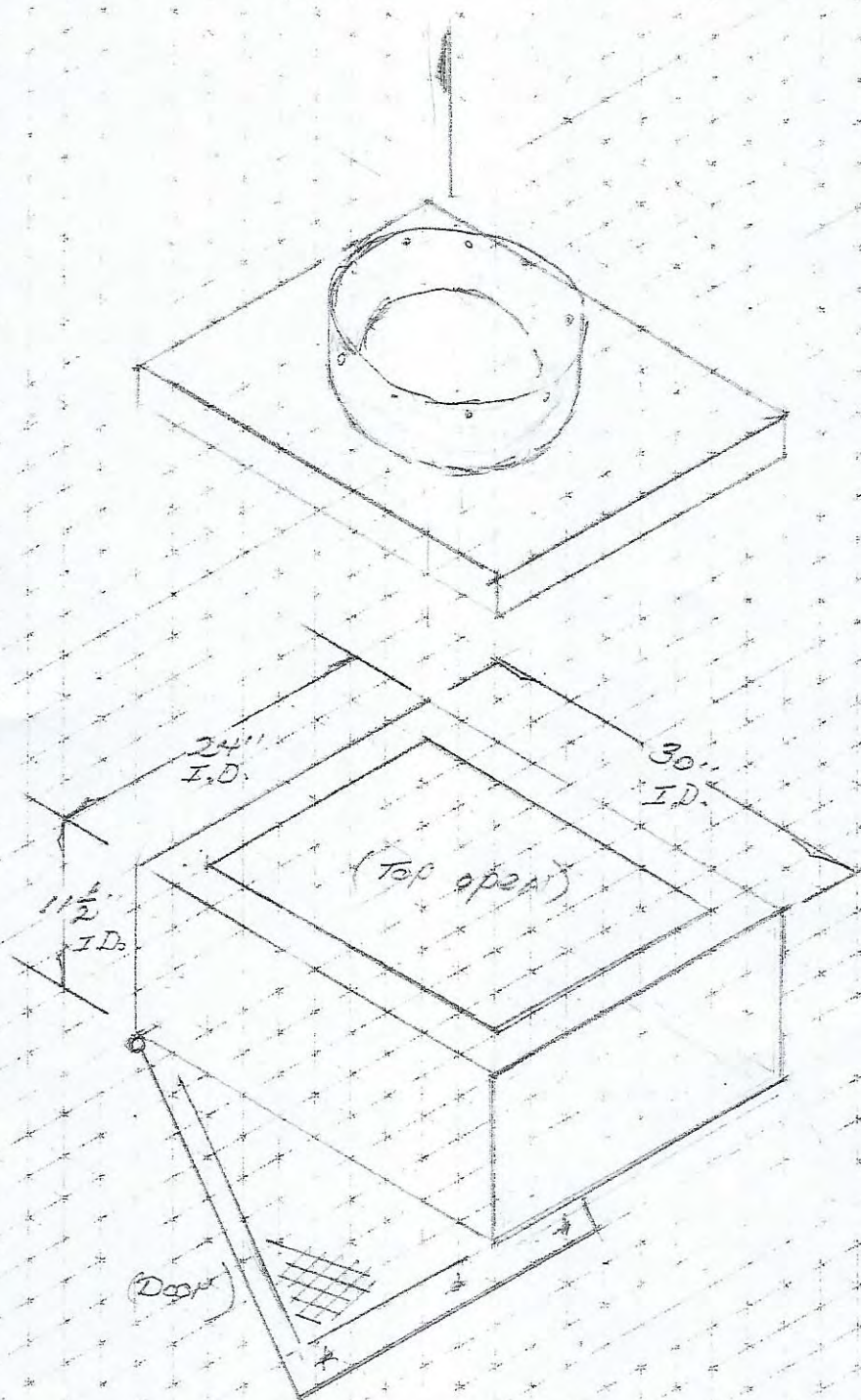
The media pack in BioMAX HEPA filters is completely sealed to the cell side frame with a specially-designed polyurethane foam bond. As the adhesive cures, the material expands into the media pack eliminating leaks.

KOCH FILTER
PURE PERFORMANCE

8401 Air Commerce Drive, Louisville, KY 40219

toll free: 800.757.5624 | phone: 502.634.4796 | Fax: 502.969.2364

info@kochfilter.com | www.kochfilter.com



(Bottom closed)

(Weld Booth)

APPENDIX B

WELDING ROD SAFETY DATA SHEETS

Bare Wires			
Arcos	AWS	Military	Applications
382	ERNiCr-3	EN/RN82	Welding of alloys 600, 601 and alloy 800 to themselves and dissimilar welding of stainless to carbon steels.
352	ERNiCrFe-7	N/A	Weld NiCrFe alloys ASTM B163, 166, 167 and 168.
392	ERNiCrFe-6	EN6A/RN6A	Clad steel with NiCrFe weld metal and join steel and stainless steel to nickel base alloys.
617	ERNiCrCoMo-1	N/A	Weld NiCrCoMo base material and join various dissimilar high-temperature alloys.
625	ERNiCrMo-3	EN/RN625	Useful for various dissimilar joints involving nickel alloys, carbon steel, low alloy and stainless steels. Primarily used on alloys 625, 601, 802 and 9% nickel.
651 (99 Nickel)	ERNi-CI	N/A	Commercially pure nickel for welding ductile, malleable and grey cast iron.
813	ERCuNi	EN/RN67	Weld 70/30, 80/20 and 90/10 copper nickel alloys.
816	ERNiCu-7	EN/RN60	Weld nickel-copper alloys B127, 163, 164 and 165.
861	ERNi-1	EN/RN61	Weld wrought and cast forms of commercially pure nickel ASTM B160, 161, 162 and 163.
2216 (44 Nickel)	ERNiFeMn-CI	N/A	Developed for welding of nodular, grey, spheroidal graphite and malleable cast irons to themselves or to other materials including stainless steel, carbon steel, low alloy steel and various nickel alloys.
C-276	ERNiCrMo-4	N/A	Weld NiCrMo base metal to itself, steel and most other nickel based alloys
622	ERNiCrMo-10	N/A	Weld NiCrMo alloys to itself, steel, to other nickel base alloys and for cladding steel with NiCrMo weld metal.
Alloy 59	ERNiCrMo-13	N/A	This nickel-chromium-molybdenum alloy is used to weld low-carbon NiCrMo alloys.
Covered Electrodes			
Arcos	AWS	Military	Applications
1N12	ENiCrMo-3	1N12	Use to join NiCrMo alloys such as 625, 800, 801, 825 and 600.
8N12	ENiCrFe-3	8N12/H	Weld similar NiCrFe composition base metals to themselves and carbon steel.
4N1A	ENiCrFe-2	4N1A	This electrode is used for various dissimilar combinations of austenitic and ferritic steels and high nickel alloys. Also can be used for welding 9% nickel.
9N10	ENiCu-7	9N10	Primarily used for welding nickel copper alloys to themselves and to steel.
352	ENiCrFe-7	N/A	Weld NiCrFe alloy 690 (UNS N06690) to themselves.
C-276	ENiCrMo-4	N/A	Weld C-276 to itself and most other nickel based alloys.
617	ENiCrCoMo-1	N/A	Weld NiCrCoMo base material and join various dissimilar high temperature alloys.
803	ECuNi	CuNi	Weld wrought or cast 70/30, 80/20 and 90/10 copper nickel alloys.
Alloy 59	ENiCrMo-13	N/A	Weld low-carbon NiCrMo alloys.
622	ENiCrMo-10	N/A	Nickel-chromium-molybdenum alloy is used to weld low-carbon NiCrMo alloys.

Safety Data Sheet

OSHA HazCom Standard 29 CFR

1910.1200 GHS Rev 03

Printing Date: 04/26/2016

1 – Identification

Copper & Brass Welding Alloys				
Welding Alloys				
CDA	Trade Name	AWS Specification	AWS Classification	DIN Classification
C18900	WWW Copp Weld	A5.7	ERCu	Not Available
C51000	WWW Phos A Weld	A5.7	ERCuSn-A	SG-CuSn6
C52100	WWW Phos C Weld	A5.7	ERCuSn-C	Not Available
C61000	WWW A1 Bronze Weld	A5.7	ERCuAl-A1	SG-CuAl8
C61800	WWW A2 Bronze Weld	A5.7	ERCuAl-A2	SG-CuAl10Fe
C62400	WWW A3 Bronze Weld	A5.7	ERCuAl-A3	Not Available
C63280	WWW Nickel Bronze Weld	A5.7	ERCuNiAl	SG-CuAl8Ni6
C63380	WWW Mang-Nickel Bronze Weld	A5.7	ERCuMnNiAl	SG-CuMn13Al7
C65600	WWW Sil Weld	A5.7	ERCuSi-A	SG-CuSi3
C70600	WWW Copp Nickel Weld 90/10	A5.7	Not Available	SG-CuNi10Fe
C71500	WWW Copp Nickel Weld 70/30	A5.7	ERCuNi	SG-CuNi30Fe
Brazing Alloys				
CDA	Trade Name	AWS Specification	AWS Classification	DIN Classification
C10200	WWW Copp Spray	A5.8	RBCu-3	Not Available
C47000	WWW Naval Brass	A5.8	RBCuZn-A	Not Available
C68000	WWW Low Fuming Nickel Bronze	A5.8	RBCuZn-B	Not Available
C68100	WWW Low Fuming Bronze	A5.8	RBCcZn-C	Not Available
C77300	WWW Nickel Silver	A5.8	RBCuZn-D	Not Available

Recommended Use

- GMAW, GTAW, Brazing, Arc Spray

Emergency Phone Number

- 1-262-968-6982

2 – Hazard Identification

Classification of the Chemical in Accordance with Paragraph (d) of Std. 1910.1200

- All classifications of Hazardous Materials are in accordance of Globally Harmonized System of Classifications(GHS) and Occupational Safety, and Health Administrations(OSHA) Classifications in how it relates to Std. 1910.1200

Signal Word, hazardous statement, symbol and precautionary statement



- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity



- Irritant (Skin and Eye)
- Skin Sensitizer
- Acute Toxicity (Harmful)
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer

- Precautionary statement

- o Keep your head out of the fumes. Use enough ventilation and/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. Welding, brazing, spraying, grinding, machining or cutting this product may cause hazardous fumes and/or dust which can cause chills (Metal Fume Fever) by overexposure. Excessive exposure may cause lung damage, systemic poisoning of flu like symptoms, Use NIOSH respirator if concentrations exceed the LV limit or maintain concentrations below the TLV limit by general ventilation of local exhaust.

Hazards not otherwise Classified

- No known hazards

Element	CAS Number	Hazard(s)
Aluminum	7429-90-5	metal dust and respirable fraction
Copper	7440-50-8	Eye, Upper Respiratory tract irritation; dermatitis; rare interstitial lung disease; pulmonary fibrosis; ingestion - nausea, vomiting, diarrhea; ingestion of large dose - liver damage, acute renal failure, death.
Iron Oxide Fumes	1332-37-2	Pulmonary Siderosis
Manganese fumes	7439-96-5	Metal Fume Fever*
Nickel	7440-02-0	Lung sinus cancers; Sensitization dermatitis, allergic skin rash
Silicon Fumes	7440-21-3	Nusiance Particulate-Accumulation in lungs
Tin	7440-31-5	Eye, Nose, Throat, and skin Irritation
Zinc	1314-13-5	Metal Fume Fever*
		*Metal Fume Fever is a temporary affliction with symptoms including: chills, fever, upset stomach, vomiting, dryness of the throat, cough, weakness, and achiness

3 – Composition/Information on Ingredients

Welding Alloys											
CDA	Trade Name	Cu	Al	Fe	Zn	Ph	P	Sn	Si	Ni	Ti
C18900	WWW Copp Weld	98% Min.	0.01% Max	-	-	0.02% Max	0.15% Max	-	-	-	-
C51000	WWW Phos A Weld	Remainder	0.01% Max	-	-	0.02% Max	0.01% - 0.35%	4% - 6%	-	-	-
C52100	WWW Phos C Weld	Remainder	0.01% Max	0.1% Max	0.2% Max	0.02% Max	0.1% - 0.35%	7% - 9%	-	-	-
C61000	WWW A1 Bronze Weld	Remainder	6% - 8.5%	-	0.2% Max	0.02% Max	-	-	-	-	-
C61800	WWW A2 Bronze Weld	Remainder	8.5% - 11%	0.5% - 1.5%	0.02% Max	0.02% Max	☺	☺	☺	☺	☺
C62400	WWW A3 Bronze Weld	Remainder	10% - 11.5%	2% - 4.5%	0.1% Max	0.02% Max	-	-	-	-	-
C63280	WWW Nickel Bronze Weld	Remainder	8.5% - 9.5%	3% - 5%	0.1% Max	0.02% Max	-	-	0.1% Max	4% - 5.5%	-
C63380	WWW Mang-Nickel Bronze Weld	Remainder	7% - 8.5%	2% - 4%	0.15% Max	0.02% Max	-	-	0.1% Max	1.5% - 3%	-
C65600	WWW Sil Weld	Remainder	0.01% Max	0.5% Max	1% Max	0.02% Max	-	1% Max	2.8% - 4%	-	-
C70600	WWW Copp Nickel Weld 90/10	Remainder	-	1% - 2%	-	0.02% Max	0.02% Max	-	0.2% Max	9% - 11%	-
C71500	WWW Copp Nickel Weld 70/30	Remainder	-	0.4% - 0.75%	-	0.02% Max	-	-	0.25% Max	29% - 32%*	0.2% - 0.5%
Brazing Alloys											
CDA	Trade Name	Cu	Al	Fe	Zn	Ph	P	Sn	Si	Ni	Ti
C10200	WWW Copp Spray	99.95% Min.	-	-	-	-	-	-	-	-	-
C47000	WWW Naval Brass	57% - 61%	0.001% Max	-	Remainder	0.05% Max	-	0.25% - 1%	-	-	-
C68000	WWW Low Fuming Nickel Bronze	56% - 60%	0.01% Max	0.25% - 1.2%	Remainder	0.05% Max	-	0.8% - 1.1%	-	0.2% - 0.8%	-
C68100	WWW Low Fuming Bronze	56% - 60%	0.1% Max	0.25% - 1.2%	Remainder	0.05% Max	-	0.8% - 1.1%	0.04% - 0.15%	-	-
C77300	WWW Nickel Silver	46% - 50%	0.01% Max	-	Remainder	0.05% Max	0.25% Max	-	0.04% - 0.25%	9% - 11%	-
*Nickel with Cobalt											
all values are nominal values and ranges, not actuals											

Element	CAS#	RETCS	
Copper	7440-50-8	GL 5325000	STOT SE 3, H335; Aquatic Chronic 4, H413
Aluminum	7429-90-5	BD 0330000	Sol. 2, H228;
Nickel	7440-02-0	-	Carc. 2, H351; STOT RE 1, H372; Skin Sens. 1, H317
Iron	7439-89-6	NO 4565500	Sol. 2, H228; (Irritant) Skin Irrit. 2, H315; STOT SE 3, H335; Eye Irrit. 2B, H320; Combustible Dust
Manganese	7439-96-5	OO 9275000	Pyr. Sol. 1, H250; Water-react. 1, H260
Silicon	7440-21-3	-	Flam. Sol. 2, H228; Acute Tox. 4, H302; Eye Irrit. 2B, H320
Zinc	7440-66-6	-	Aquatic Acute 1, H400; Aquatic Chronic 1, H410, Skin Irrit. 2, H315; Eye Irrit. 2B, H320; Combustible Dust
Cobalt	7440-48-4	GF 8750000	Resp. Sens. 1, H334; Carc. 2, H351; Skin Sens. 1, H317; Aquatic Chronic 4, H413; Combustible Dust
Titanium	7440-32-6	XR 1700000	Skin Sens. 1, H317; Eye Irrit. 2B, H320
Lead	7439-92-1	OF 7525000	Acute Tox. 1, H300; Carc. 2, H351; Repr. 1A, H360; STOT RE 2, H37

4 – First Aid

General Guidelines

- Know how to get help, and know where the First Aid kits
- Make sure the area is safe for you
- Use personal protective equipment (gloves, masks, et.)
- Position the person appropriately if their airway needs to be opened or CPR is needed
- Do not move a person who may have suffered a neck or back injury

Inhalation

- Move person to an area of clean air, or supply clean air to them. If required, provided an artificial respirator. In case of unconsciousness, place patient on side before transporting.

Skin

- Immediately wash with water and soap, then rinse thoroughly. Apply burn spray if required.

Eye

- Do not rub eyes. Immediately flush eyes under for at least 15 minutes. Use an eye washing station if available.

Ingestion

- Not really Applicable

Most Important Symptoms and effects, both acute and delayed

- Acute overexposure to welding fumes may result in discomfort such as metal fume fever (dizziness, nausea, or dryness or irritation of nose, throat, or eyes). May aggravate pre-existing respiratory problems.
- Chronic overexposure to welding fumes can lead to siderosis (Iron deposits in the lung), central nervous system effects, bronchitis and other pulmonary effects.
- Welding Hazards are complex and may include physical and health hazards such as, but not limited to, electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to welding fume or dust.

5 – Fire-fighting measures

Suitable (and unsuitable) extinguishing media

- In shipped form use the appropriate extinguishing media for the surrounding area
- For metal fires, use the appropriate media.

Special Hazards

- The Process of welding can result in sparks that may or may not, cause an ignition of combustibles or flammables. Remove ignitable materials from the area.

Special protective equipment and precautions

- Standard fire-fighting gear is required

6 – Accidental release measures

Personal precautions, protective equipment, and emergency procedures

- Allow for adequate ventilation and use proper shielding and clothing, see section 8.

Methods and materials for containment and clean up.

- Clean up mechanically; never allow waste to enter sewage or other water systems

7 – Handling and storage

Precautions of safe handling

- Handle with care. Ensure good ventilation/exhaust at the work station

Conditions for safe storage

- Store away from acids, bases and Strong Oxidizing Agents.
- Store in a dry location in compliance with local, regional, and national regulations

8 – Exposure controls/personal protection

Material	CAS #	value	REL mg/m3		PEL mg/m3		TLV mg/m3	
			Fume	Dust	Fume	Dust	Fume	Dust
Copper	7440-50-8	Long term	0.1	1	0.1	1	0.2	1
Aluminum	7429-90-5	long term	Respirable	Total Dust	Respirable	Total Dust	Respirable	Total Dust
			5	10	5	15	1	-
Silicon	7440-21-3	Long Term	Respirable	Total Dust	Respirable	Total Dust	Respirable	Total Dust
			5	10	5	15	Withdrawn	
Manganese	7439-96-5	Long term Short Term Ceiling Limit	Respirable	Fume	Respirable	Fume	Respirable	Fume
			X	1	X	X	0.02	0.1
			X	3	X	X	X	X
Zinc	7440-66-6	Long Term	X	X	X	5	X	X
			Fume	Dust	Fume	Dust	Fume	Dust
			5	5	5	10	5	5
Tin	7440-31-5	As Metal	2		2		2	
Nickel	7440-02-0	As Dust	0.015		1		1.5	
Lead	7439-92-1	As Metal	0.05		0.05		0.05	
Cobalt	7440-48-4	Long Term	Fume	Dust	Fume	Dust	Fume	Dust
			0.5	0.5	0.1	0.1	0.02	0.02
Iron	7439-89-6	Oxide	5		10		5	

Appropriate Engineering Controls

- As packaged, no special engineering controls required. While in processing, proper ventilation is required.

Individual protection measures, such as personal protective equipment

- As packaged, no additional protective measures required. When welding, brazing, spraying, grinding, and any other alteration to the original product, requires proper gloves, boots, clothing, eyes, ears, and face protection.

9 – Physical and Chemical Properties

Appearance

- Physical State
 - o Solid as packaged
- Color
 - o Red, Gold, Silver – Grade Specific

Odor

- Odorless
- No odor threshold

PH

- Not Applicable

Melting point

- Nominal Range (1650 Deg. F – 1980 Deg. F) Grade Specific

Initial boiling point and boiling range

- Not Applicable

Flash point

- Not Applicable

Evaporation rate

- Not Applicable

Flammability

- Not Applicable

Upper/Lower flammability or explosive limits

- Not Applicable

Vapor pressure

- Not Applicable

Vapor density

- Not Applicable

Relative density

- Not Determined

Solubility

- Not Applicable

Partition coefficient

- Not Applicable

Auto-ignite temperature

- This product does not self-ignite

Decomposition temperature

- Not Applicable

Viscosity

- Not Applicable

10 – Stability and Reactivity

Reactivity

- This product is non-reactive

Chemical stability

- This product is stable under normal conditions

Possibility of hazardous reactions

- None

Conditions to avoid

- None known conditions exist

Incompatible materials

- Oxidizing Agents

Hazardous decomposition products

- Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the processes and procedures followed, and the welding consumables used. Other conditions that also influence the composition and quantity of fumes and gases to which workers may be exposed include: coatings on the metal being welded, the number of welders in operation and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, and the presence of contaminants in the atmosphere. When the electrode is consumed, the fume and gas decomposition products generated are varying in percentage. Fume and gas decomposition, and not the ingredients within the electrode, are what is important.

11 – Toxicological Information

Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact)

- Acute Inhalation
 - o Welding Fumes may result in discomfort, such as dizziness, nausea, dryness, or irritation of the throat, nose, and/or eyes.
 - o Aluminum oxide may cause irritation of the respiratory system
 - o Copper may cause capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, and central nervous system excitation.
 - o Manganese may cause "metal fume fever" (section 2 on more information on metal fume fever)
 - o Nickel may cause a metallic taste, nausea, tightness in chest, fever, and allergic reactions.
- Chronic Inhalation
 - o Welding fumes in excess levels may cause bronchial asthma, lung fibrosis, pneumoconiosis, or siderosis. Overexposure to air contaminants may lead to their accumulation in the lungs, a condition which may be seen as dense area's on the chest x-rays.

- Aluminum oxide may cause pulmonary fibrosis and emphysema
- Copper may cause hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea.
- Manganese may cause “manganism”. Symptoms include languor, sleepiness, muscular weakness, emotional disturbances, spastic gait, and tremors.
- Nickel may cause lung fibrosis or pneumoconiosis.
- Ingestion
 - Highly unlikely route of exposure
- Skin
 - Irritant to skin and mucous membranes
- Eye
 - Irritating effect

Acute Toxicity

CAS #	Common Name		amount
7429-90-5	Aluminum	Oral - LD50	>5000mg/kg (rat)
7429-90-5	Aluminum	Inhalative LC50/4 h	888 mg/l (rat)
7439-89-6	Iron	Oral - LD50	7500 mg/kg (rat)
7439-96-5	Manganese	Oral - LD50	9000 mg/kg (rat)
7440-21-3	Silicon	Oral - LD50	3160 mg/kg (rat)
7440-48-4	Cobalt	Oral - LD50	6170 mg/kg (rat)

Carcinogenic

CAS #	Common Name	IARC
7440-48-4	Cobalt	2B - Possibly carcinogenic to humans
7439-92-1	Lead	2B - Possibly carcinogenic to humans
7440-02-0	Nickel	1 - Carcinogenic to humans

12 – Ecological Information

Exotoxicity

- Aquatic

CAS #	Common Name	Aquatic Toxicity
7440-50-8	Copper	0.04 - 0.05 mg/l
7440-02-0	Nickel	1 mg/l
7439-96-5	Manganese	40 mg/l

- Terrestrial
 - None

Persistence and degradability

- No further relevant information

Bioaccumulative potential

- No further relevant information

Mobility in soil

- No further relevant information

Other adverse effects

- None known at the time

13 – Disposal Considerations**Waste treatment methods**

- Minimization of waste is optimal. But when waste is accumulated, Disposal is best done through recycling in an environmental manner that is compliant with federal, state, provincial, and local requirements.

14 – Transport Information**UN Number**

- Not regulated

UN proper shipping name

- Not regulated

Transport Hazard class

- Not regulated

Packaging group

- Not regulated

Environmental Hazards

- None

Transport in bulk

- Not applicable

Special precautions

- None

15 – Regulatory Information**Safety, health, and environmental regulations**

- SARA (Superfund Amendments and Reauthorization)
 - o Section 313 (Specific toxic chemical listings)
 - 7440-50-8 – Copper
 - 7429-90-5 – Aluminum
 - 7440-02-0 – Nickel
 - 7439-96-5 – Manganese
 - 7440-66-6 – Zinc
 - 7439-92-1 – Lead
 - 7723-14-0 – Phosphorus
 - o Section 355 (Extremely hazardous substances)
 - 7723-14-0 – Phosphorus

- TSCA (Toxic substances control act)
- California proposition 65
- Chemicals known to cause cancer
 - 7440-02-0 – Nickel
 - 7440-48-4 – Cobalt
 - 7439-92-1 – Lead
- Chemicals known to cause reproductive toxicity
 - 7439-92-1 – Lead
- Chemicals known to cause developmental toxicity
 - 7439-92-1 – Lead
- EPA
 - 7440-50-8 – Copper
 - 7429-90-5 – Aluminum
 - 7440-02-0 – Nickel
 - 7439-96-5 – Manganese
 - 7440-66-6 – Zinc
 - 7439-92-1 – Lead
 - 7723-14-0 – Phosphorus

16 – Other Information

Abbreviations and Acronyms

- Carc. 2 – Carcinogenicity, Hazard Category 2
- CAS – Chemical Abstracts Service
- Flam. Sol. 1 – Flammable Solids, Hazard Category 1
- Flam. Sol. 2 – Flammable Solids, Hazard Category 2
- LC50 – Lethal concentration, 50 percent
- LD50 – Lethal dose, 50 percent
- Pyr. Sol. 1 – Pyrophoric Solids, Hazard Category 1
- Repr. 1A – Reproductive toxicity, Hazard Category 1A
- Repr. 1B – Reproductive toxicity, Hazard Category 1B
- STOT SE 3 – Specific target organ toxicity, Single exposure, Hazard Category 3
- STOT SE 2 – Specific target organ toxicity, Repeat exposure, Hazard Category 2
- STOT SE 1 – Specific target organ toxicity, Repeat exposure, Hazard Category 1



Pinnacle Alloys are products of SOWESCO

ISO 9001:2008 REGISTERED
Certificate No.: 50040 & 50415

E7018-B2L (E8018-B2L) DATA SHEET

Pinnacle Alloys E7018-B2L (E8018-B2L)

AWS CLASS E7018-B2L H4R (E8018-B2L H4R)

CODE AND SPECIFICATION DATA:

AWS A5.5 ASME SFA 5.5: 2014 (1981); UNS W52118

DESCRIPTION:

Pinnacle Alloys E7018-B2L (E8018-B2L) are low-hydrogen electrodes producing weld metal that nominally contains 1.25% Cr and 0.5% Mo. They are designed to produce weld metal for high-temperature service and for matching the properties of some chromium-molybdenum base materials such as ASTM A387 Grade 11. The maximum carbon of 0.05% will improve ductility and lower hardness, it will also reduce the high temperature strength and creep resistance of the weld metal. Since all chromium-molybdenum electrodes produce weld metal which will harden in still air, both preheat and PWHT are required for most applications. In AWS A5.5-81 and previous revisions, electrodes classified as E7018-B2L were classified as E8018-B2L. The composition ranges have not been changed from A5.5-81 for the corresponding classification. The base metals with which this classification are generally used have lower strength requirements than were reflected by the former electrode classification. Therefore, unless the higher strength indicated by the former classification of this electrode is specifically necessary for a particular welding procedure, the E7018-B2L classification should be considered as identical to the corresponding E8018-B2L classification of A5.5-81. Pinnacle Alloys E7018-B2L (E8018-B2L) has quick and easy slag removal, which reduces clean up time. The low spatter level improves weld bead appearance and lends itself to higher deposition. Typical applications include boiler fabrication and maintenance.

TYPE OF CURRENT: Direct Current Electrode Positive (DCEP) or AC

DIAMETERS: 3/32", 1/8", 5/32", 3/16"

STORAGE & RECONDITIONING: After opening, store in an oven controlled at 220°F to 350°F to ensure a low hydrogen weld deposit. If the electrode has been exposed to the atmosphere for extended periods of time, place in 250°F oven and slowly increase temperature to 600°F; bake for one hour at 600°F.

WELDING POSITIONS: All positions

3/16" is recommended for use in flat and horizontal positions only



TYPICAL DIFFUSIBLE HYDROGEN BY GAS CHROMATOGRAPHY: 3.5 ml/100g

TYPICAL DEPOSIT COMPOSITION:

SOWESCO, LLC

www.pinnaclealloys.com

9384 Wallisville Road • Houston, Texas 77013 • 1-800-856-9353 • (713) 688-9353 • Fax (713) 688-6985

2602 S. 50th Avenue • Phoenix, Arizona 85043 • 1-866-442-9353 • (602) 442-9353 • Fax (602) 442-9354



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	AWS Spec	Weld Metal Analysis (%)
Carbon (C)	0.05	0.03
Chromium (Cr)	1.00-1.50	1.48
Manganese (Mn)	0.90	0.63
Molybdenum (Mo)	0.40-0.65	0.53
Phosphorus (P)	0.03	0.014
Silicon (Si)	0.80	0.56
Sulfur (S)	0.03	0.01

NOTE: Single values are maximums.

TYPICAL MECHANICAL PROPERTIES:

	AWS Spec (min)	SR 1 HR. @ 1275°F
Ultimate Tensile Strength	75,000 psi (520 MPa)	89,000 psi (612 MPa)
Yield Strength	57,000 psi (390 MPa)	74,000 psi (510 MPa)
Percent Elongation in 2"	19%	28%

		As Welded
CVN @ -20°F (-30°C)	Not required	46 ft•lb _f (62 Joules)
CVN @ -40°F (-40°C)	Not required	30 ft•lb _f (41 Joules)

TYPICAL WELDING PARAMETERS:

Diameter	Type of Current	Amperage	Deposition Rate (lbs/hr)	Amperage Range	Voltage Range
3/32"	DCEP or AC	100	2.51	70-110	Variable
1/8"	DCEP or AC	135	3.66	90-160	Variable
5/32"	DCEP or AC	170	4.06	130-220	Variable
3/16"	DCEP or AC	250	5.88	200-300	Variable

NOTE: Optimum conditions are in boldface type. For out of position welding, decrease amperage by 15%. These values were calculated using optimum parameters and DCEP polarity. Allowance made for 2" stub loss. Maintaining a proper welding procedure, including pre-heat and interpass temperatures, may be critical depending on the type and thickness of steel being welded.

NOTICE: The results reported are based upon testing of the product under controlled laboratory conditions in accordance with American Welding Society Standards. Actual use of the product may produce different results due to varying conditions. An example of such conditions would be electrode size, plate chemistry, environment, weldment design, fabrication methods, welding procedure and service requirements. Thus the results are not guarantees for the use in the field. The manufacturer disclaims any warranty of merchantability of fitness for any particular purpose with respect to its products.

CAUTION: Consumers should be thoroughly familiar with the safety precautions on the warning label posted in each shipment and in the American National Standards A49.1, "Safety in Welding and Cutting," published by the American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33126; OSHA Safety and Health Standards 29 CFR 1910 is available from the U.S. Department of Labor, Washington, D.C. 20210.

Pinnacle Alloys SDS sheets may be obtained on the website below.

SOWESCO, LLC www.pinnaclealloys.com
9384 Wallisville Road • Houston, Texas 77013 • **1-800-856-9353** • (713) 688-9353 • Fax (713) 688-6985
2602 S. 50th Avenue • Phoenix, Arizona 85043 • **1-866-442-9353** • (602) 442-9353 • Fax (602) 442-9354



SAFETY DATA SHEET

This Safety Data Sheet (SDS) is for welding consumables and related products and may be used to comply with OSHA's Hazard Communication standard, 29 CFR 1910.1200, and Superfund Amendments and Reauthorization Act (SARA) of 1986 Public Law 99-499 and Canadian Workplace Hazardous Materials Information System (WHMIS) per Health Canada administrative policy. The OSHA standard must be consulted for specific requirements. This Safety Data Sheet complies with ISO 11014-1 and ANSI Z400.1. This document is translated in several languages and is available on our website at www.hobartbrothers.com, from your sales representative or by calling customer service at 1 (937) 332-4000.

SECTION 1 – IDENTIFICATION

Manufacturer/Supplier

Name: HOBART BROTHERS COMPANY
Address: 101 TRADE SQUARE EAST, TROY, OH 45373
Website: www.hobartbrothers.com

Telephone No: +1 (937) 332-4000
Emergency No: +1 (800) 424-9300

Product Type: SHIELDED METAL ARC WELDING (SMAW) ELECTRODES

GROUP A: Product For: CARBON STEEL
AWS Specification: E6010, E6011, E6012, E6013, E6022, E7014, E7024-1

GROUP B: Product For: LOW HYDROGEN CARBON STEEL
AWS Specification: E7016, E7018, E7018-1, E7018-M

GROUP C: Product For: LOW HYDROGEN, LOW ALLOY STEEL
AWS Specification: E7018-A1, E7018-G, E8018-B2, E8018-B2L, E8018-B6, E8018-B8, E8018-C1, E8018-C2, E8018-C3, E8018-G, E9015-B9, E9018-B3, E9018-B3L, E9018-M, E10018-D2, E10018-M, E10518-M, E11018-M, E12018-M

GROUP D: Product For: HIGH STRENGTH CELLULOSE CARBON STEEL
AWS Specification: E7010-P1, E8010-P1, E9010-G, E9010-P1

Recommended Use: SHIELDED METAL ARC WELDING (SMAW) ELECTRODES
Restrictions on Use: Use only as indicated for welding operations

SECTION 2 – IDENTIFICATION OF HAZARDS

HAZARD CLASSIFICATION – The products described in Section 1 are not classified as hazardous according to applicable GHS hazard classification criteria as required and defined in OSHA Hazard Communication Standard (29 CFR Part 1910.1200).

LABEL ELEMENTS: **Hazard Symbol** – No symbol required
Hazard Statement – Not applicable

Signal Word – No signal word required
Precautionary Statement – Not Applicable

HAZARDS NOT OTHERWISE CLASSIFIED

WARNING! - Avoid breathing welding fumes and gases, they may be dangerous to your health. Always use adequate ventilation. Always use appropriate personal protective equipment.

PRIMARY ROUTES OF ENTRY: Respiratory System, Eyes and/or Skin.
ELECTRIC SHOCK: Arc welding and associated processes can kill. See Section 8.

ARC RAYS: The welding arc can injure eyes and burn skin.
FUMES AND GASES: Can be dangerous to your health.

Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the process, procedures and electrodes used. Most fume ingredients are present as complex oxides and compounds and not as pure metals. When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction or oxidation, plus those from the base metal and coating, etc., of the materials shown in Section 3 of this Safety Data Sheet. Monitor for the component materials identified in the list in Section 3.

Fumes from the use of this product may contain complex oxides or compounds of the following elements and molecules: amorphous silica fume, calcium oxide, chromium, fluorspar or fluorides, manganese, nickel, silica and strontium. Other reasonably expected constituents of the fume would also include complex oxides of iron, titanium, silicon and molybdenum. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded (such as paint, plating or galvanizing), the number of welders and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities). One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1 and F1.3, available from the "American Welding Society", 8669 NW 36 Street, # 130, Miami, Florida 33166-6672, Phone: 800-443-9353 or 305-443-9353.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS

IMPORTANT - This section covers the hazardous materials from which this product is manufactured. This data has been classified according to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) as required and defined in OSHA Hazard Communication Standard (29 CFR Part 1910.1200). The fumes and gases produced during welding with normal use of this product are addressed in Section 8.

SAFETY DATA SHEET

INGREDIENT	CAS NO.	EINECS ^r	GROUP AND %WEIGHT				GHS Classification(s)	GHS HAZARD STATEMENTS (See Section 16 for Complete Phrases)
			A	B	C	D		
ALUMINUM OXIDE	1344-28-1	215-691-6	<5	<1	<1	---	NONE	
CALCIUM CARBONATE	1317-65-3	215-279-6	---	2-10	2-10	---	NONE	
CELLULOSE	9004-34-6	232-674-9	<5	---	---	<5	NONE	
CHROMIUM (metal)	7440-47-3	231-157-5	---	---	<9	---	NONE	
FLUORSPAR	7789-75-5	232-188-7	---	1-12	4-15	---	NONE	
IRON	7439-89-6	231-096-4	70-90	60-80	60-90	70-90	NONE	
MAGNESIUM CARBONATE	546-93-0	208-915-9	<2	<5	<1	<1	NONE	
MANGANESE	7439-96-5	231-105-1	1-5	1-5	1-5	1-5	- Acute Tox. 4 (Inhalation) ⁽¹⁾ - Acute Tox. 4 (Oral) ⁽¹⁾ - STOT RE 1 ⁽²⁾	H332 H302 H372
MICA	12001-26-2	None	<5	---	---	---	NONE	
MOLYBDENUM	7439-98-7	231-107-2	---	---	<2	<1	- STOT RE 2 ⁽²⁾ - Eye Irrit. 2 ⁽³⁾ - STOT SE 3 ⁽⁴⁾	H373 H319 H335
NICKEL	7440-02-0	231-111-4	---	---	<5	<2	Powder/Element: - Carc. 2 ⁽⁵⁾ - Skin Sens. 1 ⁽⁶⁾ - STOT RE 1 ⁽²⁾ - Aquatic Chronic 3	H351 H317 H372 H412
POTASSIUM SILICATE	1312-76-1	215-199-1	<2	<2	<2	<2	NONE	
SILICA	14808-60-7	238-878-4	<7	<8	<7	<7	- STOT RE 2 ⁽²⁾ - Carc. 2 ⁽⁵⁾ - Acute Tox. 4 (Inhalation) ⁽¹⁾	H373 H351 H332
(Amorphous Silica Fume)	69012-64-2	273-761-1	---	---	---	---	NONE	
SILICON	7440-21-3	231-130-8	<2	<2	<5	<2	NONE	
SODIUM SILICATE	1344-09-8	215-687-4	<2	<2	<2	<2	NONE	
STRONTIUM CARBONATE	1633-05-2	216-643-7	---	<2	<2	---	NONE	
TITANIUM DIOXIDE	13463-67-7	236-675-5	<14	<10	<5	<5	- Carc. 2 ⁽⁵⁾	H351
HEXAVALENT CHROMIUM [CHROMIUM (VI) TRIOXIDE] (Fume constituent)	1333-82-0	215-607-8	Varies	Varies	Varies	Varies	- Ox. Sol. 1 ⁽⁷⁾ - Carc. 1A ⁽⁵⁾ - Muta. 1B ⁽⁸⁾ - Repr. Tox 2 ⁽⁹⁾ - Acute Tox. 2 (Inhalation) ⁽¹⁾ - Acute Tox. 3 (Skin & Oral) ⁽¹⁾ - STOT RE 1 ⁽²⁾ - Skin Corr. 1A ⁽¹⁰⁾ - Skin Sens. 1 ⁽⁶⁾ - Resp. Sens. 1 ⁽¹¹⁾ - Aquatic Acute 1 - Aquatic Chronic 1	H271 H350 H340 H361f H330 H311, H301 H372 H314 H317 H334, H317 H400 H410

--- Dashes indicate the ingredient is not present within the group of products ^r – European Inventory of Existing Chemical Commercial Substance Number (1) Acute toxicity (Cat. 1, 2, 3 and 4) (2) Specific target organ toxicity (STOT) – repeated exposure (Cat. 1 and 2) (3) Serious eye damage/eye irritation (Cat. 1 and 2) (4) Specific target organ toxicity (STOT) – single exposure ((Cat. 1, 2) and Cat. 3 for narcotic effects and respiratory tract irritation, only) (5) Carcinogenicity (Cat. 1A, 1B and 2) (6) Skin sensitization (Cat. 1, Sub-cat. 1A and 1B) (7) Oxidizing solid (Cat. 1, 2 and 3) (8) Germ cell mutagenicity (Cat. 1A, 1B and 2) (9) Reproductive toxicity (Cat. 1A, 1B and 2) (10) Skin corrosion/irritation (Cat. 1, 1A, 1B, 1C and 2) (11) Respiratory sensitization (Cat. 1, Sub-cat. 1A and 1B)

SAFETY DATA SHEET

SECTION 4 – FIRST AID MEASURES

INGESTION: Not an expected route of exposure. Do not eat, drink, or smoke while welding; wash hands thoroughly before performing these activities. If symptoms develop, seek medical attention at once.

INHALATION during welding: If breathing is difficult, provide fresh air and contact physician. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

SKIN CONTACT during welding: Remove contaminated clothing and wash the skin thoroughly with soap and water. If symptoms develop, seek medical attention at once.

EYE CONTACT during welding: Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until victim is transported to an emergency medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

Section 11 of this SDS covers the acute effects of overexposure to the various ingredients within the welding consumable. Section 8 of this SDS lists the exposure limits and covers methods for protecting yourself and your co-workers.

SECTION 5 – FIRE-FIGHTING MEASURES

Fire Hazards: Welding consumables applicable to this sheet as shipped are nonreactive, nonflammable, non-explosive and essentially nonhazardous until welded.

Welding arcs and sparks can ignite combustibles and flammable products. If there are flammable materials, including fuel or hydraulic lines, in the work area and the worker cannot move the work or the flammable material, a fire-resistant shield such as a piece of sheet metal or fire resistant blanket should be placed over the flammable material. If welding work is conducted within 35 feet or so of flammable materials, station a responsible person in the work zone to act as fire watcher to observe where sparks are flying and to grab an extinguisher or sound the alarm if needed.

Unused welding consumables may remain hot for a period of time after completion of a welding process. See American National Standard Institute (ANSI) Z49.1 for further general safety information on the use and handling of welding consumables and associated procedures.

Suitable Extinguishing Media: This product is essentially nonflammable until welded; therefore, use a suitable extinguishing agent for a surrounding fire.

Unsuitable Extinguishing Media: None known.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

In the case of a release of solid welding consumable products, solid objects can be picked up and placed into a disposal container. If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8. Wear proper personal protective equipment while handling. Do not discard as general trash.

SECTION 7 - HANDLING AND STORAGE

HANDLING: No specific requirements in the form supplied. Handle with care to avoid cuts. Wear gloves when handling welding consumables. Avoid exposure to dust. Do not ingest. Some individuals can develop an allergic reaction to certain materials. Retain all warning and product labels.

STORAGE: Keep separate from acids and strong bases to prevent possible chemical reactions.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Read and understand the instructions and the labels on the packaging. Welding fumes do not have a specific OSHA PEL (Permissible Exposure Limit) or ACGIH TLV (Threshold Limit Value). The OSHA PEL for Particulates – Not Otherwise Regulated (PNOR) is 5 mg/m³ – Respirable Fraction, 15 mg/m³ – Total Dust. The ACGIH TLV for Particulates – Not Otherwise Specified (PNOS) is 3 mg/m³ – Respirable Particles, 10 mg/m³ – Inhalable Particles. The individual complex compounds within the fume may have a lower OSHA PEL or ACGIH TLV than the OSHA PNOR and ACGIH PNOS. An Industrial Hygienist, the OSHA PELs for Air Contaminants (29 CFR 1910.1000), and the ACGIH TLVs should be consulted to determine the specific fume constituents present and their respective exposure limits. All exposure limits are in milligrams per cubic meter (mg/m³).

INGREDIENT	CAS	EINECS	OSHA PEL	ACGIH TLV
ALUMINUM###	7429-90-5	231-072-3	5 R*, 15 (Dust)	1 R* {A4} 5 (Welding fumes, as Al)
CALCIUM CARBONATE	1317-65-3	215-279-6	5 R*, 5 (as CaO)	3 R*, 2 (as CaO)
CELLULOSE	9004-34-6	232-674-9	5 R*	10 Dust
CHROMIUM#	7440-47-3	231-157-5	1 (Metal) 0.5 (Cr II & Cr III Cpnds) 0.005 (Cr VI Cpnds) (Calif. OSHA PEL)	0.5 (Metal) {A4} 0.5 (Cr III Cpnds) {A4} 0.05 (Cr VI Sol Cpnds) {A1} 0.01 (Cr VI Insol Cpnds) {A1}
FLUORSPAR	7789-75-5	232-188-7	2.5 (as F)	2.5 (as F) {A4}
IRON+	7439-89-6	231-096-4	5 R*	5 R* (Fe ₂ O ₃) {A4}
IRON OXIDE	1309-37-1	215-168-2	10 (Oxide Fume)	5 R* (Fe ₂ O ₃) {A4}
MAGNESIUM CARBONATE+	546-93-0	208-915-9	5 R*	3 R*
MANGANESE#	7439-96-5	231-105-1	5 CL ** (Fume) 1, 3 STEL*** ■	0.1 I* {A4} ♦ 0.02 R* ♦♦
MICA	12001-26-2	None	3 R*■	3 R*
MOLYBDENUM	7439-98-7	231-107-2	5 R*	3 R*, 10 I* (Ele and Insol) 0.5 R* (Sol Cpnds) {A3}
NICKEL#	7440-02-0	231-111-4	1 (Metal) 1 (Sol Cpnds) 1 (Insol Cpnds)	1.5 I* (Ele) {A5} 0.1 I* (Sol Cpnds) {A4} 0.2 I* (Insol Cpnds) {A1}
POTASSIUM SILICATE	1312-76-1	215-199-1	Not established	Not established
SILICA++	14808-60-7	238-878-4	0.1 R*	0.025 R* {A2}
(Amorphous Silica Fume)	69012-64-2	273-761-1	0.8	2 R*
SILICON+	7440-21-3	231-130-8	5 R*	3 R*
SODIUM SILICATE	1344-09-8	215-687-4	Not established	Not established
STRONTIUM CARBONATE+	1633-05-2	216-643-7	5 R*	3 R*
TITANIUM DIOXIDE	13463-67-7	236-675-5	15 (Dust)	10 {A4}

R* - Respirable Fraction I* - Inhalable Fraction ** - Ceiling Limit *** - Short Term Exposure Limit + - As a nuisance particulate covered under "Particulates Not Otherwise Regulated" by OSHA or "Particulates Not Otherwise Classified" by ACGIH ++ - Crystalline silica is bound within the product as it exists in the package. However, research indicates silica is present in welding fume in the amorphous (noncrystalline) form #- Reportable material under Section 313 of SARA ## - Reportable material under Section 313 of SARA only in fibrous form ■ - NIOSH REL TWA and STEL ■■ - AIHA Ceiling Limit of 1 mg/m³ ♦ - Limit of 0.1 mg/m³ is for Inhalable Mn in 2015 by ACGIH ♦♦ - Limit of 0.02 mg/m³ is for Respirable Mn in 2015 by ACGIH Ele - Element Sol - Soluble Insol - Insoluble Inorg - Inorganic Cpnds - Compounds NOS - Not Otherwise Specified {A1} - Confirmed Human Carcinogen per ACGIH {A2} - Suspected Human Carcinogen per ACGIH {A3} - Confirmed Animal Carcinogen with Unknown Relevance to Humans per ACGIH {A4} - Not Classifiable as a Human Carcinogen per ACGIH {A5} - Not Suspected as a Human Carcinogen per ACGIH (noncrystalline form) EINECS - European Inventory of Existing Commercial Chemical Substances OSHA - U.S. Occupational Safety and Health Administration ACGIH - American Conference of Governmental Industrial Hygienists

SAFETY DATA SHEET

VENTILATION: Use enough ventilation or local exhaust at the arc or both to keep the fumes and gases below the PEL/TLV in the worker's breathing zone and the general area. Train the welder to keep his head out of the fumes.

RESPIRATORY PROTECTION: Use NIOSH-approved or equivalent fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below the regulatory limits.

EYE PROTECTION: Wear helmet or use face shield with filter lens for open arc welding processes. As a rule of thumb begin with Shade Number 14. Adjust if needed by selecting the next lighter and/or darker shade number. Provide protective screens and flash goggles, if necessary, to shield others from the weld arc flash.

PROTECTIVE CLOTHING: Wear hand, head and body protection which help to prevent injury from radiation, sparks and electrical shock. See ANSI Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection as well as dark non-synthetic clothing. Train the welder not to touch live electrical parts and to insulate himself from work and ground.

PROCEDURE FOR CLEANUP OF SPILLS OR LEAKS: Not applicable

SPECIAL PRECAUTIONS (IMPORTANT): When welding with electrodes that require special ventilation (such as stainless or hardfacing, or other products which require special ventilation, or on lead- or cadmium-plated steel and other metals or coatings like galvanized steel, which produce hazardous fumes) maintain exposure below the PEL/TLV. Use industrial hygiene monitoring to ensure that your use of this material does not create exposures which exceed PEL/TLV. Always use exhaust ventilation. Refer to the following sources for important additional information: American National Standard Institute (ANSI) Z49.1; Safety in Welding and Cutting published by the American Welding Society, 8669 NW 36 Street, # 130, Miami, Florida 33166-6672, Phone: 800-443-9353 or 305-443-9353; and OSHA Publication 2206 (29 CFR 1910), U.S. Government Printing Office, Washington, DC 20402.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Welding consumables applicable to this sheet as shipped are nonreactive, nonflammable, non-explosive and essentially nonhazardous until welded.

PHYSICAL STATE: Solid

APPEARANCE: Cored Wire/Coated Rod

COLOR: Gray

ODOR: Not Applicable

ODOR THRESHOLD: Not Applicable

pH: Not Applicable

MELTING POINT/FREEZING POINT: Not Available

INITIAL BOILING POINT AND BOILING RANGE: Not Available

FLASH POINT: Not Available

EVAPORATION RATE: Not Applicable

FLAMMABILITY (SOLID, GAS): Not Available

UPPER/LOWER FLAMMABILITY OR EXPLOSIVE LIMITS: Not Available

VAPOR PRESSURE: Not Applicable

VAPOR DENSITY: Not Applicable

RELATIVE DENSITY: Not Available

SOLUBILITY(IES): Not Available

PARTITION COEFFICIENT: N-OCTANOL/WATER: Not Applicable

AUTO-IGNITION TEMPERATURE: Not Available

DECOMPOSITION TEMPERATURE: Not Available

VISCOSITY: Not Applicable

SECTION 10 – STABILITY AND REACTIVITY

GENERAL: Welding consumables applicable to this sheet are solid and nonvolatile as shipped. This product is only intended for use per the welding parameters it was designed for. When this product is used for welding, hazardous fumes may be created. Other factors to consider include the base metal, base metal preparation and base metal coatings. All of these factors can contribute to the fume and gases generated during welding. The amount of fume varies with the welding parameters.

STABILITY: This product is stable under normal conditions.

REACTIVITY: Contact with acids or strong bases may cause generation of gas.

SECTION 11 – TOXICOLOGICAL INFORMATION

SHORT-TERM (ACUTE) OVEREXPOSURE EFFECTS: **Welding Fumes** - May result in discomfort such as dizziness, nausea or dryness or irritation of nose, throat or eyes. **Aluminum Oxide** - Irritation of the respiratory system. **Calcium Oxide** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Chromium** - Inhalation of fume with chromium (VI) compounds can cause irritation of the respiratory tract, lung damage and asthma-like symptoms. Swallowing chromium (VI) salts can cause severe injury or death. Dust on skin can form ulcers. Eyes may be burned by chromium (VI) compounds. Allergic reactions may occur in some people. **Fluorides** - Fluoride compounds evolved may cause skin and eye burns, pulmonary edema and bronchitis. **Iron, Iron Oxide** - None are known. Treat as nuisance dust or fume. **Magnesium, Magnesium Oxide** - Overexposure to the oxide may cause metal fume fever characterized by metallic taste, tightness of chest and fever. Symptoms may last 24 to 48 hours following overexposure. **Manganese** - Metal fume fever characterized by chills, fever, upset stomach, vomiting, irritation of the throat and aching of body. Recovery is generally complete within 48 hours of the overexposure. **Mica** - Dust may cause irritation of the respiratory system, skin and eyes. **Molybdenum** - Irritation of the eyes, nose and throat. **Nickel, Nickel Compounds** - Metallic taste, nausea, tightness in chest, metal fume fever, allergic reaction. **Potassium Silicate** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Silica (Amorphous)** - Dust and fumes may cause irritation of the respiratory system, skin and eyes. **Sodium Silicate** - Dust or fumes may cause irritation of the respiratory system, skin and eyes. **Strontium Compounds** - Strontium salts are generally non-toxic and are normally present in the human body. In large oral doses, they may cause gastrointestinal disorders, vomiting and diarrhea. **Titanium Dioxide** - Irritation of respiratory system.

LONG-TERM (CHRONIC) OVEREXPOSURE EFFECTS: **Welding Fumes** - Excess levels may cause bronchial asthma, lung fibrosis, pneumoconiosis or "siderosis." Studies have concluded that there is sufficient evidence for ocular melanoma in welders. **Aluminum Oxide** - Pulmonary fibrosis and emphysema. **Calcium Oxide** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Chromium** - Ulceration and perforation of nasal septum. Respiratory irritation may occur with symptoms resembling asthma. Studies have shown that chromate production workers exposed to hexavalent chromium compounds have an excess of lung cancers. Chromium (VI) compounds are more readily absorbed through the skin than chromium (III) compounds. Good practice requires the reduction of employee exposure to chromium (III) and (VI) compounds. **Fluorides** - Serious bone erosion (Osteoporosis) and mottling of teeth. **Iron, Iron Oxide Fumes** - Can cause siderosis (deposits of iron in lungs) which some researchers believe may affect pulmonary function. Lungs will clear in time when exposure to iron and its compounds ceases. Iron and magnetite (Fe₃O₄) are not regarded as fibrogenic materials. **Magnesium, Magnesium Oxide** - No adverse long term health effects have been reported in the literature. **Manganese** - Long-term overexposure to manganese compounds may affect the central nervous system. Symptoms may be similar to Parkinson's disease and can include slowness, changes in handwriting, gait impairment, muscle spasms and cramps and less commonly, tremor and behavioral changes. Employees who are overexposed to manganese compounds should be seen by a physician for early detection of neurologic problems. Overexposure to manganese and manganese compounds above safe exposure limits can cause irreversible damage to the central nervous system, including the brain, symptoms of which may include slurred speech, lethargy, tremor, muscular weakness, psychological disturbances and spastic gait. **Mica** - Prolonged overexposure may cause scarring of the lungs and pneumoconiosis characterized by cough, shortness of breath, weakness and weight loss. **Molybdenum** - Prolonged overexposure may result in loss of appetite, weight loss, loss of muscle coordination, difficulty in breathing and anemia. **Nickel, Nickel Compounds** - Lung fibrosis or pneumoconiosis. Studies of nickel refinery workers indicated a higher incidence of lung and nasal cancers. **Potassium Silicate** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Silica (Amorphous)** - Research indicates that silica is present in welding fume in the amorphous form. Long term overexposure may cause pneumoconiosis. Noncrystalline forms of silica (amorphous silica) are considered to have little fibrotic potential. **Sodium Silicate** - Prolonged overexposure may cause ulceration of the skin and perforation of the nasal septum, dermatitis and pneumonia. **Strontium Compounds** - Strontium at high doses is known to concentrate in bone. Major signs of chronic toxicity, which involve the skeleton, have been labeled as "strontium rickets". **Titanium Dioxide** - Pulmonary irritation and slight fibrosis.

SAFETY DATA SHEET

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Persons with pre-existing impaired lung functions (asthma-like conditions). Persons with a pacemaker should not go near welding and cutting operations until they have consulted their doctor and obtained information from the manufacturer of the device. Respirators are to be worn only after being medically cleared by your company-designated physician.

EMERGENCY AND FIRST AID PROCEDURES: Call for medical aid. Employ first aid techniques recommended by the American Red Cross. If irritation or flash burns develop after exposure, consult a physician.

CARCINOGENICITY: Chromium VI compounds, nickel compounds and silica (crystalline quartz) are classified as IARC Group 1 and NTP Group K carcinogens. Titanium dioxide, nickel metal/alloys and welding fumes are classified as IARC Group 2B carcinogens.

CALIFORNIA PROPOSITION 65: WARNING: These products contain or produce a chemical known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code Section 25249.5 et seq.)

INGREDIENT	CAS	IARC ^E	NTP ^Z	OSHA ^H	65 ^Θ
ALUMINUM OXIDE	1344-28-1	---	---	---	---
CALCIUM CARBONATE	1317-65-3	---	---	---	---
CELLULOSE	9004-34-6	---	---	---	---
CHROMIUM	7440-47-3	3 ¹ , 1 ^{ΣΣ}	K ^{ΣΣ}	X ^{ΣΣ}	X ^{ΣΣ}
FLUORSPAR	7789-75-5	---	---	---	---
IRON	7439-89-6	---	---	---	---
IRON OXIDE	1309-37-1	3	---	---	---
MAGNESIUM CARBONATE	546-93-0	---	---	---	---
MANGANESE	7439-96-5	---	---	---	---
MICA	12001-26-2	---	---	---	---
MOLYBDENUM	7439-98-7	---	---	---	---
NICKEL	7440-02-0	2B ^β , 1 ^{ββ}	S ^β , K ^{ββ}	---	X ^β , X ^{ββ}
POTASSIUM SILICATE	1312-76-1	---	---	---	---
SILICA	14808-60-7	1 ^ψ	K	---	X
(Amorphous Silica fume)	69012-64-2	3	---	---	---
SILICON	7440-21-3	---	---	---	---
SODIUM SILICATE	1344-09-8	---	---	---	---
STRONTIUM CARBONATE	1633-05-2	---	---	---	---
TITANIUM DIOXIDE	13463-67-7	2B	---	---	X
Welding Fumes	--	2B	--	---	--

E – International Agency for Research on Cancer (1 – Carcinogenic to Humans, 2A – Probably Carcinogenic to Humans, 2B – Possibly Carcinogenic to Humans, 3 – Not Classifiable as to its Carcinogenicity to Humans, 4 – Probably Not Carcinogenic to Humans) Z – US National Toxicology Program (K – Known Carcinogen, S – Suspected Carcinogen) H – OSHA Designated Carcinogen List Θ – California Proposition 65 (X – On Proposition 65 list) Σ – Chromium Metal and Chromium III Compounds ΣΣ – Chromium VI β – Nickel metal and alloys ββ – Nickel compounds ψ – Silica Crystalline α-Quartz --- Dashes indicate the ingredient is not listed with the IARC, NTP, OSHA or Proposition 65

SECTION 12 – ECOLOGICAL INFORMATION

Welding processes can release fumes directly to the environment. Welding wire can degrade if left outside and unprotected. Residues from welding consumables and processes could degrade and accumulate in the soil and groundwater.

SECTION 13 – DISPOSAL CONSIDERATIONS

Use recycling procedures if available. Discard any product, residue, packaging, disposable container or liner in an environmentally acceptable manner, in full compliance with federal, state and local regulations.

SECTION 14 – TRANSPORT INFORMATION

No international regulations or restrictions are applicable. No special precautions are necessary.

SECTION 15 – REGULATORY INFORMATION

Read and understand the manufacturer's instructions, your employer's safety practices and the health and safety instructions on the label and the safety data sheet. Observe all local and federal rules and regulations. Take all necessary precautions to protect yourself and others.

United States EPA Toxic Substance Control Act: All constituents of these products are on the TSCA inventory list or are excluded from listing.

CERCLA/SARA TITLE III: Reportable Quantities (RQs) and/or Threshold Planning Quantities (TPQs):

Ingredient name

RQ(lb)

TPQ (lb)

Products on this SDS are a solid solution in the form of a solid article.

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Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center and to your Local Emergency Planning Committee.

Section 311 Hazard Class

As shipped: Immediate

In use: Immediate delayed

EPCRA/SARA TITLE III 313 TOXIC CHEMICALS: The following metallic components are listed as SARA 313 "Toxic Chemicals" and potentially subject to annual SARA 312 reporting: Aluminum Oxide (fibrous forms), Chromium, Manganese and Nickel. See Section 3 for weight percentage.

CANADIAN WHMIS CLASSIFICATION: Class D; Division 2, Subdivision A

CANADIAN CONTROLLED PRODUCTS REGULATION: This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all of the information required by the CPR.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA): All constituents of these products are on the Domestic Substance List (DSL).

SECTION 16 – OTHER INFORMATION

The following Hazard Statements, provided in the OSHA Hazard Communication Standard (29 CFR Part 1910.1200) correspond to the columns labeled 'GHS Hazard Statements' within Section 3 of this safety data sheet. Take appropriate precautions and protective measures to eliminate or limit the associated hazard.

H271: May cause fire or explosion; strong oxidizer

H301: Toxic if swallowed

H302: Harmful if swallowed



SAFETY DATA SHEET

H311: Toxic in contact with skin
H314: Causes severe skin burns and eye damage
H317: May cause an allergic skin reaction
H319: Causes serious eye irritation
H330: Fatal if inhaled
H332: Harmful if inhaled
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335: May cause respiratory irritation
H340: May cause genetic defects
H350: May cause cancer
H351: Suspected of causing cancer
H361f: Suspected of damaging fertility or the unborn child
H372: Causes damage to organs through prolonged or repeated exposure
H373: May cause damage to organs through prolonged or repeated exposure
H400: Very toxic to aquatic life.
H410: Very toxic to aquatic life with long lasting effects
H412: Harmful to aquatic life with long lasting effects.

For additional information please refer to the following sources:

USA: **American National Standard Institute (ANSI) Z49.1** "Safety in Welding and Cutting", **ANSI/American Welding Society (AWS) F1.5** "Methods for Sampling and Analyzing Gases from Welding and Allied Processes", **ANSI/AWS F1.1** "Method for Sampling Airborne Particles Generated by Welding and Allied Processes", **AWSF3.2M/F3.2** "Ventilation Guide for Weld Fume", American Welding Society, 8669 NW 36 Street, # 130, Miami, Florida 33166-6672, Phone: 800-443-9353 or 305-443-9353. Safety and Health Fact Sheets available from AWS at www.aws.org.
OSHA Publication 2206 (29 C.F.R. 1910), U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.
Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH), 6500 Glenway Ave., Cincinnati, Ohio 45211, USA.
NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work" published by the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169.

Canada: **CSA Standard CAN/CSA-W117.2-01** "Safety in Welding, Cutting and Allied Processes".

Hobart Brothers Company strongly recommends the users of this product study this SDS, the product label information and become aware of all hazards associated with welding. Hobart Brothers Company believes this data to be accurate and to reflect qualified expert opinion regarding current research. However, Hobart Brothers Company cannot make any expressed or implied warranty as to this information.



SAFETY DATA SHEET (SDS)

Document Number: SDS-ARC-NI-0001

1. IDENTIFICATION

Product Type:	Ni-based solid wire electrodes for arc welding
Product Names:	Arcos 111, C-276, 352, 362, 382, 382H, 392, Alloy 59, Alloy 602CA, 622 (Alloy 22), 617, 625, 651, 813, 816, 861, 888, 2216, 2535R, 3545R, Ni55, Ni99
Specifications:	AWS A5.7, A5.14, A5.15 or None
Product Type:	Ni-based electrodes for shielded metal arc welding
Product Names:	Arcos 1N12, 4N11, 4N1A, 8N12, 9N10, C-276, 352, 59, 617, 803, 2216, Alloy 602CA, 622 (Alloy 22), Alloy 59, 2216, 2535R, 3545R
Specifications:	AWS A5.6, A5.11 or None
Product Type:	Ni-based cored electrodes for arc welding
Product Names:	Arcos 82-AP, 182-AP, 622-AP, 625-AP, 625-C, 2216-C, 2216-HT, C276-AP, ArcVar 36, ArcVar36Nb, Ni55-C, Ni65-C
Specifications:	AWS A5.34 or None
Product Intended/Recommended Use:	Arc welding
Manufacturer:	Arcos Industries, LLC 394 Arcos Drive Mt. Carmel, PA 17851 Tel: 1-800-233-8460 Fax: 1-570-339-5206
Emergency Telephone Number:	3E Company Emergency Response Hotline Company Code: 334276 U.S. / Canada / Mexico: 1-866-519-4752 Europe: 1-760-476-3962 Asia Pacific: 1-760-476-3960 Middle East/Africa: 1-760-476-3959

2. HAZARD IDENTIFICATION

Hazard Classification: Not classified as hazardous according to the applicable Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and OSHA Hazard Communication Standard (29 CFR 1910.1200) criteria.

Label Elements:

Hazard Symbol – None
Signal Word – None
Hazard Statement – Not Applicable
Precautionary Statement – Not Applicable

Other Hazards: This product presents no hazards in its intrinsic form. However, several hazards are generated during welding operations that can be harmful.

ELECTRICITY- Electric shock can kill.

HEAT- Molten metal and weld spatter can burn skin and start fires.

RADIATION- Arc rays can injure eyes and burn skin.

FUMES AND GASES - Fumes and gases generated during welding can be dangerous to your health. See Section 11.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Composition: Chemical composition information is shown below for the solid wire electrodes. For the covered and cored electrodes, chemical composition data is given as a maximum weight percentage of the composite electrode, which includes fluxing ingredients. These fluxing ingredients typically consist of manganese, silicon, titanium, aluminum and/or zirconium oxides, as well as certain fluoride, carbonate and silicate compounds.

Solid Wire Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Cu	Co	W	Al	Fluoride	Carbonate ²	Silicate ³
111	Bal	21.0		3.0	1.0	1.5										
C-276	Bal	16.5	14.5	6.0			0.02				2.5	4.5				
352	Bal	31.0		10.5	1.0		0.04									
362	Bal	17.0		10.0				3.0								
382	Bal	22.0		3.0	3.5		0.10	3.0								
382H	Bal	20.5		3.0	3.3		0.10	2.5								
392	Bal	17.0		8.0	2.7		0.08	3.5								
Alloy 59	Bal	24.0	16.5	1.5			0.015									
Alloy 602CA	Bal	25.0		9.5			0.25						2.0			
622 (Alloy 22)	Bal	22.5	14.5	6.0			0.015				2.5	4.5				
617	Bal	24.0	10.0	3.0	1.0	1.0	0.15				15.0		1.5			
625	Bal	23.0	10.0	5.0			0.10	4.2								
651	99.9						0.1									
813	32.0			1.0						Bal						
816	69.0	0.15		2.5	4.0		0.15		2.3	Bal						
861	Bal			1.0	1.0		0.15		3.5				1.5			
888	Bal					1.0							6.0			
2216	Bal			49.0	13.5		0.45									
2535R	Bal	26.5		38.7	2.0		0.45									
3545R	Bal	36.0		20.5	2.0		0.50	1.4								
Ni55	Bal			44.5	1.0		0.50									
Ni99	Bal						0.15									

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicates

Covered Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Cu	Co	W	Al	Fluoride	Carbonate ²	Silicate ³
1N12	Bal	23.0	10.0	7.0	1.0	3.0	0.10	4.2	5.0				0.5	9.0	7.5	7.5
4N11	Bal				1.0	4.0	0.10		1.2				1.5	7.0	7.5	7.5
4N1A	Bal	17.0	2.5	12.0	4.5	3.0	0.10	3.0	5.0				0.5	7.0	7.5	7.5
8N12	Bal	17.0		10.0	10.5	7.0	0.10	2.5	5.0				0.5	9.0	7.5	7.5
9N10	Bal				5.0	4.5	0.15		5.0	38.0			0.5	7.0	7.5	7.5
C-276	Bal	16.5	17.0	7.0	2.0	3.0	0.02	2.5	5.0		2.5	4.5	0.5	9.0	7.5	7.5
352	Bal	31.5	1.0	12.0	2.0	3.0	0.05	2.5	5.0				0.5	9.0	7.5	7.5
Alloy 59	Bal	24.0	16.5	1.5	2.0	3.0	0.02		5.0				0.5	9.0	7.5	7.5
617	Bal	26.0	10.0	2.5	3.5	4.0	0.15		5.0		15.0		2.0	9.0	7.5	7.5
803	33.0			0.75	2.5	2.5			5.0	Bal			1.5	9.0	7.5	7.5
2216	Bal			49.0	14.5	3.0	0.45		5.0				0.5	9.0	7.5	7.5
Alloy 602CA	Bal	25.0		9.5	1.0	3.0	0.25		5.0				0.5	9.0	7.5	7.5
622 (Alloy 22)	Bal	22.5	14.5	6.0	1.0	3.0	0.02		5.0		2.5	3.5	0.5	9.0	7.5	7.5
2535R	Bal	26.5		39.0	3.0	3.0	0.45		5.0				0.5	9.0	7.5	7.5
3545R	Bal	36.0		20.5	3.0	3.0	0.50	1.4	5.0				0.5	9.0	7.5	7.5

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicate

Cored Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Mg ¹	Co	W	Zr ¹	Fluoride	Carbonate ²	Silicate ³
82-AP	Bal	22.0		3.0	3.5	1.0	0.10	3.0	7.0				1.0	0.5		
182-AP	Bal	17.0		10.0	10.5	1.0	0.10	2.5	7.0				1.0	0.5		
622-AP	Bal	22.5	14.5	6.0		1.0	0.02		7.0		2.5	4.5	1.0	0.5		
625-AP	Bal	23.0	10.0	5.0		1.0	0.10	4.2	7.0				1.0	0.5		
625-C	Bal	23.0	10.0	5.0		1.0	0.10	4.2					1.0	0.5		
2216-C	Bal			49.0	13.5	1.0	0.45							0.5		
2216-HT	45.0	7.0		Bal	11.5		0.05	1.0						0.5		
C276-AP	Bal	16.5	14.5	6.0			0.02		7.0		2.5	4.5	1.0	0.5		
ArcVar 36	37.0			Bal	1.0	1.0	0.04		10.0	1.5				0.5		
ArcVar 36Nb	37.0			Bal	1.0	1.0	0.10	2.0	10.0	1.5				0.5		
Ni55-C	Bal			43.0	3.5	1.0	0.04		1.0				0.5			
Ni65-C	Bal			32.0	0.5	1.0	0.04		1.0				0.5			

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicates

4. FIRST AID MEASURES

Inhalation - If breathing has stopped, immediately seek medical assistance. Begin performing cardio pulmonary resuscitation (CPR) if you are trained to do so. If breathing is difficult, move to area with fresh air and seek medical attention immediately.

Skin contact - For skin burns due to arc radiation flush with cold water. If burn and irritation persists seek medical attention. In case of skin contact with fume or dust, wash affected areas with soap and water. Thoroughly clean shoes and wash clothing. Seek medical attention if irritation develops and persists.

Eye contact - In case of radiation burns due to arc flash move to a dark room and seek medical attention. To remove fume or dust flush with plenty of lukewarm water. Seek medical attention if irritation develops. In case of foreign metallic or slag material lodged in the eye, seek medical attention to remove it. Do not rub or agitate the eyes.

Ingestion – Although unlikely due to product form, immediately seek medical attention if wire pieces or metal powders from inside the wire are ingested. Do not induce vomiting unless directed to do so by medical personnel.

Electric Shock - Disconnect power. Use non-conductive material to pull victim from contact with live wires. If no detectable pulse, seek medical attention immediately and begin cardio pulmonary resuscitation (CPR) if you are trained to do so.

Most Serious Symptoms:

Short Term Exposure – Acute overexposure to welding fumes may result in discomfort such as irritation of the respiratory system, metal fume fever, nausea, and may aggravate pre-existing respiratory conditions.

Long Term Exposure – Chronic overexposure to welding fume may lead to iron deposits in the lungs (siderosis) and reduced pulmonary function. Manganese overexposure can lead to irreversible damage to the central nervous system resulting in impaired speech and movement. Chronic overexposure to nickel fumes and hexavalent chromium can cause cancer. Some of the products contain silica quartz, but not in an inhalable fraction. Silica quartz is a listed carcinogen.

Refer to Section 11 for more information.

5. FIRE FIGHTING MEASURES

General - Products are non-flammable as shipped. Welding arcs and spatter can ignite nearby combustible materials.

Suitable Extinguishing Media- Use methods and materials appropriate for the combustible material.

Specific Hazards Arising from the Chemical - Welding arcs and spatter can ignite nearby combustible materials.

General Firefighting Procedures- Keep people away. Isolate fire and deny entry to the area by any non-essential personnel. Fight fire from protected location or safe distance.

Special Actions for Firefighters- Firefighters should be equipped with self-contained breathing apparatus to protect against potentially toxic and hazardous fumes. Toxic and irritating fumes and gases may be given off during burning or thermal decomposition.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures:

For Non-Emergency Personnel – Isolate the area and keep non-essential people away. Do not touch or walk through spilled material. Allow the molten metallic material to solidify and cool before disposal. If molten metal spills out of the weldment, turn off the power. Contain the flow using sand or submerged arc flux. If airborne dust and or fumes are present, wear appropriate personal protective equipment (PPE) to avoid overexposure.

For Emergency Personnel – Wear appropriate personal protective equipment (PPE), including clothes, gloves and breathing protection. Evacuate non-essential personnel.

Environmental Precautions: Keep material out of waterways and drains.

Methods and Materials for Containment and Cleaning Up: Isolate and clean up spills immediately. Avoid generating dust or airborne particles during clean up. Dispose of solidified mass per Federal, State and Local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling: Wear safety glasses and gloves to avoid cuts and abrasion when handling welding consumables and their packaging. Do not eat drink or smoke in areas where these products are being used.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a cool, dry area in the original packaging. Keep products away from heat, flame and moisture.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Appropriate Engineering Controls: Provide adequate ventilation and/or local exhaust at the weld station to keep fumes and gases away from the welder. Train welders and welding operators to keep their head out of the fumes. See ANSI Z49.1 “Safety in Welding, Cutting, and Allied Processes” for recommendations of safe work practices.

Personal Protective Equipment:

Eye/Face Protection – Wear safety glasses or goggles with appropriate side shields. Wear a helmet or face shield with an appropriate filter lens. Use protective screens to shield others in the work area.

Skin/Body Protection – Wear hand, head and body protection including welder’s gloves, protective face shield and long sleeved protective clothing.

Respiratory Protection – Use NIOSH approved fume respirator or air supplied respirator when where ventilation is inadequate, welding in confined spaces or where required to by OSHA regulations. Fume sampling per AWS F1.1 “Method for Sampling Airborne Particulates Generated by Welding and Allied Processes” may be required. Other appropriate standards that may be considered include, but are not limited to, AWS F1.2 “Laboratory Method for Measuring Fume Generation Rate and Total Fume Emission of Welding and Allied Processes” and AWS F3.2

“Ventilation Guide for Weld Fume”. For actual weld fume and particulate analysis, refer to the appropriate analytical methods recommended by NIOSH or OSHA, and consult an industrial hygiene professional.

Control Parameters:

Exposure Limits - USA

Common Name	CAS Number	Form	Exposure Limit	Source
Aluminum Metal	7429-90-5	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	1 mg/m ³	USA. ACGIH TLVs
Aluminum Oxide	1344-28-1	Total Dust	15 mg/m ³	USA. OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	1 mg/m ³	USA. ACGIH TLVs
Barium Compounds	7440-39-3	Soluble Compounds	0.5 mg/m ³	USA. OSHA PELs
		Soluble Compounds	0.5 mg/m ³	USA. ACGIH TLVs
Calcium Carbonate	1317-65-3	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
Chromium	7440-47-3	Metal	1 mg/m ³	USA. OSHA PELs
		Metal	0.5 mg/m ³	USA. ACGIH TLVs
		Cr II compounds	0.5 mg/m ³	USA. OSHA PELs
		Cr III Compounds, Inorganic	0.5 mg/m ³	USA. OSHA PELs
		Cr III Compounds, Inorganic	0.5 mg/m ³	USA. ACGIH TLVs
	18540-29-9	Cr VI Compounds	0.1 mg/m ³	USA. OSHA PELs Ceiling
		Cr VI Compounds, Soluble (as Cr VI)	0.005 mg/m ³	USA. OSHA PELs
		Cr VI Compounds, Soluble (as Cr)	0.05 mg/m ³	USA. ACGIH TLVs
		Cr VI Compounds, Insoluble (as Cr VI)	0.005 mg/m ³	USA. OSHA PELs
		Cr VI Compounds, Insoluble (as Cr)	0.01 mg/m ³	USA. ACGIH TLVs
Cobalt	7440-48-4	As Metal, Dust & Fume	0.1 mg/m ³	USA. OSHA PELs
		As Metal, Dust & Fume	0.02 mg/m ³	USA. California OSHA PELs
		As Metal, Dust & Fume	0.02 mg/m ³	USA. ACGIH TLVs
Copper	7440-50-8	Dust	1 mg/m ³	USA. OSHA PELs & ACGIH TLVs
		Fume	0.1 mg/m ³	USA. OSHA PELs
		Fume	0.2 mg/m ³	USA. ACGIH TLVs
Fluorides	7789-75-5	As Fluorides	2.5 mg/m ³	USA. OSHA PELs & ACGIH TLVs
Iron & Iron Oxide	1309-37-1	Iron Oxide (As Fume)	10 mg/m ³	USA. OSHA PELs
		Iron Oxide (As Fume)	5 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. ACGIH TLVs
Graphite	7782-42-5	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs

		Respirable	2 mg/m ³	USA. ACGIH TLVs
Magnesite	546-93-0	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Total Dust	10 mg/m ³	USA. ACGIH TLVs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	2 mg/m ³	USA. ACGIH TLVs
Magnesium Oxide	1309-48-4	Fume	15 mg/m ³	USA. OSHA PELs
		Fume	10 mg/m ³	USA. California OSHA PELs
		Fume (Inhalable)	10 mg/m ³	USA. ACGIH TLVs
Manganese & Mn Compounds	7439-96-5	Fume	5 mg/m ³	USA. OSHA PELs Ceiling
		Fume	0.2 mg/m ³	USA. California OSHA PELs
		Fume (Respirable)	0.02 mg/m ³	USA. ACGIH TLVs
		Fume (Inhalable)	0.1 mg/m ³	USA. ACGIH TLVs
		Inorganic	5 mg/m ³	USA. OSHA PELs Ceiling
		Inorganic	0.2 mg/m ³	USA. California OSHA PELs
		Inorganic (Respirable)	0.02 mg/m ³	USA. ACGIH TLVs
		Inorganic (Inhalable)	0.1 mg/m ³	USA. ACGIH TLVs
Molybdenum	7439-98-7	Soluble Compounds	5 mg/m ³	USA. OSHA PELs
		Soluble Compounds (Respirable)	0.5 mg/m ³	USA. ACGIH TLVs
		Insoluble compounds (Total Dust)	15 mg/m ³	USA. OSHA PELs
		Insoluble compounds (Total Dust)	10 mg/m ³	USA. California OSHA PELs
		Insoluble compounds (Respirable)	3 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
		Insoluble compounds (Inhalable)	10 mg/m ³	USA. ACGIH TLVs
Nickel	7440-02-0	Metal	1 mg/m ³	USA. OSHA PELs
		Metal (Inhalable)	1.5 mg/m ³	USA. ACGIH TLVs
		Metal	0.015 mg/m ³	USA. NIOSH RELs
		Soluble Compounds	1 mg/m ³	USA. OSHA PELs
		Soluble Compounds (Inorganic)	0.1 mg/m ³	USA. ACGIH TLVs
		Insoluble Compounds	1 mg/m ³	USA. OSHA PELs
		Insoluble Compounds (Inorganic)	0.2 mg/m ³	USA. ACGIH TLVs
Potassium Silicate	1312-76-1	Total	10 mg/m ³	USA. ACGIH TLVs
Sodium Silicate	1344-09-8	Total	10 mg/m ³	USA. ACGIH TLVs
Silicon	7440-21-3	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
Silica (Quartz)	14808-60-7	Respirable	0.1 mg/m ³	USA. OSHA PELs
		Respirable	0.025 mg/m ³	USA. ACGIH TLVs
		Total Dust	0.3 mg/m ³	USA. OSHA PELs
Titanium Dioxide	13463-67-7	Total Dust	15 mg/m ³	USA. OSHA PELs

		Total Dust	10 mg/m ³	USA. ACGIH TLVs
Tungsten	7440-33-7	Insoluble	5.0 mg/m ³	USA. ACGIH TLVs
		Insoluble	10.0 mg/m ³	USA. ACGIH TLVs Ceiling
		Soluble	1.0 mg/m ³	USA. ACGIH TLVs
		Soluble	3.0 mg/m ³	USA. ACGIH TLVs Ceiling
Vanadium	7440-62-2	Oxide Dust	0.5 mg/m ³	USA. OSHA PELs Ceiling
		Oxide Dust (Inhalable)	0.05 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
		Oxide Fume	0.1 mg/m ³	USA. OSHA PELs Ceiling
		Oxide Fume (Inhalable)	0.05 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
Zirconium & Zr Compounds	7440-67-7	Metal	5 mg/m ³	USA. ACGIH TLVs
		Metal	10 mg/m ³	USA. ACGIH TLVs Ceiling
		Compound	5 mg/m ³	USA. OSHA PELs
		Compound	5 mg/m ³	USA. ACGIH TLVs
		Compound	10 mg/m ³	USA. ACGIH TLVs Ceiling

Exposure Limits – Canada

Common Name	CAS Number	Form	Exposure Limit	Source
Calcium Carbonate	1317-65-3	Total Dust	10 mg/m ³	Canada. Alberta OEL TWA
		Total Dust	20 mg/m ³	Canada. British Columbia OEL TWA STEL
		Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Respirable	3 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL for 8hr ACL
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL for 15min ACL
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
Manganese & Mn Compounds	7439-96-5	As Mn	0.2 mg/m ³	Canada. Alberta OEL TWA
		As Mn	0.2 mg/m ³	Canada. British Columbia OEL TWA
		As Mn (Inhalable)	0.1 mg/m ³	Canada. Manitoba OEL TWA
		As Mn (Respirable)	0.02 mg/m ³	Canada. Manitoba OEL TWA
		As Mn	0.2 mg/m ³	Canada. New Brunswick OEL TWA
		As Mn	0.1 mg/m ³	Canada. Newfoundland & Labrador OEL TWA
		As Mn	0.1 mg/m ³	Canada. Nova Scotia OEL TWA
		As Mn	1 mg/m ³	Canada. Nunavut OEL TWA
		As Mn	3 mg/m ³	Canada. Nunavut OEL STEL
		As Mn	5 mg/m ³	Canada. Nunavut OEL Ceiling
		As Mn	1 mg/m ³	Canada. Northwest Territories OEL TWA
		As Mn	3 mg/m ³	Canada. Northwest Territories OEL STEL
		As Mn	5 mg/m ³	Canada. Northwest Territories OEL Ceiling

		As Mn	0.2 mg/m ³	Canada. Ontario OEL TWA
		As Mn	0.2 mg/m ³	Canada. Prince Edward Island OEL TWA
		As Mn	0.2 mg/m ³	Canada. Quebec OEL TWA
		As Mn	0.2 mg/m ³	Canada. Saskatchewan OEL TWA
		As Mn	0.6 mg/m ³	Canada. Saskatchewan OEL STEL
		As Mn	5 mg/m ³	Canada. Yukon OEL Ceiling
Silicon	7440-21-3	Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	3 mg/m ³	Canada. New Brunswick OEL TWA
		Total Dust	10 mg/m ³	Canada. Nunavut OEL TWA
		Total Dust	10 mg/m ³	Canada. Northwest Territories OEL TWA
		Total Dust	10 mg/m ³	Canada. Ontario OEL TWA
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL TWA
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL STEL
		Total Dust	10 mg/m ³	Canada. Yukon OEL TWA
		Total Dust	20 mg/m ³	Canada. Yukon OEL STEL
Silica (Quartz)	14808-60-7	Respirable Fraction	0.025 mg/m ³	Canada. Alberta OEL TWA
		Respirable Fraction	0.025 mg/m ³	Canada. British Columbia OEL TWA
		Respirable Fraction	0.025 mg/m ³	Canada. Manitoba OEL TWA
		Respirable Fraction	0.1 mg/m ³	Canada. Ontario OEL TWA
		Respirable Fraction	0.05 mg/m ³	Canada. Quebec OEL TWA
		Respirable Fraction	0.1 mg/m ³	Canada. Saskatchewan OEL TWA
Titanium Dioxide	13463-67-7	Total Dust	10 mg/m ³	Canada. Alberta OEL TWA
		Dust (Respirable)	3 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. Manitoba OEL TWA
		Total Dust	10 mg/m ³	Canada. Ontario OEL TWA
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL TWA
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL STEL

Exposure Limits – Mexico

Common Name	CAS Number	Form	Exposure Limit	Source
Calcium Carbonate	1317-65-3	Total Dust	20 mg/m ³	Mexico. OEL CTT
		Total Dust	10 mg/m ³	Mexico. OEL CPT
Manganese & Mn Compounds	7439-96-5	As Mn	0.2 mg/m ³	Mexico. OEL CPT
		As Mn Fume	1.0 mg/m ³	Mexico. OEL CPT
		As Mn Fume	3.0 mg/m ³	Mexico. OEL CTT
Silicon	7440-21-3	Total Dust	10 mg/m ³	Mexico. OEL CPT
		Total Dust	20 mg/m ³	Mexico. OEL CTT
Silica	69012-46-2	Fume	10 mg/m ³	Mexico. OEL CPT
		Fume (Respirable)	3 mg/m ³	Mexico. OEL CPT
Silica (Quartz)	14808-60-7	Respirable Fraction	0.1 mg/m ³	Mexico. OEL CPT

Titanium Dioxide	13463-67-7	Total Dust	20 mg/m ³	Mexico. OEL CTT
		Total Dust	10 mg/m ³	Mexico. OEL CPT

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Solid or tubular wire
Color:	Various
Odor:	None
Odor threshold:	Not Applicable
pH:	Not Applicable
Melting point	>2000F (1100C)
Initial Boiling Point & Range:	Data Not Available
Flash point	Data Not Available
Evaporation rate	Data Not Available
Flammability	Data Not Available
Upper flammability/explosive limit:	Data Not Available
Lower flammability/explosive limit:	Data Not Available
Vapor pressure	Not Applicable
Vapor density:	Not Applicable
Relative density	0.2-0.3 lbs/in ³
Solubility in water	Data Not Available
Solubility (other)	Data Not Available
Partition coefficient	Data Not Available
Auto-ignition temperature	Data Not Available
Decomposition temperature:	Data Not Available
Viscosity :	Data Not Available

10. STABILITY AND REACTIVITY

Reactivity – This product is not reactive under normal conditions as shipped.

Chemical stability – This product is chemically stable under normal conditions as shipped.

Possibility of hazardous reactions – Polymerization reactions will not occur.

Conditions to avoid – Protect product from moisture and contamination.

Incompatible materials – Data not available

Hazardous decomposition products – Welding electrodes and wires emit fumes and gases when used under normal conditions. These fumes and gases produced during welding operations cannot be easily classified, and will differ in quantity and form from those ingredients listed in Section 3 of this SDS. The composition and quantity of these fumes and gases are directly dependent upon the metal being welded, any material coatings (such as primer or galvanizing), the welding process, the welding consumables and the welding procedures. Other conditions which also influence the composition and quantity of the fumes and gases produced include the number of welders in the work area, the volume of the work area, the quality and amount of ventilation or exhaust, and the proximity of the welder's head to the fume plume.

Decomposition products of welding consumables under normal operation include oxides of elements present in the welding consumable and base material. Manganese compounds may be present in the fume from manganese bearing electrodes. Hexavalent chromium may be present in the fume from electrodes containing chromium. Nickel compounds may be present in the fume from nickel bearing electrodes. Fluoride containing consumables may generate gaseous and particulate fluoride. Gases such as carbon monoxide, carbon dioxide, ozone and nitrogen oxides may also be produced in the arc area.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure:

Oral – Unknown health effects, but this exposure is unlikely to occur.

Inhalation – Inhalation of welding fumes may lead to acute and/or chronic health hazards (see table below).

Skin – Arc rays can burn the skin. Weld fume deposited on the skin may cause irritation (see table below).

Eye – Arc rays can injure the eyes. Weld fume contact with the eyes may cause irritation (see table below).

Information on toxicological effects:

The acute and chronic effects of compounds which may be exposed to the welder are listed in the table below. Also listed are the available measured values of toxicity for that substance and whether it is classified as carcinogenic.

Substance	Short-Term Exposure Effects	Long Term Exposure Effects	Toxicity Measure	Carcinogenicity
Aluminium Oxide	May cause eye & respiratory irritation.	May cause effects on central nervous system.	LC50 (Rat, Oral Exposure) >5,000 mg/kg	Not classifiable
Barium Compounds	May cause irritation to the nose, throat, and respiratory tract.	May cause baratosis (deposits of barium in lungs). Baratosis is benign & does not progress to fibrosis.	LD50 (Rat, Oral Exposure) = 418 mg/kg	Not classifiable
Chromium as Cr+3	May cause eye, skin & respiratory irritation.	May cause chronic bronchitis, sinusitis, rhinitis and asthma.	LC50 (Rat, 14 day Oral Exposure) >5,000 mg/kg	Not classifiable
Chromium as Cr+6	May cause eye, skin & respiratory irritation.	May cause lung, nasal and sinus cancer, ulceration and perforation of the nasal septum and skin rash.	LC50 (Rat, Oral Exposure) = 29 mg/kg	IARC-1 NTP-known OSHA
Cobalt Compounds	May cause respiratory irritation and cardiovascular inflammation.	May cause chronic irritation, diminished pulmonary function, asthma and fibrosis.	LC50 (Rat, 30 min Inhalation Exposure) = 165mg/m ³	Not classifiable
Copper Oxide	May cause metal fume fever with upper respiratory irritation, chills, and aching muscles.	Prolonged contact may cause skin sensitization.	LD50 (Rat, Oral Exposure) = 470mg/kg	Not classifiable
Fluorides	May cause eye, skin & respiratory irritation.	May cause serious bone erosion and mottling of teeth (fluorosis).	LD50 (Rat, Oral Exposure) = 31 mg/kg	Not classifiable
Iron Oxide	May cause respiratory irritation.	May cause siderosis (deposits of iron in lungs). Siderosis is benign and does not progress to fibrosis.	LD50 (Rat, Oral Exposure) > 10,000 mg/kg	Not classifiable
Lithium Compounds	May cause eye & skin irritation.	May adversely affect the central nervous system & kidneys, and may be a reproductive toxin.	LC50 (Rat, 4 hour Inhalation Exposure) > 2.17 mg/L	Not classifiable
Magnesium Oxide	May cause eye & respiratory irritation.	May cause decreased lung function.	LD50 (Rat, Oral Exposure) = 3870 mg/kg	Not classifiable
Manganese Oxide	May cause respiratory irritation, metal fume fever with chills, fever, upset stomach, body ache, vomiting.	May cause brain and central nervous system effects resulting in arm and leg tremors, slurred speech and poor coordination.	LD50 (Rat, 4 hour Inhalation Exposure) = 19 mg mg/kg	Not classifiable
Molybdenum	May cause eye & respiratory irritation.	Not found.	Not found	Not classifiable

Substance	Short-Term Exposure Effects	Long Term Exposure Effects	Toxicity Measure	Carcinogenicity
Nickel Oxide	May cause respiratory irritant, inhalation of fumes may cause pneumonitis.	Prolonged exposure may lead to asthma. Nickel refinery workers showed a higher incidence of lung and nasal cancers.	LD50 (Rat, Inhalation Exposure) > 5,000 mg/kg	IARC-1 NTP-known
Niobium	May cause respiratory irritation.	Not found.	Not found	Not classifiable
Silica	May cause eye & respiratory irritation.	Crystalline silica is a known carcinogen. Overexposure may also result in silicosis.	Not found	IARC-1 NTP-known
Titanium Dioxide	May cause respiratory irritation.	May be carcinogenic.	LD50 (Rat, Oral Exposure) > 10 g/kg	IARC-2B
Tungsten compounds	May cause respiratory irritation.	Not found.	Not found	Not found
Vanadium Oxide	May cause eye, skin & respiratory irritation.	Exposure to high concentrations of fume may lead to chronic nasal hyperplasia.	LD50 (Rat, Oral Exposure) =10 mg/kg	Not classifiable
Zirconium Oxide	May cause eye & respiratory irritation.	May cause decreased lung function.	Not found	Not classifiable
Carbon Dioxide	At low levels, may cause headache, dizziness, loss of coordination, nausea. At high levels can cause coma and possibly death.	Long term exposure may affect the body's metabolism.	LC50 (Human, Inhalation Exposure) =100,000 ppm/min	Not classifiable
Carbon Monoxide	May cause effects on the blood, resulting in carboxyhaemoglobinemia and cardiac disorders. High levels may result in death.	May have effects on the cardiovascular system and central nervous system. May cause toxicity to human reproduction or development.	LC50 (Rat, 4 hour Inhalation Exposure) =1807 ppm	Not classifiable
Ozone	May cause eye and respiratory tract irritation. Inhalation may cause lung oedema. May cause effects on the central nervous system, resulting in headache and impaired performance.	May cause decreased lung function.	LC50 (Rat, 3 hour Inhalation Exposure) =4.5 mg/m ³	Not classifiable
Nitric Oxide	May cause respiratory irritation. Inhalation may cause lung oedema. Exposure far above the OEL may result in death.	May cause decreased lung function.	LC50 (Rat, Inhalation Exposure) =160 mg/m ³	Not classifiable
Nitrogen Dioxide	Corrosive to the skin and respiratory tract. Inhalation may cause lung oedema. Exposure far above the OEL may result in death.	May cause effects on the immune system and lungs, resulting in decrease in resistance to infection.	LC50 (Rat, 4 hour Inhalation Exposure) =88 ppm	Not classifiable

Other information on toxicological effects:

Germ cell mutagenicity – Not classified

Reproductive toxicity – Not classified

Specific target organ toxicity (Single exposure) – Not classified

Specific target organ toxicity (Repeated exposure) – Not classified

Aspiration hazard – Not classified

12. ECOLOGICAL INFORMATION

Toxicity:	Not classified
Persistence and degradability:	No information available
Bioaccumulative potential:	No information available
Mobility in soil:	No information available
Other adverse effects:	Unknown

13. DISPOSAL CONSIDERATIONS

Discard any product, residue, waste or packaging in an environmentally acceptable manner in compliance with federal, State, or local laws. Do not dispose of any waste, remaining product or by-product in the sewer.

14. TRANSPORT INFORMATION

UN Number:	Not regulated
UN Proper Shipping Name:	Not regulated
Transport Hazard Class:	Not regulated
Packing Group:	Not regulated
IMDG:	Not regulated
ICAO/IATA:	Not regulated

15. REGULATORY INFORMATION

U.S. Federal Regulations:

Emergency Planning & Community Right-To-Know Act (EPCRA) of 1986

Section 313 Hazardous Chemicals:

Aluminum, Aluminum Oxide, Barium and Barium Compounds, Chromium, Copper, Lithium Carbonate, Manganese, Nickel, Silicon & Silica, Iron & Iron Oxide, Magnesium, Zirconium and Vanadium.

Superfund Amendments and Reauthorization Act of 1986 (SARA):

Hazard categories – Acute (Immediate) and Chronic (Delayed)

Toxic Substances Control Act (TSCA) Inventory:

Iron – Listed

Silicon – Listed

U.S. State Laws:

California Proposition 65:

Titanium Dioxide – Carcinogenic

Silica (Quartz) - Carcinogenic

Warning: These products contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

New Jersey Community Worker and Right-to-Know Act

Titanium Dioxide – Listed

Manganese – Listed

Massachusetts Right-to-Know Act Substance List

Titanium Dioxide – Listed

Manganese – Listed

Silica (Quartz) – Listed

Pennsylvania Right-to-Know Act Hazardous Substances List

Titanium Dioxide – Listed

Manganese – Listed

Rhode Island Right-to-Know Act Substance List

Manganese – Listed

Minnesota Right-to-Know Act Hazardous Substances List

Titanium Dioxide – Listed

Manganese – Listed

Silica (Quartz) – Listed

Canadian Regulations:

This product is classified according to the requirements of the Canadian Controlled Products Regulations Section 33, and this SDS contains all required information.

16. OTHER INFORMATION

DISCLAIMER: Users should take all standard and reasonable precautions when using this product for its intended use. The manufacturer does not recommend this product for any uses other than that described. The manufacturer makes no claims and provides no warranty for non-standard use.

NFPA 704:	HEALTH:	2	FLAMMABILITY:	0	REACTIVITY:	0
HMIS:	HEALTH:	2	FLAMMABILITY:	0	PHYSICAL HAZARD:	0

SDS Revisions

Preparation date:	5/12/2015	Revision date:	6/8/2015	Revision number:	1
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Note: Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Arcos Industries makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Arcos Industries be responsible for damages of any nature whatsoever resulting from the use of, misuse or reliance upon information. No representations or warranties, either express or implied, or merchantability, fitness for a particular purpose or any other nature are made hereunder with respect to information or the product to which information refers. Regulatory requirements are subject to change and may differ from one location to another. It is the buyer's responsibility to ensure its activities comply with federal, State, Provincial, and local laws and regulations.



SAFETY DATA SHEET (SDS)

Document Number: SDS-ARC-NI-0001

1. IDENTIFICATION

<i>Product Type:</i>	Ni-based solid wire electrodes for arc welding
<i>Product Names:</i>	Arcos 111, C-276, 352, 362, 382, 382H, 392, Alloy 59, Alloy 602CA, 622 (Alloy 22), 617, 625, 651, 813, 816, 861, 888, 2216, 2535R, 3545R, Ni55, Ni99
<i>Specifications:</i>	AWS A5.7, A5.14, A5.15 or None
<i>Product Type:</i>	Ni-based electrodes for shielded metal arc welding
<i>Product Names:</i>	Arcos 1N12, 4N11, 4N1A, 8N12, 9N10, C-276, 352, 59, 617, 803, 2216, Alloy 602CA, 622 (Alloy 22), Alloy 59, 2216, 2535R, 3545R
<i>Specifications:</i>	AWS A5.6, A5.11 or None
<i>Product Type:</i>	Ni-based cored electrodes for arc welding
<i>Product Names:</i>	Arcos 82-AP, 182-AP, 622-AP, 625-AP, 625-C, 2216-C, 2216-HT, C276-AP, ArcVar 36, ArcVar36Nb, Ni55-C, Ni65-C
<i>Specifications:</i>	AWS A5.34 or None
<i>Product Intended/Recommended Use:</i>	Arc welding
<i>Manufacturer:</i>	Arcos Industries, LLC 394 Arcos Drive Mt. Carmel, PA 17851 Tel: 1-800-233-8460 Fax: 1-570-339-5206
<i>Emergency Telephone Number:</i>	3E Company Emergency Response Hotline Company Code: 334276 U.S. / Canada / Mexico: 1-866-519-4752 Europe: 1-760-476-3962 Asia Pacific: 1-760-476-3960 Middle East/Africa: 1-760-476-3959

2. HAZARD IDENTIFICATION

Hazard Classification: Not classified as hazardous according to the applicable Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and OSHA Hazard Communication Standard (29 CFR 1910.1200) criteria.

Label Elements:

Hazard Symbol – None
Signal Word – None
Hazard Statement – Not Applicable
Precautionary Statement – Not Applicable

Other Hazards: This product presents no hazards in its intrinsic form. However, several hazards are generated during welding operations that can be harmful.

ELECTRICITY- Electric shock can kill.

HEAT- Molten metal and weld spatter can burn skin and start fires.

RADIATION- Arc rays can injure eyes and burn skin.

FUMES AND GASES - Fumes and gases generated during welding can be dangerous to your health. See Section 11.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Composition: Chemical composition information is shown below for the solid wire electrodes. For the covered and cored electrodes, chemical composition data is given as a maximum weight percentage of the composite electrode, which includes fluxing ingredients. These fluxing ingredients typically consist of manganese, silicon, titanium, aluminum and/or zirconium oxides, as well as certain fluoride, carbonate and silicate compounds.

Solid Wire Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Cu	Co	W	Al	Fluoride	Carbonate ²	Silicate ³
111	Bal	21.0		3.0	1.0	1.5										
C-276	Bal	16.5	14.5	6.0			0.02				2.5	4.5				
352	Bal	31.0		10.5	1.0		0.04									
362	Bal	17.0		10.0				3.0								
382	Bal	22.0		3.0	3.5		0.10	3.0								
382H	Bal	20.5		3.0	3.3		0.10	2.5								
392	Bal	17.0		8.0	2.7		0.08	3.5								
Alloy 59	Bal	24.0	16.5	1.5			0.015									
Alloy 602CA	Bal	25.0		9.5			0.25						2.0			
622 (Alloy 22)	Bal	22.5	14.5	6.0			0.015				2.5	4.5				
617	Bal	24.0	10.0	3.0	1.0	1.0	0.15				15.0		1.5			
625	Bal	23.0	10.0	5.0			0.10	4.2								
651	99.9						0.1									
813	32.0			1.0						Bal						
816	69.0	0.15		2.5	4.0		0.15		2.3	Bal						
861	Bal			1.0	1.0		0.15		3.5				1.5			
888	Bal					1.0							6.0			
2216	Bal			49.0	13.5		0.45									
2535R	Bal	26.5		38.7	2.0		0.45									
3545R	Bal	36.0		20.5	2.0		0.50	1.4								
Ni55	Bal			44.5	1.0		0.50									
Ni99	Bal						0.15									

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicates

Covered Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Cu	Co	W	Al	Fluoride	Carbonate ²	Silicate ³
1N12	Bal	23.0	10.0	7.0	1.0	3.0	0.10	4.2	5.0				0.5	9.0	7.5	7.5
4N11	Bal				1.0	4.0	0.10		1.2				1.5	7.0	7.5	7.5
4N1A	Bal	17.0	2.5	12.0	4.5	3.0	0.10	3.0	5.0				0.5	7.0	7.5	7.5
8N12	Bal	17.0		10.0	10.5	7.0	0.10	2.5	5.0				0.5	9.0	7.5	7.5
9N10	Bal				5.0	4.5	0.15		5.0	38.0			0.5	7.0	7.5	7.5
C-276	Bal	16.5	17.0	7.0	2.0	3.0	0.02	2.5	5.0		2.5	4.5	0.5	9.0	7.5	7.5
352	Bal	31.5	1.0	12.0	2.0	3.0	0.05	2.5	5.0				0.5	9.0	7.5	7.5
Alloy 59	Bal	24.0	16.5	1.5	2.0	3.0	0.02		5.0				0.5	9.0	7.5	7.5
617	Bal	26.0	10.0	2.5	3.5	4.0	0.15		5.0		15.0		2.0	9.0	7.5	7.5
803	33.0			0.75	2.5	2.5			5.0	Bal			1.5	9.0	7.5	7.5
2216	Bal			49.0	14.5	3.0	0.45		5.0				0.5	9.0	7.5	7.5
Alloy 602CA	Bal	25.0		9.5	1.0	3.0	0.25		5.0				0.5	9.0	7.5	7.5
622 (Alloy 22)	Bal	22.5	14.5	6.0	1.0	3.0	0.02		5.0		2.5	3.5	0.5	9.0	7.5	7.5
2535R	Bal	26.5		39.0	3.0	3.0	0.45		5.0				0.5	9.0	7.5	7.5
3545R	Bal	36.0		20.5	3.0	3.0	0.50	1.4	5.0				0.5	9.0	7.5	7.5

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicate

Cored Electrodes for Arc Welding

Product	Ni	Cr	Mo	Fe	Mn ¹	Si ¹	C	Nb	Ti ¹	Mg ¹	Co	W	Zr ¹	Fluoride	Carbonate ²	Silicate ³
82-AP	Bal	22.0		3.0	3.5	1.0	0.10	3.0	7.0				1.0	0.5		
182-AP	Bal	17.0		10.0	10.5	1.0	0.10	2.5	7.0				1.0	0.5		
622-AP	Bal	22.5	14.5	6.0		1.0	0.02		7.0		2.5	4.5	1.0	0.5		
625-AP	Bal	23.0	10.0	5.0		1.0	0.10	4.2	7.0				1.0	0.5		
625-C	Bal	23.0	10.0	5.0		1.0	0.10	4.2					1.0	0.5		
2216-C	Bal			49.0	13.5	1.0	0.45							0.5		
2216-HT	45.0	7.0		Bal	11.5		0.05	1.0						0.5		
C276-AP	Bal	16.5	14.5	6.0			0.02		7.0		2.5	4.5	1.0	0.5		
ArcVar 36	37.0			Bal	1.0	1.0	0.04		10.0	1.5				0.5		
ArcVar 36Nb	37.0			Bal	1.0	1.0	0.10	2.0	10.0	1.5				0.5		
Ni55-C	Bal			43.0	3.5	1.0	0.04		1.0				0.5			
Ni65-C	Bal			32.0	0.5	1.0	0.04		1.0				0.5			

(1) Total for this element and its compounds, which are generally characterized as oxides.

(2) Carbonate compounds consist of calcium carbonate and magnesium carbonate

(3) Silicate compounds consist of sodium and potassium silicates

4. FIRST AID MEASURES

Inhalation - If breathing has stopped, immediately seek medical assistance. Begin performing cardio pulmonary resuscitation (CPR) if you are trained to do so. If breathing is difficult, move to area with fresh air and seek medical attention immediately.

Skin contact - For skin burns due to arc radiation flush with cold water. If burn and irritation persists seek medical attention. In case of skin contact with fume or dust, wash affected areas with soap and water. Thoroughly clean shoes and wash clothing. Seek medical attention if irritation develops and persists.

Eye contact - In case of radiation burns due to arc flash move to a dark room and seek medical attention. To remove fume or dust flush with plenty of lukewarm water. Seek medical attention if irritation develops. In case of foreign metallic or slag material lodged in the eye, seek medical attention to remove it. Do not rub or agitate the eyes.

Ingestion – Although unlikely due to product form, immediately seek medical attention if wire pieces or metal powders from inside the wire are ingested. Do not induce vomiting unless directed to do so by medical personnel.

Electric Shock - Disconnect power. Use non-conductive material to pull victim from contact with live wires. If no detectable pulse, seek medical attention immediately and begin cardio pulmonary resuscitation (CPR) if you are trained to do so.

Most Serious Symptoms:

Short Term Exposure – Acute overexposure to welding fumes may result in discomfort such as irritation of the respiratory system, metal fume fever, nausea, and may aggravate pre-existing respiratory conditions.

Long Term Exposure – Chronic overexposure to welding fume may lead to iron deposits in the lungs (siderosis) and reduced pulmonary function. Manganese overexposure can lead to irreversible damage to the central nervous system resulting in impaired speech and movement. Chronic overexposure to nickel fumes and hexavalent chromium can cause cancer. Some of the products contain silica quartz, but not in an inhalable fraction. Silica quartz is a listed carcinogen.

Refer to Section 11 for more information.

5. FIRE FIGHTING MEASURES

General - Products are non-flammable as shipped. Welding arcs and spatter can ignite nearby combustible materials.

Suitable Extinguishing Media- Use methods and materials appropriate for the combustible material.

Specific Hazards Arising from the Chemical - Welding arcs and spatter can ignite nearby combustible materials.

General Firefighting Procedures- Keep people away. Isolate fire and deny entry to the area by any non-essential personnel. Fight fire from protected location or safe distance.

Special Actions for Firefighters- Firefighters should be equipped with self-contained breathing apparatus to protect against potentially toxic and hazardous fumes. Toxic and irritating fumes and gases may be given off during burning or thermal decomposition.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures:

For Non-Emergency Personnel – Isolate the area and keep non-essential people away. Do not touch or walk through spilled material. Allow the molten metallic material to solidify and cool before disposal. If molten metal spills out of the weldment, turn off the power. Contain the flow using sand or submerged arc flux. If airborne dust and or fumes are present, wear appropriate personal protective equipment (PPE) to avoid overexposure.

For Emergency Personnel – Wear appropriate personal protective equipment (PPE), including clothes, gloves and breathing protection. Evacuate non-essential personnel.

Environmental Precautions: Keep material out of waterways and drains.

Methods and Materials for Containment and Cleaning Up: Isolate and clean up spills immediately. Avoid generating dust or airborne particles during clean up. Dispose of solidified mass per Federal, State and Local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling: Wear safety glasses and gloves to avoid cuts and abrasion when handling welding consumables and their packaging. Do not eat drink or smoke in areas where these products are being used.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a cool, dry area in the original packaging. Keep products away from heat, flame and moisture.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Appropriate Engineering Controls: Provide adequate ventilation and/or local exhaust at the weld station to keep fumes and gases away from the welder. Train welders and welding operators to keep their head out of the fumes. See ANSI Z49.1 “Safety in Welding, Cutting, and Allied Processes” for recommendations of safe work practices.

Personal Protective Equipment:

Eye/Face Protection – Wear safety glasses or goggles with appropriate side shields. Wear a helmet or face shield with an appropriate filter lens. Use protective screens to shield others in the work area.

Skin/Body Protection – Wear hand, head and body protection including welder’s gloves, protective face shield and long sleeved protective clothing.

Respiratory Protection – Use NIOSH approved fume respirator or air supplied respirator when where ventilation is inadequate, welding in confined spaces or where required to by OSHA regulations. Fume sampling per AWS F1.1 “Method for Sampling Airborne Particulates Generated by Welding and Allied Processes” may be required. Other appropriate standards that may be considered include, but are not limited to, AWS F1.2 “Laboratory Method for Measuring Fume Generation Rate and Total Fume Emission of Welding and Allied Processes” and AWS F3.2

“Ventilation Guide for Weld Fume”. For actual weld fume and particulate analysis, refer to the appropriate analytical methods recommended by NIOSH or OSHA, and consult an industrial hygiene professional.

Control Parameters:
Exposure Limits - USA

Common Name	CAS Number	Form	Exposure Limit	Source
Aluminum Metal	7429-90-5	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	1 mg/m ³	USA. ACGIH TLVs
Aluminum Oxide	1344-28-1	Total Dust	15 mg/m ³	USA. OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	1 mg/m ³	USA. ACGIH TLVs
Barium Compounds	7440-39-3	Soluble Compounds	0.5 mg/m ³	USA. OSHA PELs
		Soluble Compounds	0.5 mg/m ³	USA. ACGIH TLVs
Calcium Carbonate	1317-65-3	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
Chromium	7440-47-3	Metal	1 mg/m ³	USA. OSHA PELs
		Metal	0.5 mg/m ³	USA. ACGIH TLVs
		Cr II compounds	0.5 mg/m ³	USA. OSHA PELs
		Cr III Compounds, Inorganic	0.5 mg/m ³	USA. OSHA PELs
		Cr III Compounds, Inorganic	0.5 mg/m ³	USA. ACGIH TLVs
	18540-29-9	Cr VI Compounds	0.1 mg/m ³	USA. OSHA PELs Ceiling
		Cr VI Compounds, Soluble	0.005 mg/m ³ (as Cr VI)	USA. OSHA PELs
		Cr VI Compounds, Soluble	0.05 mg/m ³ (as Cr)	USA. ACGIH TLVs
		Cr VI Compounds, Insoluble	0.005 mg/m ³ (as Cr VI)	USA. OSHA PELs
		Cr VI Compounds, Insoluble	0.01 mg/m ³ (as Cr)	USA. ACGIH TLVs
Cobalt	7440-48-4	As Metal, Dust & Fume	0.1 mg/m ³	USA. OSHA PELs
		As Metal, Dust & Fume	0.02 mg/m ³	USA. California OSHA PELs
		As Metal, Dust & Fume	0.02 mg/m ³	USA. ACGIH TLVs
Copper	7440-50-8	Dust	1 mg/m ³	USA. OSHA PELs & ACGIH TLVs
		Fume	0.1 mg/m ³	USA. OSHA PELs
		Fume	0.2 mg/m ³	USA. ACGIH TLVs
Fluorides	7789-75-5	As Fluorides	2.5 mg/m ³	USA. OSHA PELs & ACGIH TLVs
Iron & Iron Oxide	1309-37-1	Iron Oxide (As Fume)	10 mg/m ³	USA. OSHA PELs
		Iron Oxide (As Fume)	5 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. ACGIH TLVs
Graphite	7782-42-5	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs

		Respirable	2 mg/m ³	USA. ACGIH TLVs
Magnesite	546-93-0	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Total Dust	10 mg/m ³	USA. ACGIH TLVs
		Respirable	5 mg/m ³	USA. OSHA PELs
		Respirable	2 mg/m ³	USA. ACGIH TLVs
Magnesium Oxide	1309-48-4	Fume	15 mg/m ³	USA. OSHA PELs
		Fume	10 mg/m ³	USA. California OSHA PELs
		Fume (Inhalable)	10 mg/m ³	USA. ACGIH TLVs
Manganese & Mn Compounds	7439-96-5	Fume	5 mg/m ³	USA. OSHA PELs Ceiling
		Fume	0.2 mg/m ³	USA. California OSHA PELs
		Fume (Respirable)	0.02 mg/m ³	USA. ACGIH TLVs
		Fume (Inhalable)	0.1 mg/m ³	USA. ACGIH TLVs
		Inorganic	5 mg/m ³	USA. OSHA PELs Ceiling
		Inorganic	0.2 mg/m ³	USA. California OSHA PELs
		Inorganic (Respirable)	0.02 mg/m ³	USA. ACGIH TLVs
		Inorganic (Inhalable)	0.1 mg/m ³	USA. ACGIH TLVs
Molybdenum	7439-98-7	Soluble Compounds	5 mg/m ³	USA. OSHA PELs
		Soluble Compounds (Respirable)	0.5 mg/m ³	USA. ACGIH TLVs
		Insoluble compounds (Total Dust)	15 mg/m ³	USA. OSHA PELs
		Insoluble compounds (Total Dust)	10 mg/m ³	USA. California OSHA PELs
		Insoluble compounds (Respirable)	3 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
		Insoluble compounds (Inhalable)	10 mg/m ³	USA. ACGIH TLVs
Nickel	7440-02-0	Metal	1 mg/m ³	USA. OSHA PELs
		Metal (Inhalable)	1.5 mg/m ³	USA. ACGIH TLVs
		Metal	0.015 mg/m ³	USA. NIOSH RELs
		Soluble Compounds	1 mg/m ³	USA. OSHA PELs
		Soluble Compounds (Inorganic)	0.1 mg/m ³	USA. ACGIH TLVs
		Insoluble Compounds	1 mg/m ³	USA. OSHA PELs
		Insoluble Compounds (Inorganic)	0.2 mg/m ³	USA. ACGIH TLVs
Potassium Silicate	1312-76-1	Total	10 mg/m ³	USA. ACGIH TLVs
Sodium Silicate	1344-09-8	Total	10 mg/m ³	USA. ACGIH TLVs
Silicon	7440-21-3	Total Dust	15 mg/m ³	USA. OSHA PELs
		Total Dust	10 mg/m ³	USA. California OSHA PELs
		Respirable	5 mg/m ³	USA. OSHA PELs
Silica (Quartz)	14808-60-7	Respirable	0.1 mg/m ³	USA. OSHA PELs
		Respirable	0.025 mg/m ³	USA. ACGIH TLVs
		Total Dust	0.3 mg/m ³	USA. OSHA PELs
Titanium Dioxide	13463-67-7	Total Dust	15 mg/m ³	USA. OSHA PELs

		Total Dust	10 mg/m ³	USA. ACGIH TLVs
Tungsten	7440-33-7	Insoluble	5.0 mg/m ³	USA. ACGIH TLVs
		Insoluble	10.0 mg/m ³	USA. ACGIH TLVs Ceiling
		Soluble	1.0 mg/m ³	USA. ACGIH TLVs
		Soluble	3.0 mg/m ³	USA. ACGIH TLVs Ceiling
Vanadium	7440-62-2	Oxide Dust	0.5 mg/m ³	USA. OSHA PELs Ceiling
		Oxide Dust (Inhalable)	0.05 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
		Oxide Fume	0.1 mg/m ³	USA. OSHA PELs Ceiling
		Oxide Fume (Inhalable)	0.05 mg/m ³	USA. ACGIH TLVs & California OSHA PELs
Zirconium & Zr Compounds	7440-67-7	Metal	5 mg/m ³	USA. ACGIH TLVs
		Metal	10 mg/m ³	USA. ACGIH TLVs Ceiling
		Compound	5 mg/m ³	USA. OSHA PELs
		Compound	5 mg/m ³	USA. ACGIH TLVs
		Compound	10 mg/m ³	USA. ACGIH TLVs Ceiling

Exposure Limits – Canada

Common Name	CAS Number	Form	Exposure Limit	Source
Calcium Carbonate	1317-65-3	Total Dust	10 mg/m ³	Canada. Alberta OEL TWA
		Total Dust	20 mg/m ³	Canada. British Columbia OEL TWA STEL
		Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Respirable	3 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL for 8hr ACL
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL for 15min ACL
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
Manganese & Mn Compounds	7439-96-5	As Mn	0.2 mg/m ³	Canada. Alberta OEL TWA
		As Mn	0.2 mg/m ³	Canada. British Columbia OEL TWA
		As Mn (Inhalable)	0.1 mg/m ³	Canada. Manitoba OEL TWA
		As Mn (Respirable)	0.02 mg/m ³	Canada. Manitoba OEL TWA
		As Mn	0.2 mg/m ³	Canada. New Brunswick OEL TWA
		As Mn	0.1 mg/m ³	Canada. Newfoundland & Labrador OEL TWA
		As Mn	0.1 mg/m ³	Canada. Nova Scotia OEL TWA
		As Mn	1 mg/m ³	Canada. Nunavut OEL TWA
		As Mn	3 mg/m ³	Canada. Nunavut OEL STEL
		As Mn	5 mg/m ³	Canada. Nunavut OEL Ceiling
		As Mn	1 mg/m ³	Canada. Northwest Territories OEL TWA
		As Mn	3 mg/m ³	Canada. Northwest Territories OEL STEL
		As Mn	5 mg/m ³	Canada. Northwest Territories OEL Ceiling

		As Mn	0.2 mg/m ³	Canada. Ontario OEL TWA
		As Mn	0.2 mg/m ³	Canada. Prince Edward Island OEL TWA
		As Mn	0.2 mg/m ³	Canada. Quebec OEL TWA
		As Mn	0.2 mg/m ³	Canada. Saskatchewan OEL TWA
		As Mn	0.6 mg/m ³	Canada. Saskatchewan OEL STEL
		As Mn	5 mg/m ³	Canada. Yukon OEL Ceiling
Silicon	7440-21-3	Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	3 mg/m ³	Canada. New Brunswick OEL TWA
		Total Dust	10 mg/m ³	Canada. Nunavut OEL TWA
		Total Dust	10 mg/m ³	Canada. Northwest Territories OEL TWA
		Total Dust	10 mg/m ³	Canada. Ontario OEL TWA
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL TWA
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL STEL
		Total Dust	10 mg/m ³	Canada. Yukon OEL TWA
		Total Dust	20 mg/m ³	Canada. Yukon OEL STEL
Silica (Quartz)	14808-60-7	Respirable Fraction	0.025 mg/m ³	Canada. Alberta OEL TWA
		Respirable Fraction	0.025 mg/m ³	Canada. British Columbia OEL TWA
		Respirable Fraction	0.025 mg/m ³	Canada. Manitoba OEL TWA
		Respirable Fraction	0.1 mg/m ³	Canada. Ontario OEL TWA
		Respirable Fraction	0.05 mg/m ³	Canada. Quebec OEL TWA
		Respirable Fraction	0.1 mg/m ³	Canada. Saskatchewan OEL TWA
Titanium Dioxide	13463-67-7	Total Dust	10 mg/m ³	Canada. Alberta OEL TWA
		Dust (Respirable)	3 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. British Columbia OEL TWA
		Total Dust	10 mg/m ³	Canada. Manitoba OEL TWA
		Total Dust	10 mg/m ³	Canada. Ontario OEL TWA
		Total Dust	10 mg/m ³	Canada. Quebec OEL TWA
		Total Dust	10 mg/m ³	Canada. Saskatchewan OEL TWA
		Total Dust	20 mg/m ³	Canada. Saskatchewan OEL STEL

Exposure Limits – Mexico

Common Name	CAS Number	Form	Exposure Limit	Source
Calcium Carbonate	1317-65-3	Total Dust	20 mg/m ³	Mexico. OEL CTT
		Total Dust	10 mg/m ³	Mexico. OEL CPT
Manganese & Mn Compounds	7439-96-5	As Mn	0.2 mg/m ³	Mexico. OEL CPT
		As Mn Fume	1.0 mg/m ³	Mexico. OEL CPT
		As Mn Fume	3.0 mg/m ³	Mexico. OEL CTT
Silicon	7440-21-3	Total Dust	10 mg/m ³	Mexico. OEL CPT
		Total Dust	20 mg/m ³	Mexico. OEL CTT
Silica	69012-46-2	Fume	10 mg/m ³	Mexico. OEL CPT
		Fume (Respirable)	3 mg/m ³	Mexico. OEL CPT
Silica (Quartz)	14808-60-7	Respirable Fraction	0.1 mg/m ³	Mexico. OEL CPT

Titanium Dioxide	13463-67-7	Total Dust	20 mg/m ³	Mexico. OEL CTT
		Total Dust	10 mg/m ³	Mexico. OEL CPT

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Solid or tubular wire
Color:	Various
Odor:	None
Odor threshold:	Not Applicable
pH:	Not Applicable
Melting point	>2000F (1100C)
Initial Boiling Point & Range:	Data Not Available
Flash point	Data Not Available
Evaporation rate	Data Not Available
Flammability	Data Not Available
Upper flammability/explosive limit:	Data Not Available
Lower flammability/explosive limit:	Data Not Available
Vapor pressure	Not Applicable
Vapor density:	Not Applicable
Relative density	0.2-0.3 lbs/in ³
Solubility in water	Data Not Available
Solubility (other)	Data Not Available
Partition coefficient	Data Not Available
Auto-ignition temperature	Data Not Available
Decomposition temperature:	Data Not Available
Viscosity :	Data Not Available

10. STABILITY AND REACTIVITY

Reactivity – This product is not reactive under normal conditions as shipped.

Chemical stability – This product is chemically stable under normal conditions as shipped.

Possibility of hazardous reactions – Polymerization reactions will not occur.

Conditions to avoid – Protect product from moisture and contamination.

Incompatible materials – Data not available

Hazardous decomposition products – Welding electrodes and wires emit fumes and gases when used under normal conditions. These fumes and gases produced during welding operations cannot be easily classified, and will differ in quantity and form from those ingredients listed in Section 3 of this SDS. The composition and quantity of these fumes and gases are directly dependent upon the metal being welded, any material coatings (such as primer or galvanizing), the welding process, the welding consumables and the welding procedures. Other conditions which also influence the composition and quantity of the fumes and gases produced include the number of welders in the work area, the volume of the work area, the quality and amount of ventilation or exhaust, and the proximity of the welder's head to the fume plume.

Decomposition products of welding consumables under normal operation include oxides of elements present in the welding consumable and base material. Manganese compounds may be present in the fume from manganese bearing electrodes. Hexavalent chromium may be present in the fume from electrodes containing chromium. Nickel compounds may be present in the fume from nickel bearing electrodes. Fluoride containing consumables may generate gaseous and particulate fluoride. Gases such as carbon monoxide, carbon dioxide, ozone and nitrogen oxides may also be produced in the arc area.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure:

Oral – Unknown health effects, but this exposure is unlikely to occur.

Inhalation – Inhalation of welding fumes may lead to acute and/or chronic health hazards (see table below).

Skin – Arc rays can burn the skin. Weld fume deposited on the skin may cause irritation (see table below).

Eye – Arc rays can injure the eyes. Weld fume contact with the eyes may cause irritation (see table below).

Information on toxicological effects:

The acute and chronic effects of compounds which may be exposed to the welder are listed in the table below. Also listed are the available measured values of toxicity for that substance and whether it is classified as carcinogenic.

Substance	Short-Term Exposure Effects	Long Term Exposure Effects	Toxicity Measure	Carcinogenicity
Aluminium Oxide	May cause eye & respiratory irritation.	May cause effects on central nervous system.	LC50 (Rat, Oral Exposure) >5,000 mg/kg	Not classifiable
Barium Compounds	May cause irritation to the nose, throat, and respiratory tract.	May cause baratosis (deposits of barium in lungs). Baratosis is benign & does not progress to fibrosis.	LD50 (Rat, Oral Exposure) = 418 mg/kg	Not classifiable
Chromium as Cr+3	May cause eye, skin & respiratory irritation.	May cause chronic bronchitis, sinusitis, rhinitis and asthma.	LC50 (Rat, 14 day Oral Exposure) >5,000 mg/kg	Not classifiable
Chromium as Cr+6	May cause eye, skin & respiratory irritation.	May cause lung, nasal and sinus cancer, ulceration and perforation of the nasal septum and skin rash.	LC50 (Rat, Oral Exposure) = 29 mg/kg	IARC-1 NTP-known OSHA
Cobalt Compounds	May cause respiratory irritation and cardiovascular inflammation.	May cause chronic irritation, diminished pulmonary function, asthma and fibrosis.	LC50 (Rat, 30 min Inhalation Exposure) = 165mg/m ³	Not classifiable
Copper Oxide	May cause metal fume fever with upper respiratory irritation, chills, and aching muscles.	Prolonged contact may cause skin sensitization.	LD50 (Rat, Oral Exposure) = 470mg/kg	Not classifiable
Fluorides	May cause eye, skin & respiratory irritation.	May cause serious bone erosion and mottling of teeth (fluorosis).	LD50 (Rat, Oral Exposure) = 31 mg/kg	Not classifiable
Iron Oxide	May cause respiratory irritation.	May cause siderosis (deposits of iron in lungs). Siderosis is benign and does not progress to fibrosis.	LD50 (Rat, Oral Exposure) > 10,000 mg/kg	Not classifiable
Lithium Compounds	May cause eye & skin irritation.	May adversely affect the central nervous system & kidneys, and may be a reproductive toxin.	LC50 (Rat, 4 hour Inhalation Exposure) > 2.17 mg/L	Not classifiable
Magnesium Oxide	May cause eye & respiratory irritation.	May cause decreased lung function.	LD50 (Rat, Oral Exposure) = 3870 mg/kg	Not classifiable
Manganese Oxide	May cause respiratory irritation, metal fume fever with chills, fever, upset stomach, body ache, vomiting.	May cause brain and central nervous system effects resulting in arm and leg tremors, slurred speech and poor coordination.	LD50 (Rat, 4 hour Inhalation Exposure) = 19 mg mg/kg	Not classifiable
Molybdenum	May cause eye & respiratory irritation.	Not found.	Not found	Not classifiable

Substance	Short-Term Exposure Effects	Long Term Exposure Effects	Toxicity Measure	Carcinogenicity
Nickel Oxide	May cause respiratory irritant, inhalation of fumes may cause pneumonitis.	Prolonged exposure may lead to asthma. Nickel refinery workers showed a higher incidence of lung and nasal cancers.	LD50 (Rat, Inhalation Exposure) > 5,000 mg/kg	IARC-1 NTP-known
Niobium	May cause respiratory irritation.	Not found.	Not found	Not classifiable
Silica	May cause eye & respiratory irritation.	Crystalline silica is a known carcinogen. Overexposure may also result in silicosis.	Not found	IARC-1 NTP-known
Titanium Dioxide	May cause respiratory irritation.	May be carcinogenic.	LD50 (Rat, Oral Exposure) > 10 g/kg	IARC-2B
Tungsten compounds	May cause respiratory irritation.	Not found.	Not found	Not found
Vanadium Oxide	May cause eye, skin & respiratory irritation.	Exposure to high concentrations of fume may lead to chronic nasal hyperplasia.	LD50 (Rat, Oral Exposure) =10 mg/kg	Not classifiable
Zirconium Oxide	May cause eye & respiratory irritation.	May cause decreased lung function.	Not found	Not classifiable
Carbon Dioxide	At low levels, may cause headache, dizziness, loss of coordination, nausea. At high levels can cause coma and possibly death.	Long term exposure may affect the body's metabolism.	LC50 (Human, Inhalation Exposure) =100,000 ppm/min	Not classifiable
Carbon Monoxide	May cause effects on the blood, resulting in carboxyhaemoglobinemia and cardiac disorders. High levels may result in death.	May have effects on the cardiovascular system and central nervous system. May cause toxicity to human reproduction or development.	LC50 (Rat, 4 hour Inhalation Exposure) =1807 ppm	Not classifiable
Ozone	May cause eye and respiratory tract irritation. Inhalation may cause lung oedema. May cause effects on the central nervous system, resulting in headache and impaired performance.	May cause decreased lung function.	LC50 (Rat, 3 hour Inhalation Exposure) =4.5 mg/m ³	Not classifiable
Nitric Oxide	May cause respiratory irritation. Inhalation may cause lung oedema. Exposure far above the OEL may result in death.	May cause decreased lung function.	LC50 (Rat, Inhalation Exposure) =160 mg/m ³	Not classifiable
Nitrogen Dioxide	Corrosive to the skin and respiratory tract. Inhalation may cause lung oedema. Exposure far above the OEL may result in death.	May cause effects on the immune system and lungs, resulting in decrease in resistance to infection.	LC50 (Rat, 4 hour Inhalation Exposure) =88 ppm	Not classifiable

Other information on toxicological effects:

Germ cell mutagenicity – Not classified

Reproductive toxicity – Not classified

Specific target organ toxicity (Single exposure) – Not classified

Specific target organ toxicity (Repeated exposure) – Not classified

Aspiration hazard – Not classified

12. ECOLOGICAL INFORMATION

Toxicity:	Not classified
Persistence and degradability:	No information available
Bioaccumulative potential:	No information available
Mobility in soil:	No information available
Other adverse effects:	Unknown

13. DISPOSAL CONSIDERATIONS

Discard any product, residue, waste or packaging in an environmentally acceptable manner in compliance with federal, State, or local laws. Do not dispose of any waste, remaining product or by-product in the sewer.

14. TRANSPORT INFORMATION

UN Number:	Not regulated
UN Proper Shipping Name:	Not regulated
Transport Hazard Class:	Not regulated
Packing Group:	Not regulated
IMDG:	Not regulated
ICAO/IATA:	Not regulated

15. REGULATORY INFORMATION

U.S. Federal Regulations:

Emergency Planning & Community Right-To-Know Act (EPCRA) of 1986

Section 313 Hazardous Chemicals:

Aluminum, Aluminum Oxide, Barium and Barium Compounds, Chromium, Copper, Lithium Carbonate, Manganese, Nickel, Silicon & Silica, Iron & Iron Oxide, Magnesium, Zirconium and Vanadium.

Superfund Amendments and Reauthorization Act of 1986 (SARA):

Hazard categories – Acute (Immediate) and Chronic (Delayed)

Toxic Substances Control Act (TSCA) Inventory:

Iron – Listed

Silicon – Listed

U.S. State Laws:

California Proposition 65:

Titanium Dioxide – Carcinogenic

Silica (Quartz) - Carcinogenic

Warning: These products contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

New Jersey Community Worker and Right-to-Know Act

Titanium Dioxide – Listed

Manganese – Listed

Massachusetts Right-to-Know Act Substance List

Titanium Dioxide – Listed

Manganese – Listed

Silica (Quartz) – Listed

Pennsylvania Right-to-Know Act Hazardous Substances List

Titanium Dioxide – Listed

Manganese – Listed

Rhode Island Right-to-Know Act Substance List

Manganese – Listed

Minnesota Right-to-Know Act Hazardous Substances List

Titanium Dioxide – Listed

Manganese – Listed

Silica (Quartz) – Listed

Canadian Regulations:

This product is classified according to the requirements of the Canadian Controlled Products Regulations Section 33, and this SDS contains all required information.

16. OTHER INFORMATION

DISCLAIMER: Users should take all standard and reasonable precautions when using this product for its intended use. The manufacturer does not recommend this product for any uses other than that described. The manufacturer makes no claims and provides no warranty for non-standard use.

NFPA 704:	HEALTH:	2	FLAMMABILITY:	0	REACTIVITY:	0
HMIS:	HEALTH:	2	FLAMMABILITY:	0	PHYSICAL HAZARD:	0

SDS Revisions

Preparation date:	5/12/2015	Revision date:	6/8/2015	Revision number:	1
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Note: Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Arcos Industries makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Arcos Industries be responsible for damages of any nature whatsoever resulting from the use of, misuse or reliance upon information. No representations or warranties, either express or implied, or merchantability, fitness for a particular purpose or any other nature are made hereunder with respect to information or the product to which information refers. Regulatory requirements are subject to change and may differ from one location to another. It is the buyer's responsibility to ensure its activities comply with federal, State, Provincial, and local laws and regulations.

SAFETY DATA SHEET

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830/2015 amending EC No.
1907/2006, Commission Regulation (EU) 2020/878
amending CLP directive 1272/2008, also in
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Issued: 2022-04-21



Arcaloy 310-16

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name	Arcaloy 310-16
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1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Arc Welding
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1.3. Details of the supplier of the safety data sheet

SDS created by	TDS Team
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Supplier	ESAB AB
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Street address	Box 8004 402 77 Göteborg Sweden
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Telephone	+46 31 509000
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Email	sdsrequest@esab.com
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Web site	www.esab.com
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1.4. Emergency telephone number

Emergency phone number	+1 703-741-5970 / 1-800-424-9300
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Available outside office hours	Yes
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Other

Other	Classification: E310-16
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SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Description	The product is not classified as hazardous according to applicable GHS hazard classification criteria.
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2.2. Label elements

More information	The product does not require labelling in accordance with CLP Regulation (EC) No 1272/2008.
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Issued: 2022-04-21



Arcaloy 310-16

2.3. Other hazards

Other hazards

This product contains nickel, which is classified as toxic by prolonged inhalation, a skin sensitizer and a suspect carcinogen. Nickel powder is harmful for the environment. This product contains titanium dioxide which is possibly carcinogenic. This product contains quartz, but normally not in an inhalable fraction. Quartz can cause silicosis and may cause cancer.

Avoid eye contact or inhalation of dust from the product. Skin contact is normally no hazard but should be avoided to prevent possible allergic reactions.

Persons with a pacemaker should not go near welding or cutting operations until they have consulted their doctor and obtained information from the manufacturer of the device.

When this product is used in a welding process, the most important hazards are welding fumes, heat, radiation and electric shock.

Fumes: Overexposure to welding fumes 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. Prolonged inhalation of nickel and chromium compounds above safe exposure limits can cause cancer. Overexposure to manganese and manganese compounds above safe exposure limits can cause irreversible damage to the central nervous system, including the brain, symptoms of which may include slurred speech, lethargy, tremor, muscular weakness, psychological disturbances and spastic gait.

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.

Other

Other

Emergency Overview: Metal wire or rods in varying colours. This product is normally not considered hazardous as shipped. Gloves should be worn when handling to prevent cuts and abrasions.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

Chemical name	CAS No. EC No. REACH No. Index No.	Concentration	Classification	H-phrase M factor acute M factor chronic	Note
IRON(REACH Registered)	7439-89-6 231-096-4 - -	30 - 40%	-	- - -	-
CHROMIUM	7440-47-3 231-157-5 - -	20 - 23%	-	- - -	-
Nickel powder**	7440-02-0 231-111-4 - -	14 - 16%	Skin Sens. 1, Carc. 2, STOT RE 1, Aquatic Chronic 3	H317, H351, H372, H412 - -	-
TITANIUM OXIDE**	13463-67-7 236-675-5 - -	8 - 13%	-	- - -	-
LIMESTONE.	1317-65-3	3 - 8%	-	-	-

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1907/2006, Commission Regulation (EU) 2020/878
amending CLP directive 1272/2008, also in
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Issued: 2022-04-21



Arcaloy 310-16

Chemical name	CAS No. EC No. REACH No. Index No.	Concentration	Classification	H-phrase M factor acute M factor chronic	Note
	215-279-6 - -			- -	
QUARTZ*	14808-60-7 238-878-4 - -	1 - 5%	STOT RE 1	H372 - -	-
Feldspar	68476-25-5 270-666-7 - -	1 - 5%	-	- - -	-
Bentonite	1302-78-9 215-108-5 - -	1 - 5%	-	- - -	-
SILICATE BINDER (POTASSIUM SILICATE)	1312-76-1 215-199-1 - -	1 - 5%	-	- - -	-
SILICATE BINDER (SODIUM SILICATE)	1344-09-8 215-687-4 - -	1 - 5%	-	- - -	-
FLUORIDES	7789-75-5 232-188-7 - -	1 - 5%	-	- - -	-
MANGANESE	7439-96-5 231-105-1 - -	2 - 4%	-	- - -	-
SILICON.	7440-21-3 231-130-8 - -	0 - 0.5%	-	- - -	-

SECTION 4: First aid measures

4.1. Description of first aid measures

Description of first aid measures

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). call emergency physician to the scene of the accident.

Inhalation

If breathing has stopped, perform artificial respiration and obtain medical assistance immediately! If breathing is difficult, provide fresh air and call physician.

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Issued: 2022-04-21



Arcaloy 310-16

Skin contact

For skin burns from arc radiation, promptly flush with cold water. Get medical attention for burns or irritations that persist. To remove dust or particles wash with mild soap and water

Eye contact

For radiation burns due to arc flash, see physician. To remove dusts or fumes flush with water for at least fifteen minutes. If irritation persists, obtain medical assistance.

4.2. Most important symptoms and effects, both acute and delayed

Most important symptoms and effects, both acute and delayed

Not applicable

4.3. Indication of any immediate medical attention and special treatment needed

Indication of any immediate medical attention and special treatment needed

Not applicable

SECTION 5: Firefighting measures

5.1. Extinguishing media

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.

5.2. Special hazards arising from the substance or mixture

Special hazards arising from the substance or mixture

Not applicable

5.3. Advice for firefighters

Special protective equipment for fire-fighters

Wear self-contained breathing apparatus as fumes or vapors may be harmful.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions, protective equipment and emergency procedures

Wear hand, head, eyes, ear and body protection like welders gloves, helmet or face shield with filter lens, safety boots, apron, arm and shoulder protection. Keep protective clothing clean and dry.

6.2. Environmental precautions

Environmental precautions

Refer to Section 13.

6.3. Methods and material for containment and cleaning up

Methods and material for containment and cleaning up

Solid objects may be picked up and placed into a container. Liquids or pastes should be scooped up and placed into a container. Wear proper protective equipment while handling these materials. Do not discard as refuse.

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Issued: 2022-04-21



Arcaloy 310-16

6.4. Reference to other sections

Reference to other sections Refer to Section 8 and Section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Preventive handling precautions Handle with care to avoid stings and cuts. Wear gloves when handling welding consumables. Avoid exposure to dust. Do not ingest. Some individuals can develop an allergic reaction to certain materials. Retain all warning and identity labels.

7.2. Conditions for safe storage, including any incompatibilities

Conditions for safe storage, including any incompatibilities Keep separate from chemical substances like acids and strong bases, which could cause chemical reactions.

7.3. Specific end use(s)

Specific end use(s) Arc Welding

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limits Use industrial hygiene monitoring equipment to ensure that exposure does not exceed applicable national exposure limits. The following limits can be used as guidance. Unless noted, all values are for 8 hour time weighted averages (TWA).

National occupational exposure limits

Ingredient	CAS No. EC No.	Exposure limit ppm / mg/m ³	Source	Remark	Year
IRON(REACH Registered) (English- Canada) / Fer(REACH Registered) (French- Canada)	7439-89-6 231-096-4	- -	ALBERTA REGULATION 87/2009	-	2020
CHROMIUM (English- Canada) / CHROME (French- Canada)	7440-47-3 231-157-5	- 0.05	ALBERTA REGULATION 87/2009	Water-soluble Cr VI Compounds/ Composés de Cr VI hydrosolubles	2020
Nickel powder** (English- Canada) / Poudre de Nickel** (French- Canada)	7440-02-0 231-111-4	- 0.1	ALBERTA REGULATION 87/2009	Soluble compounds / Composés solubles	2020
Limestone (English- Canada) / Calcaire (French- Canada)	1317-65-3 215-279-6	- 10	ALBERTA REGULATION 87/2009	-	2020
Feldspar (English- Canada) / Feldspath (French- Canada)	68476-25-5 270-666-7	- -	ALBERTA REGULATION 87/2009	-	2020
CHROMIUM (English- Canada) / CHROME (French- Canada)	7440-47-3 231-157-5	- 0.5	ALBERTA REGULATION 87/2009	Metal and Cr III Compounds/ Composés métalliques et Cr III	2020
Titanium oxide** (English- Canada) / Oxyde	13463-67-7	-	ALBERTA	-	2020

SAFETY DATA SHEET

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1907/2006, Commission Regulation (EU) 2020/878
amending CLP directive 1272/2008, also in
accordance with ISO 11014-1 and ANSI Z400.1

Issued: 2022-04-21



Arcaloy 310-16

Ingredient	CAS No. EC No.	Exposure limit ppm / mg/m ³	Source	Remark	Year
de titane** (French- Canada)	236-675-5	10	REGULATION 87/2009		
Nickel powder** (English- Canada) / Poudre de Nickel** (French- Canada)	7440-02-0 231-111-4	- 0.2	ALBERTA REGULATION 87/2009	Insoluble compounds / Composés insolubles	2020
QUARTZ* (English- Canada) / QUARTZ* (French- Canada)	14808-60-7 238-878-4	- 0.025	ALBERTA REGULATION 87/2009	-	2020
Bentonite (English- Canada) / bentonite (French- Canada)	1302-78-9 215-108-5	- -	ALBERTA REGULATION 87/2009	-	2020
Silicates (English- Canada) / Silicates (French- Canada)	1344-09-8 215-687-4	- -	ALBERTA REGULATION 87/2009	-	2020
MANGANESE (English- Canada) / Manganèse (French- Canada)	7439-96-5 231-105-1	- 0.2	ALBERTA REGULATION 87/2009	as Mn / comme Mn	2020
Silicates (English- Canada) / Silicates (French- Canada)	1312-76-1 215-199-1	- -	ALBERTA REGULATION 87/2009	-	2020
FLUORIDES (English- Canada) / Fluorures (French- Canada)	7789-75-5 232-188-7	- -	ALBERTA REGULATION 87/2009	-	2020
Silicon (English- Canada) / Silicium (French- Canada)	7440-21-3 231-130-8	- -	ALBERTA REGULATION 87/2009	-	2020

8.2. Exposure controls

Hand protection

Abrasion (Cycles):(Type A-2 (500));(Type B-1 (100)); Cut (Factor):(Type A-1 (1.2));(Type B-1 (1.2)); Tear (Newton):(Type A-2 (25));(Type B-1 (10)); Puncture (Newton):(Type A-2 (60));(Type B-1 (20)); Burning Behaviour:(Type A-3);(Type B-2); Contact Heat:(Type A-1);(Type B-1); Convective Heat:(Type A-2);(Type B--); Small Splashes:(Type A-3);(Type B-2); Dexterity:(Type A-1 (11));(Type B-4 (6.5)) Type B gloves are recommended when high dexterity is required as for TIG welding, while type A gloves are recommended for other welding processes. The contact temp (oC) is 100 and the threshold time (seconds) >15.

Other

Other

Avoid exposure to welding fumes, radiation, spatter, electric shock, heated materials and dust. Train welders to avoid contact with live electrical parts and insulate conductive parts.

Ventilation

Use respirator or air supplied respirator when welding or brazing in a confined space, or where local exhaust or ventilation is not sufficient to keep exposure values within safe limits. Use special care when welding painted or coated steels since hazardous substances from the coating may be emitted. Ensure sufficient ventilation, local exhaust, or both, to keep welding fumes and gases from breathing zone and general area.

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Issued: 2022-04-21



Arcaloy 310-16

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	Steel rod with extruded flux coating
Colour	Varying color
Odour	Not applicable
Odour threshold	Not applicable
Melting point / freezing point	Not applicable
Boiling point or initial boiling point and boiling range	No data available.
Flammability	Not applicable
Lower and upper explosion limit	No data available.
Flash point	Not applicable
Auto-ignition temperature	Not applicable
Decomposition temperature	No data available.
pH	Not applicable
Kinematic viscosity	No data available
Solubility	No data available.
Partition coefficient n-octanol/water	Not applicable
Vapour pressure	Not applicable
Density and/or relative density	No data available
Relative density	No data available.
Relative vapour density	Not applicable
Explosive properties	Not applicable
Oxidising properties	Not applicable

9.2. Other information

No data available

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Issued: 2022-04-21



Arcaloy 310-16

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity

Non Reactive unless gets in contact with chemical substances like acids or strong bases could cause generation of gas

10.2. Chemical stability

Chemical stability

This product is stable under normal conditions.

10.3. Possibility of hazardous reactions

No data available

10.4. Conditions to avoid

Conditions to avoid

This product is only intended for normal welding purposes.

10.5. Incompatible materials

No data available

10.6. Hazardous decomposition products

Hazardous decomposition products

When this product is used in a welding process, hazardous decomposition products would include those from the volatilization, reaction or oxidation of the materials listed in Section 3 and those from the base metal / Coated wire / Coated rod / Bare wire / Bare rod.

Other

Other

Refer to applicable national exposure limits for fume compounds, including those exposure limits for fume compounds found in Section 8.

A significant amount of the chromium in the fumes can be hexavalent chromium, which has a very low exposure limit in some countries. Manganese and nickel have low exposure limits, in some countries, that may be easily exceeded.

Reasonably expected gaseous products would include carbon oxides, nitrogen oxides and ozone. Air contaminants around the welding area can be affected by the welding process and influence the composition and quantity of fumes and gases produced.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Information on toxicological effects

Inhalation of welding fumes and gases can be dangerous to your health. Classification of welding fumes is difficult because of varying base materials, coatings, air contamination and processes. The International Agency for Research on Cancer has classified welding fumes as carcinogenic to humans (Group 1).

Acute toxicity

Overexposure to welding fumes may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes.

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Issued: 2022-04-21



Arcaloy 310-16

Skin corrosion/irritation No data available.

Serious eye damage/irritation No data available.

Respiratory or skin sensitisation No data available.

Germ cell mutagenicity No data available.

Genotoxicity No data available.

Carcinogenicity

Product / Substance name CAS / EC no.	Other
TITANIUM OXIDE** 13463-67-7 / 236-675-5	**This product contains substance(s) that may cause cancer, which is/are classified as Possibly carcinogenic to humans as per IARC. This product can expose you to Titanium dioxide which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov .
QUARTZ* 14808-60-7 / 238-878-4	*This product contains substance(s) that may cause cancer, which is/are classified as Carcinogenic to humans as per IARC.
NICKEL POWDER** 7440-02-0 / 231-111-4	**This product contains substance(s) that may cause cancer, which is/are classified as Possibly carcinogenic to humans as per IARC. This product can expose you to Nickel Powder which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov .

Repeated dose toxicity No data available.

Reproductive toxicity No data available.

STOT-single exposure No data available.

STOT-repeated exposure No data available.

Aspiration hazard No data available.

LD50 Oral No data available.

LD50 Dermal No data available.

LC50 Inhalation No data available.

11.2. Information on other hazards

No data available

Other

Long term effect

Chronic toxicity: Overexposure to welding fumes may affect pulmonary function. Prolonged inhalation of nickel and chromium compounds above safe exposure limits can cause cancer. Overexposure to manganese and manganese compounds above safe exposure limits can cause irreversible damage to the central nervous system, including the brain, symptoms of which may include slurred speech, lethargy, tremor, muscular weakness, psychological disturbances and spastic gait. Prolonged inhalation of titanium dioxide above safe exposure limits can cause cancer. Inhalable quartz is a respiratory carcinogen; however, the process of welding converts crystalline quartz to the amorphous form which is not considered to be a carcinogen.

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Issued: 2022-04-21



Arcaloy 310-16

SECTION 12: Ecological information

12.1. Toxicity

Acute toxicity No data available.

Toxicity No data available.

Aquatic No data available.

Soil No data available.

Acute fish toxicity No data available.

Acute algae toxicity No data available.

Acute crustacean toxicity No data available.

Chronical toxicity

Product / Substance name CAS / EC no.	Remark
NICKEL POWDER** 7440-02-0 / 231-111-4	This product contains Nickel powder which is classified as harmful to aquatic organisms by 1272/2008 CLP Directive and may cause long-term adverse effects in the aquatic environment.

12.2. Persistence and degradability

Persistence and degradability No data available.

Decay/transformation No data available.

12.3. Bioaccumulative potential

Bioaccumulative potential No data available.

12.4. Mobility in soil

Mobility No data available.

12.5. Results of PBT and vPvB assessment

**Results of PBT and vPvB
assessment** No data available.

12.6. Endocrine disrupting properties

No data available

12.7. Other adverse effects

Other adverse effects No data available.

Other

Other Welding consumables and materials could degrade/weather into components originating from the consumables or from the materials used in the welding process. Avoid exposure to conditions that could lead to accumulation in soils or groundwater.

SAFETY DATA SHEET

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830/2015 amending EC No.
1907/2006, Commission Regulation (EU) 2020/878
amending CLP directive 1272/2008, also in
accordance with ISO 11014-1 and ANSI Z400.1

Issued: 2022-04-21



Arcaloy 310-16

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal considerations

Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal and local regulations. Use recycling procedures if available.

USA RCRA: Unused product or product residues containing chromium is considered hazardous waste if discarded, RCRA ID Characteristic Toxic Hazardous Waste D007.

(<https://rcrapublic.epa.gov/rcrainfoweb/action/main-menu/view>)

Residues from welding consumables and processes could degrade and accumulate in soils and groundwater.

SECTION 14: Transport information

14.1. UN number

Not applicable

14.2. UN proper shipping name

Not applicable

14.3. Transport hazard class(es)

Not applicable

14.4. Packing group

Not applicable

14.5. Environmental hazards

Not applicable

14.6. Special precautions for user

Not applicable

14.7. Maritime transport in bulk according to IMO instruments

Not applicable

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Issued: 2022-04-21

Arcaloy 310-16

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. of 19 November 2008. on waste and repealing certain Directives.

European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste.

SAFETY DATA SHEET

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Issued: 2022-04-21



Arcaloy 310-16

Other regulations, limitations and legal regulations

Poland Regulations:

ACT of 25 February 2011 on the chemical substances and their mixtures (OJ # 63, poz. 322).

Regulation of the Minister of Family, Labour and Social Policy of 12th June 2018 on the Maximum Admissible Concentrations and Intensities of Harmful to Health Agents in the Working Environment (Dz. U. No 1286)

The Act on Waste of 14 December 2012, Journal of Laws of 2013, item 21 with amendments

Act of 13th June 2013 on packaging management and packaging waste (Journal of Laws of 2013, item 888).

Regulation of the Minister of the Environment of 9 December 2014 on waste catalogue (Journal of Laws of 2014, item 1923).

Regulation of the Minister of Economy of 21 December 2005. Concerning essential requirements for personal protective equipment (Journal. Laws No. 259, item. 2173).

Regulation of the Minister of Health of 2 February 2011 on tests and measurements of factors harmful to health in the working environment (the Journal of Laws 2011, no. 33, item 166).

USA Regulations :

USA: This product contains or produces a chemical known to the state of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code § 25249.5 et seq.)

CERCLA/SARA Title III Reportable Quantities (RQs) and/or Threshold Planning Quantities (TPQs):
Product is a solid solution in the form of a solid article. Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center and to your Local Emergency Planning Committee.

EPCRA/SARA Title III 313 Toxic Chemicals: The following metallic components are listed as SARA 313 "Toxic Chemicals" and potential subject to annual SARA 313 reporting. See Section 3 for weight percent.
Manganese: 1.0% de minimis concentration
Chromium: 1.0% de minimis concentration
Nickel Powder: 0.1% de minimis concentration

International Inventories:

Australia: The substance(s) in this product is/are in compliance with the inventory requirements of Australia- Inventory of Industrial Chemicals (AIIC)

United States EPA Toxic Substance Control Act: All constituents of this product are on the TSCA inventory list under active substances

Canadian Environmental Protection Act (CEPA): All constituent(s) of this product is/are on the Domestic Substance List (DSL).

15.2. Chemical safety assessment

Chemical safety assessment

Not Available

SAFETY DATA SHEET

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1907/2006, Commission Regulation (EU) 2020/878
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Issued: 2022-04-21



Arcaloy 310-16

Other

Other

Read and understand the manufacturer's instructions, your employer's safety practices and the health and safety instructions on the label. Observe any federal and local regulations. Take precautions when welding and protect yourself and others.

WARNING: Welding fumes and gases are hazardous to your health and may damage lungs and other organs. Use adequate ventilation. ELECTRIC SHOCK can kill. ARC RAYS and SPARKS can injure eyes and burn skin.

Wear correct hand, head, eye and body protection

SECTION 16: Other information

Changes to previous revision

This Safety Data Sheet has been revised due to modifications to Sections 1-16. Latest Revision of SDS as per Regulation and exposure limits – October 2021.

References to key literature and data sources

Refer to ESAB "Welding & Cutting - Risks and Measures", F52-529 "Precautions and Safe Practices for ARC WELDING, CUTTING & GOUGING" and F2035 "Precautions and Safe Practices for Gas Welding, Cutting and Heating" available from ESAB Website. www.esab.com

USA: Contact ESAB at www.esabna.com or 1-800 ESAB-123 if you have any questions about this SDS.

American National Standard Z49.1 "Safety in Welding and Cutting", ANSI/AWS F1.5 "Methods for Sampling and Analyzing Gases from Welding and Allied Processes", ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes", AWSF3.2M/F3.2 "Ventilation Guide for Weld Fume", American Welding Society, 550 North Le Jeune Road, Miami Florida 33135. Safety and Health Fact Sheets available from AWS at www.aws.org.

OSHA Publication 2206 (29 C.F.R. 1910), U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954

American Conference of Governmental Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices, 6500 Glenway Ave., Cincinnati, Ohio 45211, USA.

NFPA 51B "Standard for Fire Prevention During Welding, Cutting, and Other Hot Work" published by the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169.

UK: WMA Publication 236 and 237, "Hazards from Welding Fume", "The arc welder at work, some general aspects of health and safety".

Germany: Accident prevention regulation BGV D1, "Welding, cutting and related procedures".

Canada: CSA Standard CAN/CSA-W117.2-01 "Safety in Welding, Cutting, and Allied Processes". This product has been classified according to the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

Phrase meaning

STOT RE 1 - Specific Target Organ Toxicity — Repeated exposure, hazard category 1
Skin Sens. 1 - Skin sensitisation, hazard category 1
Carc. 2 - Carcinogenicity, hazard category 2
Aquatic Chronic 3 - Hazardous to the aquatic environment — Chronic hazard category 3
H317 May cause an allergic skin reaction.
H351 Suspected of causing cancer.
H372 Causes damage to organs through prolonged or repeated exposure .
H412 Harmful to aquatic life with long lasting effects.

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Arcaloy 310-16

Other

Additional information

ESAB requests the users of this product to study this Safety Data Sheet (SDS) and become aware of product hazards and safety information. To promote safe use of this product a user should:

- notify its employees, agents and contractors of the information on this SDS and any product hazards/safety information.

- furnish this same information to each of its customers for this product.

- request such customers to notify employees and customers for the same product hazards and safety information.

The information herein is given in good faith and based on technical data that ESAB believes to be reliable. Since the conditions of use is outside our control, we assume no liability in connection with any use of this information and no warranty, expressed or implied is given.

Contact ESAB for more information.



SAFETY DATA SHEET (SDS)

For Welding Consumables and Related Products
Conforms to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS),
OSHA Hazard Communication Standard 29CFR 1910.1200
Standard Must Be Consulted for Specific Requirements

Low Alloy Steel SOLID WIRE AND RODS
REVISED 5-2018
SDS Number : 004-LAS

SECTION I – IDENTIFICATION of Product and Company

Manufacturer/Supplier: Washington Alloy Company	Recommended use: Arc and Gas Welding	Restriction on use: Not Known	Telephone No: 704-598-1325
Address: 7010-G Reames Rd , Charlotte, NC 28216			Emergency No: 704-598-1325
Trade Name of Carbon Steel : 70S-A1, 70S-B2L(80S-B2L), 80S-B2, 80S-B3L(90S-B3L), 80S-B6, 80S-B8, 80S-D2, 80S-G, 80S-Ni1, 80S-Ni2, 90S-B3, 90S-B9, 100S-1, 110S-1, 120S-1			Specification: AWS A5.28 Low Alloy Steel Wire
4130, 4140, 4340, 6150, 8620			AISI
4130VM, 4140VM, 43340VM, 6130VM			AMS
140S-1, 919(4340), 921(P20), 925(WH-1), 935(OH-1), 937(AH-2), 938(D-2), 940, 943(S-7), 954(HW), 958(H-12), 959(H-12), 966(M-2), 9770(M-250), 80S-W			NONE

SECTION II – COMPOSITION / INFORMATION ON INGREDIENTS

GHS Hazard Classification: Not Classified / **Label Elements** - Hazard symbol and Signal word = No symbol or signal word

Hazard statement and Precautionary statement = Not applicable

Other Hazards which do not result in GHS classification and Overview: Electric shock can kill. Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. Welding arc and sparks can ignite combustibles or flammable materials. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground. Arc Rays can injure eyes and burn skin. Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. See Section XIII.

As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non-hazardous and may be copper coated.

Substance: Welding fumes and gases cannot be classified simply. The composition and quantity of these fumes and gases are dependent upon the metal being welded, the procedures followed and the electrodes used. Fumes may affect eyes, skin, respiratory system as well as pancreas and liver.

Workers should be aware that the composition and quantity of fumes and gases to which they may be exposed, are influenced by: coatings which may be present on the metal being welded (such as paint, plating, or galvanizing), the number of welders in operation and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing procedure). When the electrode is consumed, the fumes and gas decomposition products generated are different in percent and form from the ingredients listed in Section III. The composition of these fumes and gases are the concerning matter and not the composition of the electrode itself. Decomposition products include those originating from the volatilization, reaction, or oxidation of the ingredients shown in Section III, plus those from the base metal, coating and the other factors noted above.

Reasonable expected fume constituents of this product would include: Complex oxides or compounds of iron, manganese, silicon, copper, aluminum, titanium, and zirconium. (Other complex oxides may be present when using fluxes).

Chemical Identity	CAS No.	EINECS#
Carbon dioxide	124-38-9	204-696-9
Carbon monoxide	630-8-0	211-128-3
Nitrogen dioxide	10102-44-0	-
Ozone	10028-15-6	233-069-2
Manganese (Mn)	7439-96-5	231-105-1
Nickel (Ni)	7440-02-0	231-111-4

SECTION III – COMPOSITION / INFORMATION ON INGREDIENTS

*The term "HAZARDOUS MATERIALS" should be interpreted as a term required and defined in OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200 however the use of this term does not necessarily imply the existence of any hazard.

Chemical Identity Ingredients	CAS No.	EINECS#	Chemical Identity Ingredients	CAS No.	EINECS#
Iron (Fe) (limits as oxide fume)	7439-89-6	231-096-4	Molybdenum (Mn)	7439-98-7	231-107-2
Manganese (Mn) (limits as fume)	7439-96-5	231-105-1	Nickel (Ni)	7440-02-0	231-111-4
Silicon (Si)	7440-21-3	231-130-8	Copper (Cu)	7440-50-8	231-159-6
Carbon	7440-44-0	231-153-3	Chromium (Cr)	7440-47-3	231-157-5
Tungsten	7440-33-7	231-143-9	Vanadium (V) Respirable dust	7440-62-2	231-171-1

SAFETY DATA SHEET (SDS)

Low Alloy Steel SOLID WIRE AND RODS
REVISED 5-2018
SDS Number : 004-LAS

Chemical Composition Percent by Weight

Name	C	Mn	Si	P	S	Ni	Cr	Mo	W
70S-A1	0.12	1.30	0.30-0.70	0.025	0.025	0.20			
70S-B2L ⁽¹⁾	0.05	0.40-0.70	0.40-0.70	0.025	0.025	0.20	1.20-1.50	0.40-0.65	
80S-B2 ⁽¹⁾	0.07-0.12	0.40-0.70	0.40-0.70	0.025	0.025	0.20	1.20-1.50	0.40-0.65	
80SB3L ⁽¹⁾	0.05	0.40-0.70	0.40-0.70	0.025	0.025	0.20	2.30-2.70	0.90-1.20	
80S-B6 ^{(1) (6)}	0.10	0.40-0.70	0.50	0.025	0.025	0.60	4.50-6.00	0.45-0.65	
80S-B8 ^{(1) (6)}	0.10	0.40-0.70	0.50	0.025	0.025	0.50	8.00-10.50	0.80-1.20	
80S-D2 ⁽²⁾	0.07-0.12	1.60-2.10	0.50-0.80	0.025	0.025	0.15		0.40-0.60	
80S-G ⁽²⁾	0.12	2.50	0.80	0.025	0.025	0.50	2.50	1.25	
80S-Ni1 ^{(1) (v)}	0.12	1.25	0.40-0.80	0.025	0.025	0.80-1.10	0.15	0.35	
80S-Ni2 ⁽¹⁾	0.12	1.25	0.40-0.80	0.025	0.025	2.00-2.75			
80S-W	0.12	2.50	0.20-0.60	0.035	0.035	0.50-2.80	0.30	1.40	
90S-B3	0.07-0.12	0.40-0.70	0.40-0.70	0.025	0.025	0.20	2.30-2.70	0.90-1.20	
90S-B9 ⁽³⁾	0.07-0.13	1.20	0.15-0.50	0.010	0.010	0.80	8.00-10.50	0.85-1.20	
100S-1 ^{(v) (4)}	0.08	1.25-1.80	0.20-0.55	0.010	0.010	1.40-2.10	0.30	0.25-0.55	
110S-1 ^{(v) (4)}	0.09	1.40-1.80	0.20-0.55	0.010	0.010	1.90-2.60	0.50	0.25-0.55	
120S-1 ^{(v) (4)}	0.10	1.40-1.80	0.25-0.60	0.010	0.010	2.00-2.80	0.60	0.30-0.65	
140S-1 ^{(v) (4)}	0.15	2.50	0.80	0.010	0.010	3.50	2.50	1.25	
4130, 4130VM	0.28-0.33	0.40-0.60	0.15-0.35	0.035	0.040	0.25	0.80-1.10	0.15-0.25	
4140, 4140VM	0.38-0.43	0.75-1.00	0.15-0.35	0.035	0.040		0.80-1.10	0.15-0.25	
4340, 4340VM	0.38-0.43	0.60-0.80	0.15-0.30	0.035	0.040	1.65-2.00	0.70-0.90	0.20-0.30	
6130VM	0.28-0.33	0.60-0.90	0.15-0.35	0.008	0.008	0.25	0.80-1.10	0.06	
6150	0.48-0.53	0.70-0.90	0.15-0.35	0.035	0.040		0.80-1.10		
8620	0.18-0.23	0.70-0.90	0.15-0.35	0.035	0.040	0.40-0.70	0.40-0.60	0.15-0.25	
9xx, 9xxx	1.6	1.5	1.8	V = 0.10-2.5		0.20- 2.0	0.20-6.00	0.15-10.0	7.50

⁽¹⁾Cu < 0.35⁽²⁾ Cu < 0.50⁽⁶⁾ Similar to former class ER502⁽⁶⁾ Similar to former class ER505^(v) V < 0.05⁽⁴⁾ Ti, Zr, Al < 0.10 for each element,

⁽³⁾ V = 0.15-0.30, Niobium (Columbium) 0.02-0.10, N 0.03-0.07, Balance is Iron, Cu < 0.25 on copper coated rods

Other elements or ingredients may be present but in quantities much less than 1%.⁽¹⁾ Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit

SECTION IV – FIRST AID MEASURES

Contact with skin, eyes, ingestion or injection should not be a source for exposure with proper protection.

Ingestion: Avoid contact with metal fume or powers which may lead to ingestion

Inhalation: If breathing has stop or difficult move to fresh air and as needed perform artificial respiration. Call medical assistance or physician.

Skin Contact: Remove any contaminated clothing, gloves or other personnel equipment and promptly wash/flush with mild soap and water. For reddish or blistered skin from thermal/arc radiation promptly wash/flush with water. Get medical assistance or physician help as needed.

Eye Contact: Arc radiation can injure eyes and also cause an arc flash – if this occurs, move to dark room removing lenses as required and get rest and cover eyes with non-stick dressings (padded dressing) Removal of dust and fumes requires flushing with abundant amounts of clean water for at least 15 minutes. Get medical assistance or physician help as needed or if issues persist.

Most important symptoms/effects, acute and delayed:

Symptoms: Short-term(acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted.

Hazards: Welding fumes and gases cannot be classified simply. Refer to Section II under Substance

SECTION V – FIRE-FIGHTING MEASURES

As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous and may be copper coated. Welding arcs and sparks can ignite combustibles or flammable materials Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. Read and understand: American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Also National Fire Protection Association NFPA 51B, *Standard for Fire Prevention During Welding, Cutting and other Hot Work*

Suitable (and unsuitable) extinguishing media: As shipped these items will not burn however in the event use media recommended for the burning materials and fire situation and surroundings. No unsuitable media known at this time.

Specific hazards arising from the chemicals: Welding arcs and sparks can ignite combustibles or flammable materials

Specific protective equipment and precautions for firefighters: Wear self-contained breathing apparatus and full protective clothing in case of fire or when fumes and vapors are present. Follow general fire-fighting precautions as in the workplace.

SAFETY DATA SHEET (SDS)

Low Alloy Steel SOLID WIRE AND RODS
REVISED 5-2018
SDS Number : 004-LAS

SECTION VI – ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures: With airborne dust and fumes be sure to use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII.

Environment precautions: Control work practices to eliminate environmental release. These products are solid metal rods, with no spill or leak hazards as shipped. If product becomes molten dam up with sand type media until it cools back to a solid and reuse/recycle as scrap.

Methods and Materials for containment and cleaning up: Solid rods can be picked up and placed back in the original container. Clean up immediately while following all safety guidelines as well as using all personal protection safety listed in section VIII. Avoid generating dust and prevent materials from entering and drains, sewers or water sources. Disposal considerations found in Section XIII.

When fumes and vapors are present. Follow general fire-fighting precautions as in the workplace.

SECTION VII – HANDLING AND STORAGE

Precautions for safe handling: Handle with care wearing gloves and keep formation of airborne dust and fumes to a minimum. If needed use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII. Also read American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Do not eat or drink while using these products and ensure proper ventilation is used. Wash hands after use.

Conditions for safe storage, including any incompatibilities: All employees who handle these products should be trained to handle it safely. Open packages of these products/containers on a safe stable surface and must be properly labeled at all times. Store products in original closed packages, cool dry place, while avoiding extreme temperatures or incompatible items such as acids, oxidizers and halogens. Always follow all regulations in accordance with local/regional/state/national guidelines.

SECTION VIII – EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Flux or other ingredients	CAS No.	EINECS#	Exposure Limit (mg/m ³)		
			OSHA PEL	ACGIH TLV	NIOSH REL
Iron (Fe) (limits as oxide fume)	7439-89-6	231-096-4	10	5 (Resp)	5.0
Carbon (C)	7440-44-0	231-153-3	10 (TOTAL) 2 (Resp)	15 (TOTAL)5 (Resp)	-
Manganese (Mn) (limits as fume) ⁽¹⁾	7439-96-5	231-105-1	1 , 3.0** , 5*	0.02 (Resp) 0.1***	1.0
Silicon (Si)	7440-21-3	231-130-8	15 (dust) 5 (Resp)	WITHDRAWN	5 (Resp) 10 (TOTAL)
Copper (Cu) ⁽¹⁾	7440-50-8	231-159-6	1 (dust) 0.1(fume)	1 (dust) 0.2 (fume)	
Chromium (Cr) ^{(C) (1)}	7440-47-3	231-157-5	1 (metal) 0.5 (Cr III) 0.005 (Cr VI)	0.5 (metal) 0.5 (Cr III) 0.05 (Cr VI)	0.5 (metal)
Nickel (Ni) ⁽¹⁾	7440-02-0	231-111-4	1	1.5 (inhalable fraction)	0.015
Tungsten (W)	7440-33-7	231-143-9	5.0 ,10.0**	5.0 ,10.0**	5.0
Vanadium (V) Respirable dust ⁽¹⁾	7440-62-2	231-171-1	0.05 as V ₂ O ₅	0.5 * as V ₂ O ₅	1.0
Molybdenum(Mo)	7439-98-7	231-107-2	15(dust), 5 (SC)	10***, 3(Resp) , 0.5 (SC)	15

Other elements or ingredients may be present but in quantities much less than 1%.⁽¹⁾ Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit ***Inhalable fraction (SC) = Soluble compounds

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits used a guideline in control for health hazards but not an indication of safe and dangerous exposure limits **TLV - Threshold Limit Value** - an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers, may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour & **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **OSHA** - U.S. Occupational Safety and Health Administration. **PEL - Permissible Exposure Limit** - this exposure value means the same as a TLV, except that it is limits guideline by OSHA.

Eye Protection: Wear a helmet or face shield with a filter lens shade number 12-14 or darker for arc welding. Shield other workers by providing screens and flash goggles. Use face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting").

Protective Clothing: Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground.

Ventilation: Use plenty of ventilation and/or local exhaust at the arc, to keep the fumes and gases below the threshold limit value within the worker's breathing zone and the general work area. Welders should be advised to keep their head out of the fumes.

Respiratory Protection: Use respirable fume respirator or air supplied respirator when welding in a confined space or general work area where local exhaust and/or ventilation does not keep exposure below the threshold limit value.

HYGIENE/ WORK PRACTICES: With all chemicals/materials, avoid getting these products ON YOU or IN YOU. Wash hands after handling these products. Do not eat or drink while handling these products. Use ventilation and other engineering controls to minimize potential exposure to these products.

SAFETY DATA SHEET (SDS)

Low Alloy Steel SOLID WIRE AND RODS
REVISED 5-2018
SDS Number : 004-LAS

SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

Appearance / Color / Odor / Physical state / Form: Gray or copper coated round solid welding rods or wire that are odorless
Odor Threshold / pH / Flash Point / Evaporation Rate / Flammability (Solid, Gas) / Upper & Lower Flammability or Explosive Limits: No data available
Vapor Pressure & Density / Relative Density / Solubility(water/other) / Partition coefficient (n-octanol/water) / Auto-ignition Decomposition temperature : No data available

SECTION X – STABILITY and REACTIVITY

Chemical stability: These products are considered stable as shipped and under normal conditions
Possibility of hazard reactions: No data and will not occur
Conditions to avoid: Avoid exposure to extreme temperatures, Incompatible materials
Incompatible materials: Incompatible items such as acids, oxidizers and halogens Strong acids, strong oxidizers, mineral acids, and halogens.
Hazardous decomposition products: Read Substance in Section II. Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). The best method to determine the actual composition of generated fumes and gases is to take an air sample from inside the welder's helmet if worn or in breathing zone. For additional information, refer to the American Welding Society Publication, "Fumes and Gases in the Welding Environment".

SECTION XI- TOXICOLOGICAL INFORMATION

Oral/Dermal/inhalation Iron: (Human-child); TDLo: 77 mg/kg. Oral (rat); LD50:30 gm/kg. Intraperitoneal (rabbit); LDLo: 20 mg/kg. Oral (guinea pig); LD50:20 gm/kg. Oral (rat); TDLo: 63 gm/kg/6W-C. Inhalation (rat); 250 mg/m³/6H/4W-I. Intratracheal (rat); TDLo:450 mg/kg/15W-I. **Silicon:** Acute oral toxicity (LD50): 3160 mg/kg [Rat]. **Chromium** (IV) Acute oral toxicity LD 50 (Rat): 27-59 mg/kg Inhalation (Rat 4h): 33-70 mg/m³. **Manganese:** Acute oral toxicity (LD50): 9000 mg/kg [Rat]. **Skin corrosion or irritation / Serious eye damage or irritation / Respiratory or skin sensitization / Germ cell mutagenicity / Reproductive toxicity / Specific target organ toxicity – single exposure / Specific target organ toxicity – repeated exposure:** Not classified
Carcinogenicity: Arc Rays can injure eyes and burn skin. Skin cancer has been reported. **Information on the likely routes of exposures:** Ingestion is not a likely route of exposure for this product or expected under normal use. If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing. **Inhalation** of welding fumes and gases can be dangerous to your health. **Skin/Eye Contact:** Arc Rays can injure eyes and burn skin. Skin cancer has been reported. International Agency for Research on Cancer **IARC-** has classified welding fumes & Nickel as a possible carcinogenic to humans (Group 2B). **Chromium** (IV) evaluation as carcinogenic to humans (Group1). **Chromium oxides** evaluation, not classified as to carcinogenicity to humans (Group 3). **National Toxicology Program (NTP)** list Nickel with Reasonably Anticipated to be a Human Carcinogen; **Chromium** (IV) known to be human carcinogen. **OSHA Specifically Regulated Substances Chromium** (IV) Cancer **Symptoms related to physical, chemical and toxicological characteristics:** **Inhalation:** **Chromium** (IV) and compounds pose a cancer risk to humans, liver damage, allergic and skin rash have been reported. Nickel and compounds pose a respiratory cancer risk, and may give skin itch to dermatitis. Short-term (acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. **Delayed and immediate effects and also chronic effects from short and long term exposure:** There are no immediate health hazards associated with the wire or rod form of this product. Skin, respiratory, pancreas, and liver disorders may be aggravated by prolonged over-exposures to the dusts or fumes generated by these products. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. Treat symptoms and eliminate overexposure. **Other information during use:** **Inhalation acute toxicity:** Carbon dioxide LC Lo (Human, 5 min): 90000 ppm, Carbon monoxide LC 50 (Rat, 4 h): 1,300 mg/l, Nitrogen dioxide LC 50 (Rat, 4 h): 88 ppm, Ozone LC Lo (Human, 30 min): 50 ppm, Chromium (IV) LC 50 (Rat, 4 h): 33-70 mg/m³

SECTION XII- TOXICOLOGICAL INFORMATION

Ecotoxicity / Persistence and Degradability / Bioaccumulative Potential / Mobility in Soil:
Acute; Fish /Aquatic Invertebrates = Iron= LC50 Channel catfish (Ictalurus punctatus) > 500 mg/l, 96 hours; **Nickel** LC50 Fathead minnows (Pimephales promelas) 2.916 mg/l, 96 hours, **EC50 Water flea** (Daphnia obtusa) 1 mg/l, 48 hours; **Molybdenum** LC50 Rainbow trout, Donaldson trout (Oncorhynchus mykiss) 800 mg/l, 96 hours, **Manganese = EC 50 (Water flea)** (Daphnia magna), 48 h): 40 mg/l; **Persistence and Degradability / Mobility in Soil:** No data **Bioaccumulative Potential Accumulation/The** product contains potentially bioaccumulating substances.
Other Adverse Effects: Possibly harmful to aquatic life. Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

SECTION XIII- DISPOSAL CONSIDERATIONS

Disposal Methods: Avoid or minimize generating waste. When possible collect scrap and by-products with proper id for recycling. Waste disposal must be in accordance with appropriate Federal, National, Provincial, State, and local regulations. These products, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

SECTION XIV- TRANSPORT INFORMATION


UN Number / UN Proper shipping name / Transport Hazard class (es)/ Packing group / Marine pollutant / Special Precautions: Not Regulated as Dangerous Good or Not Regulated, No international regulations

SECTION XV- REGULATORY INFORMATION

United States: TSCA INVENTORY STATUS: The components of these products are listed on the TSCA Inventory

CERCLA REPORTABLE QUANTITY (RQ): Copper = 5000 lbs. (for particulates less than 100 micrometers in size). Nickel = 100 lbs. Chromium and Chromium compounds or alloys 5000 lbs. Manganese = Reportable quantity: Included in the regulation but with no data values. See regulation (40 CFR 302.4). **EPCRA/SARA Title III 313 Toxic Chemicals** The following metallic components are listed as SARA 313 "Toxic Chemicals" and potential subject to annual SARA 313 reporting. See Section 3 for weight percent. Ingredient & Disclosure threshold: Copper 1.0% de minimis concentration; Manganese 1.0% de minimis concentration

Section 311 Hazard Class: As shipped: Immediate (Acute) In use: Immediate & delayed (Acute)

California Proposition 65:  **WARNING:** This product may expose you to chemicals including [Cobalt (II) Oxide, Titanium dioxide (airborne, unbound particles of respirable size), Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Carbon Black, Cadmium, Beryllium and Beryllium Compounds] which are known to the State of California to cause cancer, and [Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Cadmium] which are known to the State of California to cause birth defects and/or other reproductive harm. For more information go to <https://www.p65warnings.ca.gov/>

US State Regulations list:

Alaska-Designated Toxic and Hazardous Substances: Carbon Black, Manganese.

California-Hazardous Substances Listed substance: Carbon Black, Chromium, Copper, Manganese, Molybdenum, Silicon, Iron, Iron oxide, Nickel,

California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance: Hexavalent chromium compounds, Nickel - **CRT:**

Listed date/Carcinogenic substance: Hexavalent chromium compounds (2-27-1987), Nickel (10-1-1989) - **CRT: Listed date/Developmental toxin &**

Listed date/Male or Female reproductive toxin: Hexavalent chromium compounds (12-19-2008)

Florida-Substance List: Manganese

Illinois-Toxic Substance List: Carbon Black, Copper, Manganese and Silicon.

Kansas-Section 302/313 List: Copper, and Manganese.

Massachusetts-Substance List: Carbon Black, Chromium, Copper, Manganese, Molybdenum, Nickel, Silicon

Michigan - Critical Materials Register: Copper.

Minnesota-List of Hazardous Substances: Welding Fumes, Carbon Black, Manganese, and Silicon.

Missouri-Employer Information/Toxic Substance List: Carbon Black, Copper, Manganese, Molybdenum, Silicon,

New Jersey-Right to Know Hazardous Substance List: Carbon Black, Chromium, Hexavalent chromium compounds, Copper, Iron, Iron oxide, Manganese, Molybdenum, Nickel, Silicon,

North Dakota-List of Hazardous Chemicals, Reportable Quantities: Copper.

Pennsylvania-Hazardous Substance List: Carbon Black, Copper, Hexavalent chromium compounds, Chromium, Manganese, Molybdenum, Nickel, Silicon,

Rhode Island-Hazardous Substance List: Welding Fumes, Carbon Black, Manganese, Nickel, Silicon,

Texas-Hazardous Substance List: Carbon Black, Manganese

West Virginia-Hazardous Substance List: Carbon Black, Manganese.

Wisconsin-Toxic and Hazardous Substances: Carbon Black, Manganese.

SECTION XVI- OTHER INFORMATION

Approval Date: 5-29-2018 NEW SDS Number : 004-LAS

HMIS® ratings Health: 2 Flammability: 0 Physical hazard: 0

NFPA CODES : FIRE: 0 HEALTH: 2 REACTIVITY: 0



U.S. DOT = Material is not hazardous and is not considered as a dangerous item.

Washington Alloy Co. Believes that the information contained in this (SDS) Safety Data Sheet is accurate. However,

Washington Alloy Co. does not express or implies any warranty with respect to this information.

Download the most current SDS and product information @ www.weldingwire.com

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Silicon Bronze

Product Size: 3/32" (2.4 mm)

Other means of identification

SDS number: 200000006817

Recommended use and restriction on use

Recommended use: GTAW (Gas Tungsten Arc Welding)

Restrictions on use: Not known. Read this SDS before using this product.

Manufacturer/Importer/Supplier/Distributor Information

Company Name: The Harris Products Group

Address: 4501 Quality Place
Mason, OH 45040-1971
USA

Telephone: +1 (513) 754-2000

Contact Person: Safety Data Sheet Questions: custservmason@jwharris.com

Company Name: The Lincoln Electric Company of Canada LP

Address: 179 Wicksteed Avenue
Toronto, Ontario M4G 2B9
Canada

Telephone: +1 (416) 421-2600

Contact Person: Safety Data Sheet Questions: www.lincolnelectric.com/sds
Arc Welding Safety Information: www.lincolnelectric.com/safety

Emergency telephone number:

USA/Canada/Mexico +1 (888) 609-1762

Americas/Europe +1 (216) 383-8962

Asia Pacific +1 (216) 383-8966

Middle East/Africa +1 (216) 383-8969

3E Company Access Code: 333988

2. HAZARDS IDENTIFICATION

Hazard Classification

Not classified as hazardous according to applicable GHS hazard classification criteria.

Label Elements

Hazard Symbol: No symbol

Signal Word: No signal word.

Hazard Statement: Not applicable

Precautionary Statements: Not applicable

Other hazards which do not result in GHS classification: None.

Substance(s) formed under the conditions of use:

The welding fume produced from this welding electrode may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below.

Chemical Identity	CAS-No.
Carbon dioxide	124-38-9
Carbon monoxide	630-08-0
Nitrogen dioxide	10102-44-0
Ozone	10028-15-6
Manganese	7439-96-5
Copper and/or copper alloys and compounds (as Cu)	7440-50-8

3. COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Ingredients Mixtures

Chemical Identity	CAS number	Content in percent (%)*
Copper and/or copper alloys and compounds (as Cu)	7440-50-8	50 - <100%
Aluminum and/or aluminum alloys (as Al)	7429-90-5	5 - <10%
Tin	7440-31-5	5 - <10%
Silicon	7440-21-3	1 - <5%
Manganese	7439-96-5	1 - <5%
Iron	7439-89-6	1 - <5%
Phosphorus	7723-14-0	0.1 - <1%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Composition Comments:

The term "Hazardous Ingredients" should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding hazard. The product may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 and 8 for more information.

4. FIRST AID MEASURES

Ingestion:

Avoid hand, clothing, food, and drink contact with fluxes, metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. Unless the poison control center advises otherwise, wash out mouth thoroughly with water. If symptoms develop, seek medical attention at once.

Inhalation:

Move to fresh air if breathing is difficult. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

Skin Contact:

Remove contaminated clothing and wash the skin thoroughly with soap and water. For reddened or blistered skin, or thermal burns, obtain medical assistance at once.

Eye contact:

Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until transported to an emergency

medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

Most important symptoms/effects, acute and delayed

Symptoms:

Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Refer to Section 11 for more information.

Hazards:

The hazards associated with welding and its allied processes such as soldering and brazing are complex and may include physical and health hazards such as but not limited to electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to fumes, gases or dusts potentially generated during the use of this product. Refer to Section 11 for more information.

Indication of immediate medical attention and special treatment needed

Treatment:

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

General Fire Hazards:

As shipped, this product is nonflammable. However, welding arc and sparks as well as open flames and hot surfaces associated with brazing and soldering can ignite combustible and flammable materials. Read and understand American National Standard Z49.1, "Safety in Welding, Cutting and Allied Processes" and National Fire Protection Association NFPA 51B, "Standard for Fire Prevention during Welding, Cutting and Other Hot Work" before using this product.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:

As shipped, the product will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

Unsuitable extinguishing media:

Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical:

Welding arc and sparks can ignite combustibles and flammable products.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:

Use standard firefighting procedures and consider the hazards of other involved materials.

Special protective equipment for fire-fighters:

Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures:

If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

Methods and material for containment and cleaning up:

Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk. Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal.

Environmental Precautions:

Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages.

7. HANDLING AND STORAGE

Precautions for safe handling:

Prevent formation of dust. Provide appropriate exhaust ventilation at places where dust is formed.

Read and understand the manufacturer's instruction and the precautionary label on the product. Refer to Lincoln Safety Publications at www.lincolnelectric.com/safety. See American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, www.gpo.gov.

Conditions for safe storage, including any incompatibilities:

Store in closed original container in a dry place. Store in accordance with local/regional/national regulations. Store away from incompatible materials.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control Parameters
Occupational Exposure Limits: US

Chemical Identity	Type	Exposure Limit Values	Source
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
	REL	0.1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2016)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2016)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	PEL	0.1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Copper and/or copper alloys and compounds (as Cu)	IDLH	100 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Aluminum and/or aluminum alloys (as Al) - Respirable fraction.	TWA	1 mg/m3	US. ACGIH Threshold Limit Values, as amended (12 2010)
Aluminum and/or aluminum alloys (as Al) - Total dust. - as Al	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Aluminum and/or aluminum alloys (as Al) - Welding fume	REL	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)

or pyrophoric powder. - as Al			
Aluminum and/or aluminum alloys (as Al) - Respirable.	REL	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Aluminum and/or aluminum alloys (as Al) - Total	REL	10 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Aluminum and/or aluminum alloys (as Al) - Respirable fraction. - as Al	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (03 2016)
Tin - as Sn	PEL	2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Tin	IDLH	100 mg/m3	US. NIOSH: Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Tin - Inhalable fraction.	TWA	2 mg/m3	US. ACGIH Threshold Limit Values, as amended (01 2019)
Silicon - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Silicon - Respirable fraction.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Silicon - Respirable.	REL	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Silicon - Total	REL	10 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Manganese - Fume. - as Mn	Ceiling	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	STEL	3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Manganese	IDLH	500 mg/m3	US. NIOSH: Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Phosphorus	REL	0.1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	PEL	0.1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	IDLH	5 mg/m3	US. NIOSH: Immediately Dangerous to Life or Health (IDLH) Values (10 2017)

Occupational Exposure Limits: Canada

Chemical Identity	Type	Exposure Limit Values	Source
Copper and/or copper alloys and compounds (as Cu) - Fume.	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)

Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Copper and/or copper alloys and compounds (as Cu) - Dust and fume. - as Cu	TWA	1 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	8 HR ACL	1 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	15 MIN ACL	3 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (08 2017)
Aluminum and/or aluminum alloys (as Al) - Pyrophoric powder. - as Al	TWA	5 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Aluminum and/or aluminum alloys (as Al) - Dust.	TWA	10 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Aluminum and/or aluminum alloys (as Al) - Respirable.	TWA	1 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Aluminum and/or aluminum alloys (as Al) - Respirable fraction.	TWA	1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	TWA	1 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
Aluminum and/or aluminum alloys (as Al) - Pyrophoric powder. - as Al	8 HR ACL	5 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Aluminum and/or aluminum alloys (as Al) - Dust. - as Al	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Aluminum and/or aluminum alloys (as Al) - Pyrophoric powder. - as Al	15 MIN ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Aluminum and/or aluminum alloys (as Al) - Dust. - as Al	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Aluminum and/or aluminum alloys (as Al)	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Aluminum and/or aluminum alloys (as Al) - as Al	TWA	5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the

			Work Environment), as amended (09 2017)
Aluminum and/or aluminum alloys (as Al) - Welding fume. - as Al	TWA	5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Tin - as Sn	TWA	2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Tin	TWA	2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Tin - as Sn	TWA	2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	4 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Tin	TWA	2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Tin - Inhalable fraction.	TWA	2 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2019)
Silicon - Total dust.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
Silicon	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Silicon - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
Manganese - Fume, total dust. - as Mn	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)

Manganese - Respirable. - as Mn	TWA	0.02 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2018)
Manganese - Total - as Mn	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2018)
Phosphorus	TWA	0.1 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	0.1 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)

Occupational Exposure Limits: Mexico

Chemical Identity	Type	Exposure Limit Values	Source
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Aluminum and/or aluminum alloys (as Al) - Respirable fraction.	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Tin	VLE-PPT	2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Iron - as Fe	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)

Additional exposure limits under the conditions of use: US

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	TWA	5,000 ppm	US. ACGIH Threshold Limit Values, as amended (12 2010)
	STEL	30,000 ppm	US. ACGIH Threshold Limit Values, as amended (12 2010)
	PEL	5,000 ppm 9,000 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	30,000 ppm 54,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	REL	5,000 ppm 9,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	40,000 ppm	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Carbon monoxide	TWA	25 ppm	US. ACGIH Threshold Limit Values, as amended (12 2010)
	PEL	50 ppm 55 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	35 ppm 40 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)

	Ceiling	200 ppm	229 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	1,200 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Nitrogen dioxide	TWA	0.2 ppm		US. ACGIH Threshold Limit Values, as amended (02 2012)
	Ceiling	5 ppm	9 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	1 ppm	1.8 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	20 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
	IDLH	13 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Ozone	PEL	0.1 ppm	0.2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceiling	0.1 ppm	0.2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	TWA	0.05 ppm		US. ACGIH Threshold Limit Values, as amended (03 2014)
	TWA	0.20 ppm		US. ACGIH Threshold Limit Values, as amended (03 2014)
	TWA	0.10 ppm		US. ACGIH Threshold Limit Values, as amended (03 2014)
	TWA	0.08 ppm		US. ACGIH Threshold Limit Values, as amended (03 2014)
	IDLH	5 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Manganese - Fume. - as Mn	Ceiling		5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL		1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	STEL		3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Manganese - Inhalable fraction. - as Mn	TWA		0.1 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Manganese - Respirable fraction. - as Mn	TWA		0.02 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Manganese	IDLH		500 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA		1 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA		0.2 mg/m3	US. ACGIH Threshold Limit Values, as amended (03 2014)
	REL		0.1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2016)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	REL		1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2016)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	PEL		0.1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	PEL		1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Copper and/or copper alloys and compounds (as Cu)	IDLH		100 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)

Additional exposure limits under the conditions of use: Canada

Chemical Identity	Type	Exposure Limit Values		Source
Carbon dioxide	STEL	30,000 ppm	54,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)

	TWA	5,000 ppm	9,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	5,000 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	STEL	15,000 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	5,000 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	STEL	30,000 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	STEL	30,000 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	TWA	5,000 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	5,000 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	30,000 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	5,000 ppm	9,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
	STEL	30,000 ppm	54,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Carbon monoxide	TWA	25 ppm	29 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	25 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	STEL	100 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	25 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	TWA	25 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	8 HR ACL	25 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	190 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	35 ppm	40 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)

	STEL	200 ppm	230 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Nitrogen dioxide	STEL	5 ppm	9.4 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	3 ppm	5.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	CEILING	1 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.2 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2012)
	STEL	5 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	TWA	3 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	3 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	5 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	3 ppm	5.6 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Ozone	STEL	0.3 ppm	0.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	0.1 ppm	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	0.05 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.1 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.08 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.2 ppm		Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.1 ppm	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	STEL	0.3 ppm	0.6 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	15 MIN ACL	0.15 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)

	8 HR ACL	0.05 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	CEILING	0.1 ppm 0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (12 2008)
	TWA	0.20 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.05 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.08 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.10 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
Manganese - Fume, total dust. - as Mn	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Manganese - Respirable. - as Mn	TWA	0.02 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2018)
Manganese - Total - as Mn	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2018)
Copper and/or copper alloys and compounds (as Cu) - Fume.	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as

			amended (03 2014)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Copper and/or copper alloys and compounds (as Cu) - Dust and fume. - as Cu	TWA	1 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	8 HR ACL	1 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	15 MIN ACL	3 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment), as amended (09 2017)
	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (08 2017)

Additional exposure limits under the conditions of use: Mexico

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	VLE-CT	30,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
	VLE-PPT	5,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Carbon monoxide	VLE-PPT	25 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Nitrogen dioxide	VLE-PPT	0.2 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Ozone	VLE-P	0.1 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)

Appropriate Engineering Controls

Ventilation: Use enough ventilation and local exhaust at the arc, flame or heat source to keep the fumes and gases from the worker's breathing zone and the general area. Train the operator to keep their head out of the fumes. **Keep exposure as low as possible.**

Individual protection measures, such as personal protective equipment

General information:

Exposure Guidelines: To reduce the potential for overexposure, use controls such as adequate ventilation and personal protective equipment (PPE). Overexposure refers to exceeding applicable local limits, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) or the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs). Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required. Absent these controls, overexposure to one or more compound constituents, including those in the fume or airborne particles, may occur resulting in potential health hazards. According to the ACGIH, TLVs and Biological Exposure Indices (BEIs) "represent conditions under which ACGIH believes that nearly all workers may be repeatedly exposed without adverse health effects." The ACGIH further states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on constituents which have some potential to present health hazards. Welding consumables and materials being joined may contain chromium as an unintended trace element. Materials that contain chromium may produce some amount of hexavalent chromium (CrVI) and other chromium compounds as a byproduct in the fume. In 2018, the American Conference of Governmental Industrial Hygienists (ACGIH) lowered the Threshold Limit Value (TLV) for hexavalent chromium from 50 micrograms per cubic meter of air ($50 \mu\text{g}/\text{m}^3$) to $0.2 \mu\text{g}/\text{m}^3$. At these new limits, CrVI exposures at or above the TLV may be possible in cases where adequate ventilation is not provided. CrVI compounds are on the IARC and NTP lists as posing a lung cancer and sinus cancer risk. Workplace conditions are unique and welding fume exposures levels vary. Workplace exposure assessments must be conducted by a qualified professional, such as an industrial hygienist, to determine if exposures are below applicable limits and to make recommendations when necessary for preventing overexposures.

Eye/face protection:

Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes – or follow the recommendations as specified in ANSI Z49.1, Section 4, based on your process and settings. No specific lens shade recommendation for submerged arc or electroslag processes. Shield others by providing appropriate screens and flash goggles.

Skin Protection

Hand Protection:

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

Other:

Protective Clothing: Wear hand, head, and body protection which help to prevent injury from radiation, open flames, hot surfaces, sparks and electrical shock. See Z49.1. At a minimum, this includes welder's gloves and a protective face shield when welding, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing when welding, brazing and soldering. Wear dry gloves free of holes or split seams. Train the operator not to permit electrically live parts or electrodes from contacting the skin . . . or clothing or gloves if they are wet. Insulate

yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.

Respiratory Protection:

Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits.

Hygiene measures:

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, www.aws.org.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Solid welding wire or rod.
Physical state:	Solid
Form:	Solid
Color:	No data available.
Odor:	No data available.
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	No data available.
Initial boiling point and boiling range:	No data available.
Flash Point:	No data available.
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Density:	No data available.
Relative density:	No data available.
Solubility(ies)	
Solubility in water:	No data available.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. STABILITY AND REACTIVITY

Reactivity:	The product is non-reactive under normal conditions of use, storage and transport.
Chemical Stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	None under normal conditions.
Conditions to avoid:	Avoid heat or contamination.
Incompatible Materials:	Strong acids. Strong oxidizing substances. Strong bases.
Hazardous Decomposition Products:	<p>Fumes and gases from welding and its allied processes such as brazing and soldering cannot be classified simply. The composition and quantity of both are dependent upon the metal to which the joining or hot work is applied, the process, procedure - and where applicable - the electrode or consumable used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded or worked (such as paint, plating, or galvanizing), the number of operators and the volume of the work area, the quality and amount of ventilation, the position of the operator's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities.)</p> <p>In cases where an electrode or other applied material is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal and coating, etc., as noted above. Reasonably expected fume constituents produced during arc welding and brazing include the oxides of iron, manganese and other metals present in the welding consumable or base metal. Hexavalent chromium compounds may be in the welding or brazing fume of consumables or base metals which contain chromium. Gaseous and particulate fluoride may be in the fume of consumables or flux materials which contain fluoride. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc associated with welding.</p>

11. TOXICOLOGICAL INFORMATION

General information:	The International Agency for Research on Cancer (IARC) has determined welding fumes and ultraviolet radiation from welding are carcinogenic to humans (Group 1). According to IARC, welding fumes cause cancer of the lung and positive associations have been observed with cancer of the kidney. Also according to IARC, ultraviolet radiation from welding causes ocular melanoma. IARC identifies gouging, brazing, carbon arc or plasma arc cutting, and soldering as processes closely related to welding. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product.
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Information on likely routes of exposure

Inhalation:	Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in Section 11.
Skin Contact:	Arc rays can burn skin. Skin cancer has been reported.
Eye contact:	Arc rays can injure eyes.
Ingestion:	Health injuries from ingestion are not known or expected under normal use.

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation:	Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects.
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Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	Not classified
Specified substance(s): Copper and/or copper alloys and compounds (as Cu)	LD 50 (Rat): 481 mg/kg
Iron	LD 50 (Rat): 98.6 g/kg

Dermal

Product:	Not classified
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Inhalation

Product:	Not classified
Specified substance(s): Aluminum and/or aluminum alloys (as Al)	LC 50 (Rat, 1 h): 7.6 mg/l

Repeated dose toxicity

Product:	Not classified
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Skin Corrosion/Irritation

Product:	Not classified
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Serious Eye Damage/Eye Irritation

Product:	Not classified
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Respiratory or Skin Sensitization

Product:	Not classified
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Carcinogenicity

Product:	Arc rays: Skin cancer has been reported.
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IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:

No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050), as amended:

No carcinogenic components identified

Germ Cell Mutagenicity

In vitro

Product: Not classified

In vivo

Product: Not classified

Reproductive toxicity

Product: Not classified

Specific Target Organ Toxicity - Single Exposure

Product: Not classified

Specific Target Organ Toxicity - Repeated Exposure

Product: Not classified

Aspiration Hazard

Product: Not classified

Other effects: Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.

Symptoms related to the physical, chemical and toxicological characteristics under the condition of use

Inhalation:

Specified substance(s):

Manganese

Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.

Copper and/or copper alloys and compounds (as Cu)

Overexposure to copper fumes may cause fever, chills, congestion and headaches.

Additional toxicological information under the conditions of use:

Acute toxicity

Oral

Specified substance(s):

Copper and/or copper alloys and compounds (as Cu)

LD 50 (Rat): 481 mg/kg

Inhalation

Specified substance(s):

Carbon dioxide
Carbon monoxide
Nitrogen dioxide
Ozone

LC Lo (Human, 5 min): 90000 ppm
LC 50 (Rat, 4 h): 1300 ppm
LC 50 (Rat, 4 h): 88 ppm
LC Lo (Human, 30 min): 50 ppm

Other effects:

Specified substance(s):

Carbon dioxide	Asphyxia
Carbon monoxide	Carboxyhemoglobinemia
Nitrogen dioxide	Lower respiratory tract irritation

12. ECOLOGICAL INFORMATION

Ecotoxicity

Acute hazards to the aquatic environment:

Fish

Product:	Not classified.
Specified substance(s):	
Copper and/or copper alloys and compounds (as Cu)	LC 50 (Fathead minnow (<i>Pimephales promelas</i>), 96 h): 1.6 mg/l
Aluminum and/or aluminum alloys (as Al)	LC 50 (Grass carp, white amur (<i>Ctenopharyngodon idella</i>), 96 h): 0.21 - 0.31 mg/l
Phosphorus	LC 50 (Danio rerio, 96 h): 33.2 mg/l

Aquatic Invertebrates

Product:	Not classified.
Specified substance(s):	
Copper and/or copper alloys and compounds (as Cu)	EC 50 (Water flea (<i>Daphnia magna</i>), 48 h): 0.102 mg/l
Manganese	EC 50 (Water flea (<i>Daphnia magna</i>), 48 h): 40 mg/l
Phosphorus	EC 50 (<i>Daphnia magna</i> , 48 h): 10.5 mg/l

Chronic hazards to the aquatic environment:

Fish

Product:	Not classified.
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Aquatic Invertebrates

Product:	Not classified.
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Toxicity to Aquatic Plants

Product:	Not classified.
Specified substance(s):	
Copper and/or copper alloys and compounds (as Cu)	LC 50 (Green algae (<i>Scenedesmus dimorphus</i>), 3 d): 0.0623 mg/l

Persistence and Degradability

Biodegradation

Product:	No data available.
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Bioaccumulative potential

Bioconcentration Factor (BCF)

Product:	No data available.
Specified substance(s):	
Copper and/or copper alloys and compounds (as Cu)	Blue-green algae (<i>Anacystis nidulans</i>), Bioconcentration Factor (BCF): 36.01 (Static)
Phosphorus	Various, Bioconcentration Factor (BCF): 62,000 Aquatic sediment Experimental result, Key study

Mobility in soil:	No data available.
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13. Disposal considerations

General information:	The generation of waste should be avoided or minimized whenever possible. When practical, recycle in an environmentally acceptable, regulatory compliant manner. Dispose of non-recyclable products in accordance with all applicable Federal, State, Provincial, and Local requirements.
Disposal instructions:	Dispose of this material and its container to hazardous or special waste collection point.
Contaminated Packaging:	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

14. TRANSPORT INFORMATION

DOT

UN Number:	
UN Proper Shipping Name:	NOT DG REGULATED
Transport Hazard Class(es)	
Class:	NR
Label(s):	—
Packing Group:	—
Marine Pollutant:	No

IMDG

UN Number:	
UN Proper Shipping Name:	NOT DG REGULATED
Transport Hazard Class(es)	
Class:	NR
Label(s):	—
EmS No.:	
Packing Group:	—
Marine Pollutant:	No

IATA

UN Number:	
Proper Shipping Name:	NOT DG REGULATED
Transport Hazard Class(es):	
Class:	NR
Label(s):	—
Packing Group:	—
Marine Pollutant:	No
Cargo aircraft only:	Allowed.

TDG

UN Number:	
UN Proper Shipping Name:	NOT DG REGULATED
Transport Hazard Class(es)	
Class:	NR
Label(s):	—
Packing Group:	—
Marine Pollutant:	No

15. REGULATORY INFORMATION

US Federal Regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

None present or none present in regulated quantities.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050), as amended

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Copper and/or copper alloys and compounds (as Cu)	5000lbs.
Manganese	Included in the regulation but with no data values. See regulation for further details.
Phosphorus	1lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Not classified

Not classified

SARA 302 Extremely Hazardous Substance

<u>Chemical Identity</u>	<u>Reportable quantity</u>	<u>Threshold Planning Quantity</u>
Phosphorus	1 lbs.	100 lbs.

SARA 304 Emergency Release Notification

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Copper and/or copper alloys and compounds (as Cu)	5000 lbs.
Manganese	Included in the regulation but with no data values. See regulation for further details.
Phosphorus	1 lbs.

SARA 311/312 Hazardous Chemical

<u>Chemical Identity</u>	<u>Threshold Planning Quantity</u>
Phosphorus	100lbs
Copper and/or copper alloys and compounds (as Cu)	10000 lbs
Aluminum and/or aluminum alloys (as Al)	10000 lbs
Tin	10000 lbs
Silicon	10000 lbs
Manganese	10000 lbs
Iron	10000 lbs

SARA 313 (TRI Reporting)

<u>Chemical Identity</u>	<u>Reporting threshold for other users</u>	<u>Reporting threshold for manufacturing and processing</u>
Copper and/or copper alloys and compounds (as Cu)	10000 lbs	25000 lbs.
Aluminum and/or aluminum alloys (as Al)	10000 lbs	25000 lbs.
Manganese	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Phosphorus	Reportable quantity: 1 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US State Regulations

US. California Proposition 65

No ingredient requiring a warning under CA Prop 65.

WARNING: This product contains or produces a chemical known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code Section 25249.5 et seq.)

WARNING: Cancer and Reproductive Harm – www.P65Warnings.ca.gov

US. New Jersey Worker and Community Right-to-Know Act

Chemical Identity

Copper and/or copper alloys and compounds (as Cu)

Aluminum and/or aluminum alloys (as Al)

Tin

Silicon

Manganese

US. Massachusetts RTK - Substance List

Chemical Identity

Phosphorus

US. Pennsylvania RTK - Hazardous Substances

Chemical Identity

Copper and/or copper alloys and compounds (as Cu)

Aluminum and/or aluminum alloys (as Al)

Tin

Silicon

Manganese

US. Rhode Island RTK

No ingredient regulated by RI Right-to-Know Law present.

Canada Federal Regulations

List of Toxic Substances (CEPA, Schedule 1)

Chemical Identity

Aluminum and/or

aluminum alloys (as Al)

Export Control List (CEPA 1999, Schedule 3)

Not Regulated

National Pollutant Release Inventory (NPRI)

Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements

NPRI PT5

Not Regulated

Canada. National Pollutant Release Inventory (NPRI) (Schedule 1, Parts 1-4)

NPRI

Not Regulated

Greenhouse Gases

Not Regulated

Controlled Drugs and Substances Act

CA CDSI

Not Regulated

CA CDSII	Not Regulated
CA CDSIII	Not Regulated
CA CDSIV	Not Regulated
CA CDSV	Not Regulated
CA CDSVII	Not Regulated
CA CDSVIII	Not Regulated

Precursor Control Regulations
Not Regulated

Mexico. Substances subject to reporting for the pollutant release and transfer registry (PRTR): Not applicable

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	One or more components are not listed or are exempt from listing.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	One or more components are not listed or are exempt from listing.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	One or more components are not listed or are exempt from listing.
Japan Pharmacopoeia Listing:	One or more components are not listed or are exempt from listing.
Mexico INSQ:	On or in compliance with the inventory
Ontario Inventory:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory

16. OTHER INFORMATION

Definitions:

Revision Date: 04/13/2020

Further Information: Additional information is available by request.

Disclaimer: The Lincoln Electric Company urges each end user and recipient of this SDS to study it carefully. See also www.lincolnelectric.com/safety. If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from potential hazards associated with the handling or use of this product. This information is believed to be accurate as of the revision date shown above. However, no warranty, expressed or implied, is given. Because the conditions or methods of use are beyond Lincoln Electric's control, we assume no liability resulting from the use of this product. Regulatory requirements are subject to change and may differ between various locations. Compliance with all applicable Federal, State, Provincial, and local laws and regulations remain the responsibility of the user.

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Lincore® BU-G

Product Size: .045" (1.1 mm)

Other means of identification

SDS number: 200000000018

Recommended use and restriction on use

Recommended use: FCAW-G (Gas Shielded Flux Cored Arc Welding)

Restrictions on use: Not known. Read this SDS before using this product.

Manufacturer/Importer/Supplier/Distributor Information

Company Name: The Lincoln Electric Company

Address: 22801 Saint Clair Avenue
Cleveland, Ohio 44117
USA

Telephone: +1 (216) 481-8100

Contact Person: Safety Data Sheet Questions: www.lincolnelectric.com/sds
Arc Welding Safety Information: www.lincolnelectric.com/safety

Company Name: The Lincoln Electric Company of Canada LP

Address: 179 Wicksteed Avenue
Toronto, Ontario M4G 2B9
Canada

Telephone: +1 (416) 421-2600

Contact Person: Safety Data Sheet Questions: www.lincolnelectric.com/sds
Arc Welding Safety Information: www.lincolnelectric.com/safety

Emergency telephone number:

USA/Canada/Mexico +1 (888) 609-1762

Americas/Europe +1 (216) 383-8962

Asia Pacific +1 (216) 383-8966

Middle East/Africa +1 (216) 383-8969

3E Company Access Code: 333988

2. HAZARDS IDENTIFICATION

Classified according to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), The United States Occupational Safety and Health Administration's Hazard Communication Standard (29 CFR 1910.1200), Canada's Hazardous Product Regulations and Mexico's Harmonized System for the Identification and Communication of Hazards and Risks from Hazardous Chemicals in the Workplace.

Hazard Classification Not classified as hazardous according to applicable GHS hazard classification criteria.

Label Elements

Hazard Symbol: No symbol

Signal Word: No signal word.

Hazard Statement: Not applicable

Precautionary Not applicable

Statements:**Other hazards which do not result in GHS classification:**

Electrical Shock can kill. If welding must be performed in damp locations or with wet clothing, on metal structures or when in cramped positions such as sitting, kneeling or lying, or if there is a high risk of unavoidable or accidental contact with work piece, use the following equipment: Semiautomatic DC Welder, DC Manual (Stick) Welder, or AC Welder with Reduced Voltage Control.

Arc rays can injure eyes and burn skin. Welding arc and sparks can ignite combustibles and flammable materials. Overexposure to welding fumes and gases can be hazardous. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product. Refer to Section 8.

Substance(s) formed under the conditions of use:

The welding fume produced from this welding electrode may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below.

Chemical Identity	CAS-No.
Carbon dioxide	124-38-9
Carbon monoxide	630-08-0
Nitrogen dioxide	10102-44-0
Ozone	10028-15-6
Manganese	7439-96-5

3. COMPOSITION / INFORMATION ON INGREDIENTS**Reportable Hazardous Ingredients
Mixtures**

Chemical Identity	CAS number	Content in percent (%)*
Iron	7439-89-6	50 - <100%
Manganese	7439-96-5	1 - <5%
Chromium and chromium alloys or compounds (as Cr)	7440-47-3	1 - <5%
Silicon	7440-21-3	0.1 - <1%
Molybdenum	7439-98-7	0.1 - <1%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Composition Comments:

The term "Hazardous Ingredients" should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding hazard. The product may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 and 8 for more information.

4. FIRST AID MEASURES**Ingestion:**

Avoid hand, clothing, food, and drink contact with fluxes, metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. Unless the poison control center advises otherwise, wash out mouth thoroughly with water. If symptoms

develop, seek medical attention at once.

Inhalation:

Move to fresh air if breathing is difficult. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

Skin Contact:

Remove contaminated clothing and wash the skin thoroughly with soap and water. For reddened or blistered skin, or thermal burns, obtain medical assistance at once.

Eye contact:

Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until transported to an emergency medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

Most important symptoms/effects, acute and delayed**Symptoms:**

Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Refer to Section 11 for more information.

Hazards:

The hazards associated with welding and its allied processes such as soldering and brazing are complex and may include physical and health hazards such as but not limited to electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to fumes, gases or dusts potentially generated during the use of this product. Refer to Section 11 for more information.

Indication of immediate medical attention and special treatment needed**Treatment:**

Treat symptomatically.

5. FIRE-FIGHTING MEASURES**General Fire Hazards:**

As shipped, this product is nonflammable. However, welding arc and sparks as well as open flames and hot surfaces associated with brazing and soldering can ignite combustible and flammable materials. Read and understand American National Standard Z49.1, "Safety in Welding, Cutting and Allied Processes" and National Fire Protection Association NFPA 51B, "Standard for Fire Prevention during Welding, Cutting and Other Hot Work" before using this product.

Suitable (and unsuitable) extinguishing media**Suitable extinguishing media:**

As shipped, the product will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

Unsuitable extinguishing media:

Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical:

Welding arc and sparks can ignite combustibles and flammable products.

Special protective equipment and precautions for firefighters**Special fire fighting procedures:**

Use standard firefighting procedures and consider the hazards of other involved materials.

Special protective equipment for fire-fighters:

Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions, protective equipment and emergency procedures:**

If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

Methods and material for containment and cleaning up:

Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk. Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal.

Environmental Precautions:

Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages.

7. HANDLING AND STORAGE**Precautions for safe handling:**

Prevent formation of dust. Provide appropriate exhaust ventilation at places where dust is formed.

Read and understand the manufacturer's instruction and the precautionary label on the product. Refer to Lincoln Safety Publications at www.lincolnelectric.com/safety. See American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, www.gpo.gov.

Conditions for safe storage, including any incompatibilities:

Store in closed original container in a dry place. Store in accordance with local/regional/national regulations. Store away from incompatible materials.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION**Control Parameters****Occupational Exposure Limits: US**

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Fume. - as Mn	Ceiling	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	STEL	3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Manganese	IDLH	500 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)

Chromium and chromium alloys or compounds (as Cr) - as Cr	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	0.5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
Chromium and chromium alloys or compounds (as Cr) - Inhalable fraction. - as Cr(0)	TWA	0.5 mg/m3	US. ACGIH Threshold Limit Values (03 2018)
Chromium and chromium alloys or compounds (as Cr)	IDLH	250 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Silicon - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Silicon - Respirable fraction.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Silicon - Respirable.	REL	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
Silicon - Total	REL	10 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
Molybdenum - Total dust. - as Mo	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Molybdenum - Respirable fraction. - as Mo	TWA	3 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Molybdenum	IDLH	5,000 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)

Occupational Exposure Limits: Canada

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Manganese - as Mn	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)
Manganese - Fume, total dust. - as Mn	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Chromium and chromium alloys or compounds (as Cr) - as Cr	TWA	0.5 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
Chromium and chromium alloys or compounds (as Cr)	TWA	0.5 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Chromium and chromium alloys or compounds (as Cr) - as Cr	TWA	0.5 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)

	8 HR ACL	0.5 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	1.5 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Chromium and chromium alloys or compounds (as Cr)	TWA	0.5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Chromium and chromium alloys or compounds (as Cr) - Inhalable fraction. - as Cr(0)	TWA	0.5 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2018)
Silicon - Total dust.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)
Silicon	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Silicon - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Molybdenum - Inhalable	TWA	10 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Molybdenum - Respirable.	TWA	3 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Molybdenum - Respirable fraction. - as Mo	8 HR ACL	3 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Molybdenum - Inhalable fraction. - as Mo	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Molybdenum - Respirable fraction. - as Mo	15 MIN ACL	6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	TWA	3 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Molybdenum - Respirable fraction. - as Mo	TWA	3 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)
Molybdenum - as Mo	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)

Occupational Exposure Limits: Mexico

Chemical Identity	Type	Exposure Limit Values	Source
Iron - as Fe	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace;

			Assessment and Control) (04 2014)
Chromium and chromium alloys or compounds (as Cr)	VLE-PPT	0.5 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
	VLE-PPT	0.05 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
	VLE-PPT	0.01 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Molybdenum - Respirable fraction. - as Mo	VLE-PPT	0.5 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)

Additional exposure limits under the conditions of use: US

Chemical Identity	Type	Exposure Limit Values		Source
Carbon dioxide	TWA	5,000 ppm		US. ACGIH Threshold Limit Values (12 2010)
	STEL	30,000 ppm		US. ACGIH Threshold Limit Values (12 2010)
	PEL	5,000 ppm	9,000 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	30,000 ppm	54,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	REL	5,000 ppm	9,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	IDLH	40,000 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Carbon monoxide	TWA	25 ppm		US. ACGIH Threshold Limit Values (12 2010)
	PEL	50 ppm	55 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	35 ppm	40 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	Ceil_Time	200 ppm	229 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	IDLH	1,200 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Nitrogen dioxide	TWA	0.2 ppm		US. ACGIH Threshold Limit Values (02 2012)
	Ceiling	5 ppm	9 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	1 ppm	1.8 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	IDLH	20 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
	IDLH	13 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Ozone	PEL	0.1 ppm	0.2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceil_Time	0.1 ppm	0.2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	TWA	0.05 ppm		US. ACGIH Threshold Limit Values (03 2014)
	TWA	0.20 ppm		US. ACGIH Threshold Limit Values (03 2014)
	TWA	0.10 ppm		US. ACGIH Threshold Limit Values (03 2014)
	TWA	0.08 ppm		US. ACGIH Threshold Limit Values (03 2014)
	IDLH	5 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Manganese - Fume. - as Mn	Ceiling	5 mg/m3		US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02

			2006)
	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
	STEL	3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2005)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Manganese	IDLH	500 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)

Additional exposure limits under the conditions of use: Canada

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	STEL	30,000 ppm 54,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	5,000 ppm 9,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	5,000 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	STEL	15,000 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	5,000 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)
	STEL	30,000 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)
	STEL	30,000 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	TWA	5,000 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	8 HR ACL	5,000 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	30,000 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	TWA	5,000 ppm 9,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
	STEL	30,000 ppm 54,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Carbon monoxide	TWA	25 ppm 29 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	25 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	STEL	100 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	25 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

			(03 2011)
	TWA	25 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)
	8 HR ACL	25 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	190 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	TWA	35 ppm 40 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
	STEL	200 ppm 230 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Nitrogen dioxide	STEL	5 ppm 9.4 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	3 ppm 5.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	CEILING	1 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.2 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2012)
	STEL	5 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	TWA	3 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	8 HR ACL	3 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL	5 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	TWA	3 ppm 5.6 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)
Ozone	STEL	0.3 ppm 0.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	0.1 ppm 0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA	0.05 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.1 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.08 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	0.2 ppm	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)

	TWA	0.1 ppm	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)
	STEL	0.3 ppm	0.6 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)
	15 MIN ACL	0.15 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	8 HR ACL	0.05 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	CEILING	0.1 ppm	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
	TWA	0.20 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
	TWA	0.05 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
	TWA	0.08 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
	TWA	0.10 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Manganese - as Mn	TWA		0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)
	TWA		0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	8 HR ACL		0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
	15 MIN ACL		0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)
Manganese - Respirable fraction. - as Mn	TWA		0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Manganese - Inhalable fraction. - as Mn	TWA		0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)
Manganese - as Mn	TWA		0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)
Manganese - Fume, total dust. - as Mn	TWA		0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (09 2017)

Additional exposure limits under the conditions of use: Mexico

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	VLE-CT	30,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
	VLE-PPT	5,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Carbon monoxide	VLE-PPT	25 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Nitrogen dioxide	VLE-PPT	0.2 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Ozone	VLE-P	0.1 ppm	Mexico. OELs. (NOM-010-STPS-2014

			Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m ³	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)

Appropriate Engineering Controls

Ventilation: Use enough ventilation and local exhaust at the arc, flame or heat source to keep the fumes and gases from the worker's breathing zone and the general area. Train the operator to keep their head out of the fumes. **Keep exposure as low as possible.**

Individual protection measures, such as personal protective equipment

General information:

Exposure Guidelines: To reduce the potential for overexposure, use controls such as adequate ventilation and personal protective equipment (PPE). Overexposure refers to exceeding applicable local limits, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) or the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs). Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required. Absent these controls, overexposure to one or more compound constituents, including those in the fume or airborne particles, may occur resulting in potential health hazards. According to the ACGIH, TLVs and Biological Exposure Indices (BEIs) "represent conditions under which ACGIH believes that nearly all workers may be repeatedly exposed without adverse health effects." The ACGIH further states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on constituents which have some potential to present health hazards. Welding consumables and materials being joined may contain chromium as an unintended trace element. Materials that contain chromium may produce some amount of hexavalent chromium (CrVI) and other chromium compounds as a byproduct in the fume. In 2018, the American Conference of Governmental Industrial Hygienists (ACGIH) lowered the Threshold Limit Value (TLV) for hexavalent chromium from 50 micrograms per cubic meter of air (50 µg/m³) to 0.2 µg/m³. At these new limits, CrVI exposures at or above the TLV may be possible in cases where adequate ventilation is not provided. CrVI compounds are on the IARC and NTP lists as posing a lung cancer and sinus cancer risk. Workplace conditions are unique and welding fume exposures levels vary. Workplace exposure assessments must be conducted by a qualified professional, such as an industrial hygienist, to determine if exposures are below applicable limits and to make recommendations when necessary for preventing overexposures.

Eye/face protection:

Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes – or follow the recommendations as specified in ANSI Z49.1, Section 4, based on your process and settings. No specific lens shade recommendation for submerged arc or electrosag processes. Shield others by providing appropriate screens and flash goggles.

Skin Protection

Hand Protection:

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

Other:

Protective Clothing: Wear hand, head, and body protection which help to prevent injury from radiation, open flames, hot surfaces, sparks and electrical shock. See Z49.1. At a minimum, this includes welder's gloves and a protective face shield when welding, and may include arm protectors,

aprons, hats, shoulder protection, as well as dark substantial clothing when welding, brazing and soldering. Wear dry gloves free of holes or split seams. Train the operator not to permit electrically live parts or electrodes from contacting the skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.

Respiratory Protection:

Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits.

Hygiene measures:

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, www.aws.org.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Cored welding wire.
Physical state:	Solid
Form:	Solid
Color:	No data available.
Odor:	No data available.
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	No data available.
Initial boiling point and boiling range:	No data available.
Flash Point:	No data available.
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Density:	No data available.
Relative density:	No data available.
Solubility(ies)	
Solubility in water:	No data available.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.

Decomposition temperature: No data available.
Viscosity: No data available.

10. STABILITY AND REACTIVITY

Reactivity: The product is non-reactive under normal conditions of use, storage and transport.

Chemical Stability: Material is stable under normal conditions.

Possibility of hazardous reactions: None under normal conditions.

Conditions to avoid: Avoid heat or contamination.

Incompatible Materials: Strong acids. Strong oxidizing substances. Strong bases.

Hazardous Decomposition Products: Fumes and gases from welding and its allied processes such as brazing and soldering cannot be classified simply. The composition and quantity of both are dependent upon the metal to which the joining or hot work is applied, the process, procedure - and where applicable - the electrode or consumable used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded or worked (such as paint, plating, or galvanizing), the number of operators and the volume of the work area, the quality and amount of ventilation, the position of the operator's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities.)

In cases where an electrode or other applied material is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal and coating, etc., as noted above. Reasonably expected fume constituents produced during arc welding and brazing include the oxides of iron, manganese and other metals present in the welding consumable or base metal. Hexavalent chromium compounds may be in the welding or brazing fume of consumables or base metals which contain chromium. Gaseous and particulate fluoride may be in the fume of consumables or flux materials which contain fluoride. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc associated with welding.

11. TOXICOLOGICAL INFORMATION

General information: The International Agency for Research on Cancer (IARC) has determined welding fumes and ultraviolet radiation from welding are carcinogenic to humans (Group 1). According to IARC, welding fumes cause cancer of the lung and positive associations have been observed with cancer of the kidney. Also according to IARC, ultraviolet radiation from welding causes ocular melanoma. IARC identifies gouging, brazing, carbon arc or plasma arc cutting, and soldering as processes closely related to welding. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product.

Information on likely routes of exposure

Inhalation:	Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in Section 11.
Skin Contact:	Arc rays can burn skin. Skin cancer has been reported.
Eye contact:	Arc rays can injure eyes.
Ingestion:	Health injuries from ingestion are not known or expected under normal use.

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation:	Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects.
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Information on toxicological effects**Acute toxicity (list all possible routes of exposure)****Oral**

Product:	Not classified
Specified substance(s):	
Iron	LD 50 (Rat): 98.6 g/kg

Dermal

Product:	Not classified
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Inhalation

Product:	Not classified
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Repeated dose toxicity

Product:	Not classified
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Skin Corrosion/Irritation

Product:	Not classified
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Serious Eye Damage/Eye Irritation

Product:	Not classified
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Respiratory or Skin Sensitization

Product:	Not classified
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Carcinogenicity

Product:	Arc rays: Skin cancer has been reported.
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IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:

No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):

No carcinogenic components identified

Germ Cell Mutagenicity**In vitro****Product:** Not classified**In vivo****Product:** Not classified**Reproductive toxicity****Product:** Not classified**Specific Target Organ Toxicity - Single Exposure****Product:** Not classified**Specific Target Organ Toxicity - Repeated Exposure****Product:** Not classified**Aspiration Hazard****Product:** Not classified

Other effects: Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.

Symptoms related to the physical, chemical and toxicological characteristics under the condition of use**Inhalation:****Specified substance(s):**

Manganese

Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.

Additional toxicological information under the conditions of use:**Acute toxicity****Inhalation****Specified substance(s):**

Carbon dioxide	LC Lo (Human, 5 min): 90000 ppm
Carbon monoxide	LC 50 (Rat, 4 h): 1300 ppm
Nitrogen dioxide	LC 50 (Rat, 4 h): 88 ppm
Ozone	LC Lo (Human, 30 min): 50 ppm

Other effects:**Specified substance(s):**

Carbon dioxide	Asphyxia
Carbon monoxide	Carboxyhemoglobinemia
Nitrogen dioxide	Lower respiratory tract irritation

12. ECOLOGICAL INFORMATION**Ecotoxicity****Acute hazards to the aquatic environment:**

Fish

Product: Not classified
Specified substance(s):
Molybdenum LC 50 (Rainbow trout, donaldson trout (*Oncorhynchus mykiss*), 96 h): 800 mg/l

Aquatic Invertebrates

Product: Not classified
Specified substance(s):
Manganese EC 50 (Water flea (*Daphnia magna*), 48 h): 40 mg/l

Chronic hazards to the aquatic environment:**Fish**

Product: Not classified

Aquatic Invertebrates

Product: Not classified

Toxicity to Aquatic Plants

Product: Not classified

Persistence and Degradability**Biodegradation**

Product: No data available.

Bioaccumulative potential**Bioconcentration Factor (BCF)**

Product: No data available.

Mobility in soil:

No data available.

13. Disposal considerations**General information:**

The generation of waste should be avoided or minimized whenever possible. When practical, recycle in an environmentally acceptable, regulatory compliant manner. Dispose of non-recyclable products in accordance with all applicable Federal, State, Provincial, and Local requirements.

Disposal instructions:

Disposal of this product may be regulated as a Hazardous Waste. The welding consumable and/or by-product from the welding process (including, but not limited to slag, dust, etc.) may contain levels of leachable heavy metals such as Barium or Chromium. Prior to disposal, a representative sample must be analyzed in accordance with US EPA's Toxicity Characteristic Leaching Procedure (TCLP) to determine if any constituents exist above regulated threshold levels. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner according to Federal, State and Local Regulations.

Contaminated Packaging:

Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

14. TRANSPORT INFORMATION**DOT**

UN Number:

UN Proper Shipping Name:

NOT DG REGULATED

Transport Hazard Class(es)

Class: NR
Label(s): —
Packing Group: —
Marine Pollutant: No

IMDG

UN Number:
UN Proper Shipping Name: NOT DG REGULATED
Transport Hazard Class(es)
Class: NR
Label(s): —
EmS No.:
Packing Group: —
Marine Pollutant: No

IATA

UN Number:
Proper Shipping Name: NOT DG REGULATED
Transport Hazard Class(es):
Class: NR
Label(s): —
Packing Group: —
Marine Pollutant: No
Cargo aircraft only: Allowed.

TDG

UN Number:
UN Proper Shipping Name: NOT DG REGULATED
Transport Hazard Class(es)
Class: NR
Label(s): —
Packing Group: —
Marine Pollutant: No

15. REGULATORY INFORMATION**US Federal Regulations****TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**

None present or none present in regulated quantities.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):**Chemical Identity**

Manganese

Chromium and chromium alloys or
compounds (as Cr)

Reportable quantity

Included in the regulation but with no data values. See
regulation for further details.
5000lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)**Hazard categories**

Not classified
Not classified

SARA 302 Extremely Hazardous Substance

None present or none present in regulated quantities.

SARA 304 Emergency Release Notification**Chemical Identity****Reportable quantity**

Manganese

Included in the regulation but with no data values. See regulation for further details.

Chromium and chromium alloys or compounds (as Cr)

5000 lbs.

SARA 311/312 Hazardous Chemical**Chemical Identity****Threshold Planning Quantity**

Iron

10000 lbs

Manganese

10000 lbs

Chromium and chromium alloys or compounds (as Cr)

10000 lbs

Silicon

10000 lbs

Molybdenum

10000 lbs

SARA 313 (TRI Reporting)**Chemical Identity****Reporting threshold for other users****Reporting threshold for manufacturing and processing**

Manganese

10000 lbs

25000 lbs.

Chromium and chromium alloys or compounds (as Cr)

10000 lbs

25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

None present or none present in regulated quantities.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US State Regulations**US. California Proposition 65**

No ingredient requiring a warning under CA Prop 65.

WARNING: This product contains or produces a chemical known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code Section 25249.5 et seq.)

WARNING: Cancer and Reproductive Harm – www.P65Warnings.ca.gov

US. New Jersey Worker and Community Right-to-Know Act**Chemical Identity**

Manganese

Chromium and chromium alloys or compounds (as Cr)

US. Massachusetts RTK - Substance List**Chemical Identity**

Chromium and chromium alloys or compounds (as Cr)

US. Pennsylvania RTK - Hazardous Substances**Chemical Identity**

Manganese

Chromium and chromium alloys or compounds (as Cr)

US. Rhode Island RTK

No ingredient regulated by RI Right-to-Know Law present.

Canada Federal Regulations**List of Toxic Substances (CEPA, Schedule 1)**

Not Regulated

Export Control List (CEPA 1999, Schedule 3)

Not Regulated

National Pollutant Release Inventory (NPRI)**Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements**

NPRI PT5 Not Regulated

Canada. National Pollutant Release Inventory (NPRI) (Schedule 1, Parts 1-4)

NPRI Not Regulated

Greenhouse Gases

Not Regulated

Controlled Drugs and Substances Act

CA CDSI Not Regulated

CA CDSII Not Regulated

CA CDSIII Not Regulated

CA CDSIV Not Regulated

CA CDSV Not Regulated

CA CDSVII Not Regulated

CA CDSVIII Not Regulated

Precursor Control Regulations

Not Regulated

Mexico. Substances subject to reporting for the pollutant release and transfer registry (PRTR): Not applicable**Inventory Status:**

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	One or more components are not listed or are exempt from listing.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	One or more components are not listed or are exempt from listing.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	One or more components are not listed or are exempt from listing.
Japan Pharmacopoeia Listing:	One or more components are not listed or are exempt from listing.
Mexico INSQ:	On or in compliance with the inventory
Ontario Inventory:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory

16. OTHER INFORMATION**Definitions:****Revision Date:** 06/12/2019**Further Information:** Additional information is available by request.

Disclaimer:

The Lincoln Electric Company urges each end user and recipient of this SDS to study it carefully. See also www.lincolnelectric.com/safety. If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from potential hazards associated with the handling or use of this product. This information is believed to be accurate as of the revision date shown above. However, no warranty, expressed or implied, is given. Because the conditions or methods of use are beyond Lincoln Electric's control, we assume no liability resulting from the use of this product. Regulatory requirements are subject to change and may differ between various locations. Compliance with all applicable Federal, State, Provincial, and local laws and regulations remain the responsibility of the user.

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