

WHY HALOGEN FREE?

Understanding why the proper use of halogen free materials is important in electrical applications.

Introduction: What are Halogens?

We, in the electrical industry, hear the term halogen bantered around quite a lot. Often we hear the term halogen lamp, or some derivative such as tungsten halogen or quartz-halogen. It seems as though halogen is added to other materials to make them better. Still other times we hear about halogen free products. The purpose of this document is to add some clarity to the world of halogens.

Our journey begins with a quick review of exactly what a halogen is and what makes them special. First the name comes from a Swedish Baron with a penchant for chemistry. In 1842, he proposed the name halogen which is translated from Latin to mean “salts from the sea.” Originally there were four elements that produced a sea-salt like substance; those being fluorine, chlorine, bromine and iodine. When we reached the atomic age, another element, astatine, was discovered. We don't hear much about it because it is highly radioactive and only has very short-lived isotopes.

For those of you who took a little chemistry and have good memories, all of these elements are found in the periodic table in Group 17, which is adjacent to the inert gasses. (See Periodic Table) Halogens are

chemically reactive with other commonly occurring materials. Further, this propensity to combine chemically has the effect of being harmful and in sufficient quantities, lethal to living organisms.

This high level of reactivity means some halogens are almost impossible to safely contain. For example, Fluorine is one of the most reactive elements, attacking (reacting with sometimes violently) otherwise-inert materials such as glass. However this ultra-high reactivity means once a reaction does take place the newly created chemical will not react with anything else. For example, the Teflon found in so many applications (home

and work) comes from the reaction and subsequent bonding between fluorine and carbon.

THE PERIODIC TABLE

() = ESTIMATES																		
SYMBOL ATOMIC NUMBER ATOMIC WEIGHT NAME																		
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 IA IIA IIIA IVA VA VIA VIIA VIIIA																		
1	H 1.008 Hydrogen																	He 4.00 Helium
2	Li 3 6.94 Lithium	Be 4 9.01 Beryllium											B 5 10.81 Boron	C 6 12.01 Carbon	N 7 14.01 Nitrogen	O 8 16.00 Oxygen	F 9 19.00 Fluorine	Ne 10 20.18 Neon
3	Na 11 22.99 Sodium	Mg 12 24.31 Magnesium											Al 13 26.98 Aluminum	Si 14 28.09 Silicon	P 15 30.97 Phosphorus	S 16 32.07 Sulfur	Cl 17 35.45 Chlorine	Ar 18 39.95 Argon
4	K 19 39.10 Potassium	Ca 20 40.08 Calcium	Sc 21 44.96 Scandium	Ti 22 47.88 Titanium	V 23 50.94 Vanadium	Cr 24 52.00 Chromium	Mn 25 54.94 Manganese	Fe 26 55.85 Iron	Co 27 58.93 Cobalt	Ni 28 58.69 Nickel	Cu 29 63.55 Copper	Zn 30 65.39 Zinc	Ga 31 69.72 Gallium	Ge 32 72.61 Germanium	As 33 74.92 Arsenic	Se 34 78.96 Selenium	Br 35 79.90 Bromine	Kr 36 83.80 Krypton
5	Rb 37 85.47 Rubidium	Sr 38 87.62 Strontium	Y 39 88.91 Yttrium	Zr 40 91.22 Zirconium	Nb 41 92.91 Niobium	Mo 42 95.94 Molybdenum	Tc 43 (97.9) Technetium	Ru 44 101.07 Ruthenium	Rh 45 101.07 Rhodium	Pd 46 106.42 Palladium	Ag 47 107.87 Silver	Cd 48 112.41 Cadmium	In 49 114.82 Indium	Sn 50 118.71 Tin	Sb 51 121.76 Antimony	Te 52 127.60 Tellurium	I 53 126.90 Iodine	Xe 54 131.29 Xenon
6	Cs 55 132.91 Cesium	Ba 56 137.33 Barium	La 57 138.91 Lanthanum	Hf 72 178.49 Hafnium	Ta 73 180.95 Tantalum	W 74 183.85 Tungsten	Re 75 186.21 Rhenium	Os 76 190.24 Osmium	Ir 77 192.22 Iridium	Pt 78 195.08 Platinum	Au 79 196.97 Gold	Hg 80 200.59 Mercury	Tl 81 204.38 Thallium	Pb 82 207.2 Lead	Bi 83 208.98 Bismuth	Po 84 (209) Polonium	At 85 (210) Astatine	Rn 86 (222) Radon
7	Fr 87 223.02 Francium	Ra 88 226.03 Radium	Ac 89 227.03 Actinium	Rf 104 (261) Rutherfordium	Db 105 (262) Dubnium	Sg 106 (263) Seaborgium	Bh 107 (264) Bohrium	Hs 108 (265) Hassium	Mt 109 (266) Meitnerium	Unlabeled Discovery 110 110 Nov. 1994	Unlabeled Discovery 111 111 Nov. 1994	Unlabeled Discovery 112 112 1996	Unlabeled Discovery 113 113 1996	Unlabeled Discovery 114 114 1996	Unlabeled Discovery 115 115 1996	Unlabeled Discovery 116 116 1996	Unlabeled Discovery 117 117 1996	Unlabeled Discovery 118 118 1996
ALKALI METALS TRANSITION METALS HALOGENS NOBLE GASES																		
LANTHANIDES ACTINIDES																		
Ce 140.12 Pr 140.91 Nd 144.24 Pm (145) Sm 150.36 Eu 152.07 Gd 157.25 Tb 158.93 Dy 162.50 Ho 164.93 Er 167.26 Tm 168.93 Yb 173.04 Lu 174.97																		
Th 232.04 Pa 231.04 U 238.03 Np 237.05 Pu 242.06 Am 243.06 Cm 247 Bk 247 Cf 251 Es 252.08 Fm 257 Md 257 No 259 Lr 262.11																		

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Halogens are both our friend and our enemy

Taking a quick run through the halogen family, we are going to discover halogens liberally and literally sprinkled through our daily life. For example, common table salt is the combination of Sodium (Na on the table) and Chlorine (Cl on the table). And, it is essential for human life. Without salt, our bodies become chemically unbalanced and our muscles and nervous system fail. Adults require something like six grams of salt per day to maintain a healthy life. Other blends of chlorine are used to disinfect drinking water, maintain swimming pools, clean (bleach) our clothes and sanitize living spaces. Medical products made of chlorine are used to treat everything from low level infections to diabetes. Chlorine is

found in a multitude of automotive, agricultural and industrial products. The 'C' in the PVC pipe and electronic components is chloride.

Adding further to the list of halogens as our friend, iodine is necessary for the proper function of the thyroid gland. And, in days before iodine was added to 'purchased' salt, iodine deficiencies were the root cause of a long string of maladies; everything from depression to slowed heartbeat and on to goiters.

Halogens have thousands of other human friendly applications. As we mentioned earlier, many readers from the electrical industry are

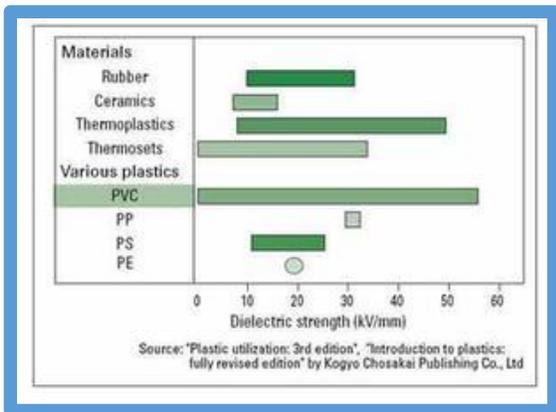


familiar with halogen lamps (light bulbs.) Halogen was one of the first major breakthroughs in lamp technology. A small amount of halogen material (mostly iodine or bromine) is added to an otherwise incandescent tungsten lamp to extend the life of the tungsten filament and provide a brighter light output over the course of the useful life.



With all of these positive uses for halogen, it is hard to imagine the diabolical side of these friendly chemicals. Halogens (Chlorine mostly) were the active ingredients in the infamous "Mustard Gas" of World War I. When released, the gas created blisters on the skin, eyes and exposed mucus areas. A couple of breaths of this stuff caused terrible pain, blindness and slow suffocation due to blisters forming on the lungs. For those who managed to survive the original holocaust, exposure to the gas was determined to be highly carcinogenic.

So, how do halogens impact the electrical and construction industry?



Polyvinyl Chloride (aka PVC or vinyl) is the single most popular plastic in use today. It's low cost, easy to mold and shape plus it offers many other great properties; like electrical insulation. PVC is one of the most popular electrical insulations because of its wide temperature range (-55-105 degrees C) and its flame, moisture and abrasion resistance. PVC holds up well against gasoline, ozone, acids and solvents.

PVC is not the only halogen-based plastic used in the electrical industry. Many other products have been developed based on their flexibility and ability to withstand various chemicals. All seem to carry

wondrous properties but they have an inherent issue. When they reach their flammable temperature, they release dangerous plumes of nasty gasses.

PVC begins to decompose in the range of 203-572 degrees Fahrenheit and flash ignition occurs at 735 degrees. During this process, deadly hydrogen chloride gas and carbon dioxide (CO) is given off. As the temperature rises ethylene, benzene, naphthalene and other gasses are given off which only increase the temperature and rate of gas release. All of these gasses are known to be hazardous to humans and

other animals. We should note the danger limit for hydrogen chloride gas is less than 5 parts per million. A tiny dose can result in death or permanent injury.

In addition to the impact on living things, the hydrogen chloride gas is highly corrosive. Release of this gas into areas with electronic equipment can create much damage as the gas acts on the electronic connections and various components. One often referenced incident occurred in 1988. The central offices of Illinois Bell in Suburban Chicago were impacted by a fire which released corrosive gas extensively damaging the electronic switching system. Service to over 35,000 users, including hospitals, emergency systems and even Chicago's O'Hare Airport was interrupted with an economic impact ranging into the tens of millions of dollars. While this white paper will not dwell on the impact to equipment, two important points come from this example: First, improper use of halogen based products does present a danger to equipment. More importantly, limited exposure to the released gasses is dangerous. In the case of the Illinois Bell incident, home owners and other "civilians" were evacuated in a five block radius of the fire.

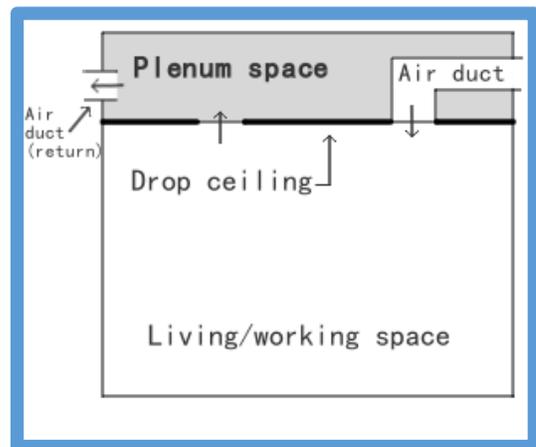
Protecting people and animals from halogen based gasses.

Based on these known dangers, a new breed of halogen free plastics has been developed to avoid the dangers of exposure. Unlike their halogen containing cousins, these products do not release dangerous gasses when exposed to fire or high temperatures.

Most halogen free applications center on areas with air flow restrictions or limited egress possibilities. Applications in mass transit vehicles (trains, busses, and ferries,) ship building, and offshore drilling platforms are common due to their obvious airflow and difficulty to exit during a potential fire or other issue. However, a good many people fail to identify dangers in locations with airflow issues. Subway systems, mines and closed locations within large buildings may possess safety hazards with sometimes restricted airflow. The airflow issue must be considered when installing lighting in areas (often called plenums) which channel and recirculate the air.

Plenums are defined as the part of the building which provides pathways for heating/air conditioning, return air or fresh air flow. In most homes, these are called the ductwork and do not contain electrical devices or connections. However, in larger commercial buildings these sometimes do have electrical devices installed. Extending further, many modern facilities use the space above a drop ceiling as a plenum.

Lighting and other devices use the same airspace for their electrical connections. In these cases any release of hazardous gas or other materials could easily be channeled to other work spaces exposing workers to the same dangers previously described.



Selecting the right product.

When human safety is involved, the best decision is to err on the side of safety. Any electrical product, whether it be wire, cable, channels or devices, should be designed of halogen free materials if used in a contained space or airflow situation. Strangely, users often overlook the flexible conduit used in these applications. The conduit and associated fittings must carry the same halogen free properties.

You can never just assume a product is halogen free; “might be,” “probably is” or some other variation are not good substitutes for safety. The only way to insure the product you apply is halogen free is to make sure it clearly labeled and the claims are backed by tests to third party standards. In the case of flexible conduit the standards are IEC 60614-1. These clearly list allowable maximum levels of HCl (the dangerous halogen) and the products ability to sustain combustion once a heat source is removed. In the case of Anaconda SEALTITE, other standards are met. For instance, Navel Engineering Standard (NES) 713 dictate maximum measures of toxicology and NES 711 sets standards for smoke emitted. Going further, the Anaconda SEALTITE is tested against the rigorous gas generation standards laid out in BSS 7239 which has become the standard for railroads and other mass transit specifications.

Let the makers of Anaconda SEALTITE help

Anaconda SEALTITE is available in a number of halogen free configurations. All of these provide the user with protection from the bio-hazards produced when electrical systems are exposed to heat and fire. There are products ranging from 3/8 to 4 inches in size and products designed to withstand extreme temperature ranges. In addition to flexible conduit, Anamet offers FireTech a full line of high temperature silicon coated fiberglass sleeves, tape and wrap which are designed for use as a fire protection system in extreme heat situations. These are once again halogen free.

If your needs are simple and a high quality metal conduit will work in your environment, allow us to offer one more easy solution. Anamet’s line of metal only (both galvanized and stainless) conduit is by its very nature halogen free.



About Anamet Electrical Inc. the makers of Anaconda SEALTITE

Anamet Electrical Inc., is the global leader in offering the highest quality products, superior service and pioneering innovations for flexible liquid-tight electrical wiring conduit and industrial stainless steel stripwound hose markets. Our Anaconda - SEALTITE® brand name is recognized and respected worldwide by customers in multiple markets including electrical distribution, residential commercial and industrial construction, MRO-industrial maintenance and repair, OEMs, government, military shielding, power generation, mass transit, utility, petrochemical, food processing, nuclear power plants and chemical processing.

Anamet's Anaconda - SEALTITE® is recognized for quality innovation, the innovation and quality which competition follows. For more than 100 years, we have utilized our proprietary machinery and process technology to enhance and expand our product lines while effectively meeting our customers' increasing

needs for actual enhanced flexible conduit performance. Our focused solutions emphasize quality and superior performance for our many globally recognized customers.

Delivering the most advanced and strategic solutions for today's demanding marketplace continues to be the driving force behind our expanding product lines. We have earned a reputation for the broadest engineered and the highest quality offering in the flexible liquid-tight electrical wiring conduit market. Our commitment to excellence and dedication to customer satisfaction acts as our vision for the future. Headquartered in Mattoon, Illinois - Anamet respectfully acknowledges our global customer base in making us the world's largest manufacturer and supplier of flexible conduit.

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