THE BEST OF THE WELDING CURRENT©

STOODY
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Index of selected articles from previous issues of the Welding Current©

(Updated to reflect the 2006/2007 Handbook & Catalog)

Gases & Cylinders

Safe Cylinder Handling!

Often referred to as a “Sleeping Giant” compressed gas cylinders pose a variety of hidden dangers. Therefore only properly trained personnel should handle or transport compressed gas cylinders.

1) High pressure compressed gas cylinders have been known to travel, for over a mile [and even to go through brick walls], when the valve on the cylinder has broken off. Cylinder manufacturers provide a safety cap (valve hood), as seen on (pg70), to assist in protecting the valve should the cylinder fall or should something strike the top of the cylinder. For valve protection this cap should remain on the cylinder, when not in use. The cylinder should be restrained from falling at all times. The STOODY WELDING HANDBOOK & CATALOG provides a variety of cylinder storage and handling products (pages 66-69) to keep your cylinders convenient and safe.

2) Never lift a cylinder by it’s cap. In addition to the obvious fact (that the threads could strip and the cap could slip) the collar could also slip off. (The cap screws onto the threaded part of the cylinder collar. This collar is pressed onto the main cylinder body and can loosen and slip.)

   On (pg68) we provide an easy way to move full size cylinders. The NESCO1 cylinder carrier provides an easy way to give cylinders “carry handles”. We now carry the new BOA GRIP, a gas cylinder sling (pg66). Simply “slip on and pull tight” and this ingenious design holds your cylinder in place with urethane gripper bars molded onto a nylon web sling (4” to 15” in diameter & up to 2000 pounds! The part number, of this new product, is #BG400. Cylinder carts are also now available with lifting eyes (pages 67-68). A Dolly w/Stair Climber is also available (pg69).

3) Keep oil & grease from coming into contact with the cylinder.

4) Protect the cylinder from extreme heat or cold, shock, and electric arc.

5) Do not tamper with labels & safety devices.

6) Material Safety Data Sheets are available for all gases.

7) Because of the hazards associated we prefer to deliver, and pick up the required cylinders to your job site. If you wish you can pick up the cylinders at one of our locations. If you choose to transport compressed gas cylinders please comply the following:

a) Properly train the driver in complying with Local, State and federal (DOT) compressed gas transportation requirements. A vehicle with a combined (cylinder & gas) weight of a 1000 pounds or more, of non-poisons, must be properly placarded; the driver must provide proof of proper HAZMAT endorsements on their license, and proper emergency response and shipping papers. Some states require a lower weight threshold for some of the above requirements, such as shipments within California, which additionally require shipping papers on compressed gas shipments of 500 pounds or more.

b) Avoid transporting gas cylinders in cars or vans. (If you must, keep the windows open to maintain ventilation.)

c) Never transport cylinders in enclosed spaces such as a car trunk.

d) Secure the cylinder(s) to the vehicle in a way to prevent movement during transportation.

e) Do not smoke. Keep sparks & flames away (At least 25 feet from the cylinders).

f) Drive directly to your destination. Choose the most direct and safest route. Do not make intermediate stops.

g) Once you have reached your destination, immediately remove the cylinders from your vehicle

h) Acetylene, Propane (type), and Cryogenic gas containers must be transported standing up.

From Cannonballs to Cylinders!

Compressed gas cylinders, as we know them today, have only been around for little more than 100 years. The history of colonial iron manufacturing, and compressed gas cylinders, are synonymous.

William Allen (the founder of Allentown, Pennsylvania), and his partner Joseph Turner, began producing iron as Union Forge in 1742 (a company now known as Taylor-Wharton). Mr. Allen and Mr. Turner later hired Robert Taylor as a bookkeeper, who eventually headed the firm, naming it Taylor Iron & Steel Company. This company, along with other colonial forges, filled the gap for a "consistent supply" of iron. (Shipments from Britain were not always dependable and they became less certain once hostilities began with the king.) This company supported the "call of patriots" by supplying General George Washington's army with cannon balls!

The Revolutionary War's end brought a return to the manufacturing of; shoes for ox, steel rims (for wagon wheels), and other small forgings. By the mid-1800's much of the American requirement for iron & steel was in the railroad industry. Taylor Iron & Steel was producing wheels, axles, and other parts for the railroads. Another company, the William Wharton, Jr. Company was producing track rails and switches for this same industry. It didn't take long before the two decided to join forces, creating the Taylor-Wharton Iron & Steel Co. In 1956 Harrisburg Steel, Heckett Engineering, and Precision Castings, joined with Taylor-Wharton to become Harsco.

Taylor-Wharton has Furnished products in support of U.S. Forces in every major war, including the manufacture of high-carbon cast steel bomb shells, used by the Army and Navy during World War I.

The primary product produced (by the Taylor-Wharton division) throughout the 1900's has been their seamless high-pressure compressed gas cylinder. Their "gas storage" product line was further enhanced, in 1985, when the Taylor-Wharton division was assigned to operate the newly acquired Linde Division of Union Carbide. This acquisition provided the additional manufacturing technology to produce cryogenic [gas in liquid form] storage vessels and equipment (such as Dewars).

An excerpt from "An Open Letter to the Compressed Gas Industry" Taylor-Wharton (Harsco), June 2002;

From the beginning, safety has been the guiding principal in the design, material selection, manufacturing and inspection of high-pressure cylinders. As technical advances were made, the safety of high-pressure cylinders improved. Essentially, there have been four generations of [high-pressure] cylinder technology over the past 100 years.

The first generation ran from 1902 to approximately 1930. Cylinders were made from carbon steel, the principal material for use at that time.

By 1930 the second generation of cylinders, manufactured from intermediate manganese steel, was in use. [The Interstate Commerce Commission (I.C.C.) gave this manufacturing style a designation of "3A". Note: In 1967 the Department of Transportation (D.O.T.), assumed compressed gas regulatory functions from the I.C.C.]

The development of the third generation of cylinders was driven by U.S. military demands for cylinders that would not fragment when ruptured like earlier cylinders. [Into more than two pieces when ruptured by a .50 caliber projectile while the cylinder is filled to its service pressure, a.k.a. Non-Shat.] The result was the development of quenched and tempered chrome molybdenum alloy

steel cylinders designated as "3AA". [Cylinders manufactured prior to 1944 are non-shatterable only if they are so indicated by the manufacturer.]

The fourth generation of cylinders are high strength cylinders manufactured from enhanced alloy steels. These cylinders are currently manufactured under D.O.T. exemptions; such as 'E9421" and "E9909".

Concurrent with cylinder material and technology developments, innovations in the machinery and process employed by the steelmaking industry have further contributed to the enviable safety record of today's cylinders. The progression from the Bessemer converters [a process of creating mild steel, from molten iron, by uniformly lowering the carbon content. This was done by blowing air through pipes in the bottom of the converter] to open-hearth furnaces to present day electric furnaces and BOF's (basic oxygen furnaces) all factored into current, enhanced cylinder composition and design.

Each advance from carbon steel to intermediate manganese steel to the modern chrome-moly alloy steel has resulted in the enhanced toughness of seamless steel cylinder products. In addition to allowing thinner walls, the increased toughness equates to cylinders that exhibit improved flaw tolerance and fracture performance. For example, an antiquated carbon steel cylinder may fragment on failure as opposed to the predictable "leak before break" attribute of a modern chrome-moly cylinder. Decades of advancements in cylinder design, manufacturing technology and inspection expertise have also contributed to a modern cylinder population with improved fracture performance.
Taylor-Wharton recommends that in the interest of public safety, only seamless high-pressure cylinders employing state-of-the-art technology (third and fourth generations) be used.

As a result, Taylor-Wharton believes that users of the first generation [and most second generation] cylinders should be warned of potential fragmentation hazard associated with those cylinders. SIWS

Luxfer SCBA's a 5-Year Hydro?

Self Contained Breathing Apparatus, carbon composite cylinders, primarily used by Firefighters, have required hyrotesting once every 3 years.

Hydrotesting is a method of verifying that the cylinder is safe for filling & storing the gas it contains. Most compressed gas cylinders are required, by the U.S. Department of Transportation, to undergo this testing. The majority of common steel, or aluminum, cylinders require a new test once every 5 years. See (pg41) part # CYL-SERV-HYD-1 (Military YCYL-SERV-HYD-1)
Composite cylinders came on the scene first (page 578) then carbon composites (in1996). New, thinner cylinder walls required a 3-year retest. See (pg41) part # CYL-SERV-HYD-2 (Military YCYL-SERV-HYD-2) for hydrotest on exemption cylinders.

In addition to creating standards for common cylinder production, the U.S. D.O.T. established exemption class types, to respond to demand as cylinders evolve. Marked on every cylinder, governed by the D.O.T., is a stamping or permanent label telling the standard that the cylinder was manufactured to. A common welding Oxygen cylinder would most likely be stamped with a "DOT3A or DOT3AA" (this is the formula for the cylinder.) The numbers following the 3A or 3AA stamp reveal the pressure at which the cylinder can be filled to. Exemption cylinder markings start with an "E" then are followed with the exemption number, followed by the fill pressure. Most exemptions require a 3-year retest interval. The carbon composite cylinders manufactured by Luxfer for U.S. (having an exemption number of DOT-E 10915) now have been granted a 5-year retest interval. The life of an exemption cylinder is normally 15-years; this means only 2 retests over the cylinder's life.

Cylinder & Gas Identification.

Have you ever had trouble when ordering a gas cylinder refill?

The STOODY WELDING HANDBOOK & CATALOG assists you with solutions in identifying the correct gas, along with cylinder type & size.

When identifying the type of gas in a cylinder, color alone does not automatically reveal its contents. The gas cylinder content is normally identified with a label applied onto the cylinder (usually on the shoulder) at the time of filling. If the label is missing contact your gas supplier before handling or using.

The Compressed Gas Association (CGA) has provided a "Position Statement" on "Establishing An Industry Standard Color Code for Compressed Gas Cylinders". In there statement they rejected the possibility of a uniform commercial color code, reasoning that color identification of gas cylinders "could create confusion" due issues such as: colors fading, too many different gases (there are over 100 different gases), as well as lighting variables. Government owned cylinders should be painted and marked in accordance with MIL-STD-101B, the Stoody Catalog pages use this standard to help identify requirements.

An added safety plan (in identifying cylinder contents) has been developed by the CGA and recognized by the United States D.O.T., is the "Valve Style". Different hazard classes, and pressure limits are assigned different valve configurations (male, female, left or right hand threads, size variations, or yolk style valves). This is why you cannot connect an acetylene regulator onto an oxygen cylinder, or an industrial oxygen regulator will not fit onto medical "yolk" type cylinder valve.

The CGA has assigned a number system to designate the valve style for the gases contained in cylinders (This number is often stamped on the side of the cylinder valve), The CGA valve style numbers for common industrial gases with

filling pressures of 3000 psi or less (250 psi for acetylene & 500 psi for liquid Fuel gases) are:

GAS TYPE	CGA #
Acetylene (MC)	200
Acetylene (B)	520
Acetylene (POL)	510
Acetylene (COM)	300
Air (Breathable)	346
Argon	580
Carbon Dioxide	320
Helium	580
Hydrogen	350
Liquid Fuel Gases	510
Mixes (Inert Based)	580
Nitrogen (Oil Free)	580
Nitrogen (Oil Tolerant)	590
Oxygen	540
Refrigerant Gases	660
Sulfur Hexafluoride	590

Pressures of 3001 to 5500 psi, are:

GAS TYPE	CGA #
Air (Breathable)	347
Argon	680
Helium	680
Nitrogen (Oil Free)	680
Nitrogen (Oil Tolerant)	590

Pressures of 5501 to 7500 psi, are:

GAS TYPE	CGA #
Air (Breathable)	702
Argon	677
Helium	677
Nitrogen (Oil Free)	677

Adaptors are manufactured to allow the ability to join various regulator-to-cylinder combinations. Cylinder adaptors can be used as a temporary solution to connection a regulator onto a cylinder (until the proper permanent connection can be installed). For safety's sake, we limit our product offering to adaptors (page 50) that have the ability only to combine the valves and cylinders of inert gases (on cylinders of 3000 psi or less), such as; argon, nitrogen, helium, carbon dioxide & some mixes. Additionally we provide adaptors for the combinations of the 4 different acetylene valves available in the United States (page 49). For those who require the ability to safely adapt an inert regulator made, to connect onto a cylinder - that is filled to no more than 3000 psi (CGA-580) - onto an inert

cylinder that has a fill pressure of 3500/3600 psi (CGA-680), we offer a "Stem Regulator Adaptor" (part # ST680-580, page 63)

The Size & Pressure of a cylinder can be confusing. The pressure rating provides the proper pressure that a cylinder can be safely filled to, as determined by the D.O.T. (see related article "From cannon balls to cylinders" in this publication, to learn more about the D.O.T. and their manufacturing specifications). This pressure rating "in pounds per square inch" is then stamped onto the shoulder of standard high-pressure cylinders, following the manufacturing specification.

> Example: A cylinder made to contain 2265 psi of gas could be stamped "DOT3AA2265".

If you wish to check your cylinder to see if it is full (use one of the content test gauges on page 65), on gases such as; Air, Argon, Helium, Mixes (Inert), Nitrogen, Oxygen. Remember to consider the temperature of the cylinder. If the Nitrogen test gauge read "2265 psi at 70^0 F (on the above mentioned cylinder) it would mean that your cylinder is full. However, since gas expands - when it gets hot - and shrinks - when it gets cold – a full cylinder reading of 2494 psi would be required (of a cylinder at 110^0 F) and 2046 psi (at 32^0 F). In the STOODY WELDING HANDBOOK & CATALOG the cylinder psi is listed in the far right column, of the corresponding cylinder on that page (such as on page 30) and is given a representative letter such as A, B, etc. The bottom legend, on each applicable page, defines the pressure rating for each letter, For instance: A = 1800 psi, B = 2015 psi, C = 2265, etc.

Some of the gases are filled (and often sold) by content weight such as; Carbon Dioxide, Propane & Other Liquid Fuel Gases, Refrigerants, and Sulfur Hexafluoride. Checking these requires a scale (The contents of Propane & Cryogenic gas vessels can also be check with a level gauge - if your container has one built-in to it). Look for the "Tare Weight" ("TW") stamp on the cylinder valve (or on the shoulder of the cylinder). The numbers following the "TW" are the empty weight of the cylinder in pounds and fractions of pounds (if it is a small cylinder it will be stamped in ounces, and will be followed by a stamp "OZ". Add the content weight (known for that cylinder) to the "TW" to get the total full weight. Place the cylinder on a proper scale and compare.

> Example: If a (50lbs.) cylinder of Carbon Dioxide has a "TW" of 112lbs. Add 112 + 50 = 162lbs.

Your cylinder should weigh 162 pounds, if it is full. At 137 pounds - your 50lbs. Carbon Dioxide cylinder would only be half full.

Fire extinguishers are filled by weight, with the agent, then topped off with a propellant such as: Air, Argon, or Nitrogen. (Except for Carbon Dioxide, which is

only filled by weight). Therefore, to properly check the contents of a fire extinguisher you must check the built-in pressure gauge and weigh the extinguisher as well. Acetylene is a gas that is dissolved into the interior of a cylinder as it is filled. This is done to stabilize the gas contained within the cylinder. Acetylene cylinders are not hollow like other gas containers. They are filled with a porous material that absorbs the Acetylene and other materials, such as acetone. (This is why you do not want to transport, store, or ship an Acetylene cylinder lying down.) Therefore, even though Acetylene cylinders are filled by weight you can check a cylinder (with a content test gauge) to get an approximate idea of whether your cylinder is full or empty.

At 70^0 F an Acetylene cylinder should read approximately 200 psi to register as full.

When identifying a cylinder, it is often helpful to know the diameter and height. Cylinder size often refers to more than the physical dimensions. For gases that are filled by pressure (and Acetylene) they are often sold or (at least identified by) the volume of gas they hold, in cubic feet. This is done by measuring the theoretical water capacity of the cylinder, then converting the water capacity to the gas capacity that the cylinder was meant to contain, at the proper psi. This is why a Nitrogen cylinder, filled to 1800 psi will be sold as a 184 cubic foot cylinder, but one filled to 2265 psi will be sold as a 220 cubic foot cylinder refill.

Liquefied gases, such as those sold in Dewar containers are often sold by the liter or by the cubic foot.

Some gas supply companies have assigned letters for specific cylinder content capacity. The problem with this is that different companies use may use the same letter designation. They may use the same letter, but for a different capacity of cylinder. Ordering one company's "K" size will provide you with a refill of a 200 cubic foot cylinder, while another company's "K" would yield 300 cubic feet.

Ownership - Cylinders are commonly available in three ways:

Rental
Lease
Customer Owned

Rental plans allow you to acquire a cylinder without requiring up front capital. The down side is that you never own the cylinder, and you can only get it refilled from the supplier that owns that cylinder.

Leasing usually requires that you place a large deposit for the cylinder, but then has the negative attributes of the rental plan.

Customer Owned, or Agency owned (though it initially requires a large capitol outlay provides a cap your cylinder expense and provides the ability for any supplier to refill your cylinder. Rental & lease cylinders are often stamped (with the suppliers name) on the neck-ring at the top of the cylinder, just below the cylinder cap. Agencies and companies also stamp their name onto cylinders.

It is illegal to fill a cylinder that is the property of another, without the owner's permission.

Hydrotesting & Requalification - The negative side of owning your own cylinders is that you are responsible for the expense to maintain your cylinder in a fillable condition. Most often this requires you get your cylinder hydrotested, or inspected (once ever five years) to hydrotest standard high-pressure cylinders, and (once every ten years) for an Acetylene cylinder shell inspection. In 2011 Acetylene cylinders will also require an internal filler requalification.

MC-10 Acetylene & the Motorcycle!

You may be wondering just what does an Acetylene cylinder have to do with a motorcycle?

In the early days of biking, the real early days (like around the beginning of the 1900's), the electric generator or alternator had not been perfected yet. One of the hazards of bike riding was the peril of "what to do" if you did not make it to your destination before dusk. The solution came from the mining industries. Before the days of batteries & flashlights, miners seeking a better way "than candles" to illuminate their way, turned to a simple method of creating a flammable gas on demand. On the top of their hat they mounted a small Acetylene generator. At the beginning of their shift a miner would fill his generator with Calcium Carbide powder and water. This would continually generate Acetylene gas. This gas was then directed into the lamp area, lit, and the miner could work now work without having to change candles or worry about a draft.

The Acetylene gas was able to meet other needs, once industry figured out how to safely store this gas in cylinders. One application was; lighting the way for the motorcyclist. A small Acetylene cylinder (about the size of a "throw-away" propane cylinder) was mounted on its side onto the handlebars of the bike.

Thus the "MC" part, of the name MC-10, stands for "motorcycle".

Once in a while we run across one of these old cylinders. They look and work exactly the same way that the new ones do, except for a small gauge that was installed into the bottom of the cylinder. This "Empty/Full" pressure gauge allowed the content level to be visible to the driver. Now, do to its portability, this is one of the two most popular sizes used by the Plumbing/HVAC industry. The other size? The knee high "B-40" (Your right, the "B" was for bus).

CGA info now on web-site!

Some of the technical manuals and position statements (of the Compressed Gas Association) are now accessible on the STOODY web site, under safety. These are posted along with other safety information, such as MSDS's.

Gas Equipment

Do you know the difference between a Check Valve and a Flashback Arrestor?

When installed on Welding & Cutting gas lines, both add to safety. A Check Valve allows the gas, on the line it is installed, to flow in only one chosen direction. If backpressure occurs the Check Valve closes, preventing reverse flow of gas. You would appreciate this if you were to loose pressure by running out of oxygen (during a cutting job.) Without a Check Valve, the positive pressure of the flammable acetylene gas could cause a reverse flow back through the torch, travel back up the oxygen hose, into the oxygen regulator, and end up in the oxygen tank. A recipe for disaster! One piece, and quick connect, brass Check Valves, for torches and regulators, (displayed on pg136-137) are available to be installed between your existing hose and equipment. Since the gas can only flow one way decide, before you buy, whether you wish to install a set at the torch or regulator end of the hose. Look for the "gas direction" arrows on each Check Valve. Flashback Arrestors do exactly what their name implies. A backfire, or flashback, occurs when mixed gases are ignited in the torch, hose, or regulator. This can occur in a variety of scenarios; the torch tip gets plugged or blocked, the equipment gets "starved" for fuel, improper settings, or broken equipment, etc. Properly installed arrestors are designed to stop and quench a backfire, or flashback (at the torch "to protect the operator" and/or at the regulator "to protect the equipment"). Just as with Check Valves be sure to check the gas flow direction arrows, on the arrestors, prior to installation. The Flashback Arrestors (on pg137) include built-in Check Valves, providing a double safety barrier. Now, for added safety, the torch handles contained in the Victor® brand complete Welding & Cutting Outfits (pg101) come standard, from the factory, with Vanguard built-in Flashback Arrestors & Check Valves. Flashback Arrestors & Check Valves are also available for installation on manifold, or pigtail, supplied gas systems. (pages 55-58).

Fire

What is the best type portable Fire Extinguisher for me?

Extinguishers sold & serviced by SIWS are industrial grade and don't have plastic (or nylon) valves. The Badger® brand extinguishers, that we provide, all have metallic valves. Those listed as "standard" provide aluminum valves, handles & levers. A catalog description of "extra" will provide an extinguisher with a nickel plated brass valve, stainless steel handles & levers. (pages 600-

605) The National Fire Protection Agency has provided various classes for extinguishers, rated by the type of fire hazard they extinguish:

A - type is for trash, wood or paper.
B - type is for flammable liquids.
C - type is for electrical equipment.
D - type is for combustible metals, such as magnesium.
K - type is for cooking oils & fats.

So if you require “ABC” protection you’ll require an extinguisher rated for all three of those fire classes. A “BC” only extinguisher would not suffice, since it would not provide protection from a trash, wood or paper fire. Along with the class markings, there is also a size criteria marking. In addition to being “ABC”, a rating of “3A-40B:C” tells you that the volume of extinguishing agent meets, or exceeds, the requirements for the specified size & type of space intended. Example: If the NFPA recommends that you install an extinguisher of a minimum “2A” rating, the rating of “3A” (listed above) would provide more than enough “A” Class protection for ordinary hazard occupancy, with a maximum floor area of 1,500 sq. ft. per unit and maximum travel distance (to the extinguisher) of 75’. “40B” tell that this extinguisher also is “B” rated, for high hazard, and would require a maximum distance of travel of not more than 30’. Since fire itself is a Class “A” or “B” hazard, the extinguisher rating for Class “C” hazards are sized & located on the basis of the Class “A” or “B” hazard. The Class “D” is for a specific risk, so the size and distance requirements are according to the hazard. Class “K” (not to be confused with Purple-K powder agent) is a new class created specifically for fires of cooking oils & fats, so the size and distance requirements are according to the hazard. Though all Class “B” agent will extinguish flammable liquids, it is normally accomplish by discharging powder, or foam, under pressure. If you aren’t careful the discharge pressure can splash (the flammable liquid) accelerating the hazard. Class “K” wet chemical agent is softly dispensed through a diffusing nozzle, minimizing the risk of splash. The benefits and limitations of each agent type is:

Powder (Dry Chemical) Class, Agent, Benefits & Limits

A, B, C - Ammonium Phosphate Base
Benefit - Multi-Purpose for the 3 most common classes of fires.
Limits - Messy discharge cleanup. This agent is designed to melt at 250^0F and produce a clear, thin oxygen-sealing residue. (When being used on Class “A” fires.) Not compatible with food. Can splash liquid flammables.

B, C - Standard - Sodium Bicarbonate Base
Benefit - Agent is made primarily of digestible baking soda. (Easier kitchen cleanup).
Limits - Can splash liquid flammables. Messy discharge powder cleanup.

Purple K - (B, C) - Potassium Bicarbonate Base.
Benefit - Heavy Duty Agent, Ideal for plants & refineries.
Limits - Can splash liquid flammables. Messy discharge cleanup.

D - Sodium Chloride Base
Benefit - Agent is good for metal fires on magnesium, sodium, potassium & their alloys.
Limits – Good for Class "D" fires only

Liquid, Foam or Gas, Class, Agent Benefit & Limits
A - Water (w/anti-freeze, if required)
Benefit - Simply pressurized water, no chemicals, no agent cleanup.
Limits - Good for Class "A" Fires only.

A, B - AR-AFFF Foam (Alcohol Resistant-Aqueous Film Forming Foams) utilize a biodegradable synthetic base. It is more desirable & universal (to use & clean up) rather than the smelly FFFP (Film Forming Fluro-Protein) that is made of organic protein waste, such as chicken feathers, and is not for alcohol fires.
Benefit - When applied correctly, in addition to extinguishing flammable liquids, it can suppress their vapors. Limiting the potential of re-ignition or re-flash. Also assists in cooling.
Limits - For Class "A&B" Fires only.

K - Wet Chemical Agent with a Potassium Acetate Base.
Benefit - Overspray does not splash.
Limits - Cooking oil/fat type fires only.

A, B, C - Halotron 1, Clean Agent replacement for Halon 1211
(BC only rating on 2.5 & 5 lb. Units)
Benefit - No residue to clean.
Limits - Expensive.

B, C - (CO2) Carbon Dioxide Gas.
Benefit - No residue to clean.
Limits - Can cause frost or condensation when discharged.

Q: AR-AFFF was compared to FFFP Foam agents, but what's the difference between AR-AFFF & AFFF?

A: The addition of "AR" defines this Aqueous Film Forming Foam to be "Alcohol Resistant" allowing the agent to be universally applied to Alcohol (polar solvent) & Hydrocarbon based Fuel Fires. Without being "AR" the agent could only be used on fuels of a Hydrocarbon base (pg604). Note: Extinguishers, of one type, cannot be retrofitted with a different type agent.

Q: Can a “K” class extinguisher (pg602) be used when electricity is present?

A: No, the agent can conduct electricity. This class was designed to backup an automatic kitchen hood system, which cuts the power upon discharge, such as the Range Guard® series (pg604). Therefore, if the agent could contact a live electrical circuit, class “K” would not be appropriate. 

Halon - History & Replacements

Halon once the miracle of Fire suppression is now illegal to manufacture is still in use. The Montreal Protocol Agreement listed Halon as one of the outlaw CFC’s. The belief behind the CFC ban was that “the chlorine blend of these gases damaged the earth’s ozone layer”. Those promoting the ban failed to communicate the fact that “just one volcanic explosion spews more of these base gases, into the universe, than mankind has, since the beginning of CFC production”.

If you have a Halon extinguisher, it is okay to use. You can even get your extinguisher refilled, as long as recycled product is available and your unit is still serviceable (pg604).

Cylinder service requirements have been modified for Halon system cylinders, to lessen the chance of loosing gas due to inspections. Halon portable, and system, cylinders contain the appropriate type and weight of Halon, as well as an overcharge of pressurized of dry Nitrogen gas. The first indicator of a small leak is that the pressure gauge will read low, if unattended to, the cylinder contents weight will start to drop. The old requirement was that you had to retest a full Halon 1301 cylinder if the most recent hydro-test date was 12 years old, if discharged 5 years. The new minimum requirements allow full Halon 1301 systems cylinders to remain in service indefinitely, or until discharged. Halon 1301 cylinders still shall not be refilled when the cylinder’s (most recent) hydro-date is more than five years old. You are also required to weigh or check the liquid level of the gas (if you have that type of equipment), and check to verify that the cylinder’s pressure gauge reads within the full range every year. Every 5th year you must weigh the cylinder (not just check the liquid level), and visually inspect the external cylinder, making sure that it meets the requirements as specified in the Compressed Gas Association’s pamphlet C-6, except that the cylinders need not be emptied, the tare weight need only be verified prior to filling, or refilling.

When hydrotesting a full, or partially full, Halon 1301 cylinder, it must be emptied first. The contents must be captured and reclaimed or recycled.

Remember - the requirements have only changed for the Halon gas cylinder portion of the system. There have been no inspection changes on the actuation side of your system. (If your system uses gases such as Carbon Dioxide (CO_2) to actuate.) There were two common types of Halon produced:

1) 1301 - for fire-systems.
2) 1211 - for portable extinguisher use.

With Halon you could extinguish a fire, on or around sensitive equipment, without fearing that the extinguishing agent would further damage the equipment. (As with liquid, foam, or powdered agents.) An appropriate size would allow you to dowse a paper, flammable liquid, or an electrical fire.

There are various options that we can recommend (by application) when replacing Halon 1301, for built-in fire systems, such as; Carbon Dioxide, call or e-mail us to discuss them.

If you don't have a portable Halon 1211 extinguisher, but would like the benefits of a clean agent, then you'll want to acquire a Halotron 1 Fire extinguisher (pg601). Halotron 1 is not as efficient as Halon, so the containers are slightly larger than a comparable Halon. Therefore, only the 11 & 15.5 pound units offer the type "A" (burning paper, wood, trash) rating, along with the "B & C" rating. The 2.5 & 5.5 pound units offer a "B & C" only rating.

Convert from dry chemical to AFFF!

For quite sometime commercial kitchens have realized, that a foam agent is preferred to a messy powder, when choosing a back-up for a hood installed automatic fire extinguishing system (APC). Class type "K" was created to meet this non-splashing commercial requirement (part #WC250, pg602).

The Naval Research Laboratory that has shown AFFF has performed now testing & (Alcohol Resistant) AR-AFFF portable Foam Fire extinguishers to be appropriate, as a back up, for combating fires aboard U.S. naval shipboard deep fat/donut fryer hood systems.

The Naval Ships Technical Manual (NSTM), Chapter 555, "Firefighting - Ship", has been changed to reflect this new fire fighting doctrine. NAVSEA is using the Alteration Equivalent to Repair (AER) program to affect this replacement on existing installations.

An AFFF or AR-AFFF portable fire extinguisher (such as the model # F-250 found on page #604) is to be installed near each location where one or more deep fat fryers are grouped, in spaces containing deep fat/donut fryers. The extinguisher is to be mounted (using bracket part # UB-20, page 602) on a bulkhead or support, or if necessary, standing vertically on the deck backed up against the joiner. The installation is to meet the requirements for grade "A" shock. The extinguisher is to be located along the normal path of approach to the fryer location, easily accessible to personnel at the fryer location. It is not to obstruct normal passage. Where a suitable location is not available inside the space, the extinguisher may be located outside and next to the normal access (to

the space that leads most directly to the fryer location). Once installed the dry chemical extinguisher may be removed, or may be left in place.

If you have existing AFFF foam extinguishers to be serviced (military use part number YCYL-SERV-AFFF, page 604) or (commercial use part number CYL-SERV-AFFF, page 549).

Fireside Chat

Signs of the times!

Fire & Plague Insurance as first offered in Iceland in 1152. Little else is known about this particular form of "insurance bundling". However, we can suppose, by modern day standards, that it addressed the two greatest dangers to a person in the 12th century. In 1752, exactly six hundred years later, colonial insurance companies financed local fire departments. A company's fire sign or "fire mark", mounted on your building, would insure that the insurance-sponsored fire brigade would attempt to extinguish your flaming house. Amazingly, if they did not see their fire sign on your house, they would let it burn! Now fire signs are thought of as directional or instructional, such as the self-illuminating photoluminescent extinguisher location signs listed on (pg607).

Fire Watch!

Roman Emperor Augustus established the first recorded fire department in history; by 24 B.C., citizens of Rome were enjoying the protection of the fire "Watchmen". When you are welding, sparks can fly as far as 35', so if combustibles are within 35' or less, it is recommended that you provide an assistant (to stand as "Fire Watch".) Even if your job doesn't require a "Fire Watch, a proper extinguisher must be at hand. The most common, general-purpose extinguisher is the 5-pound "ABC"(class) extinguisher, part number 5MB-6H, found on (pg601). When a "BC" class will do, the lightweight (10 pound net) aluminum Carbon Dioxide extinguisher, part number B10V, (pg602) is the favorite, since this gas agent, does not require cleanup. Remember, combustible metals, such as magnesium, require class "D" (pg601).

Hot Dog, the Dalmatian

A Firefighter's best friend- the modern day Dalmatian, named for its origins in the Dalmatia province of Austria, is often called the Fire House Dog. Though a variety of breeds have assisted Firefighters with chores, as simple as, protecting the wagon horses, assuring that the equipment would be available and ready, when needed. In the early 1800's, a Firehouse in London touted a Dalmatian as it's mascot; the tradition, of the Dalmatian as a Firehouse pet, spread to America by the late 19th century. Long before then, the ancient Egyptians tapped into this breed's affinity for

traveling at brisk speeds. Hieroglyphics, almost four millenniums old, reveal spotted dogs trotting along side carriages and chariots.

Be sure that your equipment is available and ready, should you require it, with the extinguisher cabinets, covers & locks (pg607). The Break Rite series of cabinets are supplied, standard, with tempered safety glass and a non-removable, injury reducing, pull handle (that eliminates the need for a hammer or a breaker bar). SIWS

Technical Foul!

Prior to 1967, General Fire Extinguisher Corporation (now out of business) stamped the required markings onto the side of some of the Carbon Dioxide fire extinguisher cylinders they manufactured (instead of the shoulder, as regulated by law).

According to D.O.T., regulation number 49CFR §173.34(c)(1) states, "No indentation may be made on the side wall of the cylinder unless specifically permitted in the applicable specification." The specifications for manufacturing high-pressure cylinders "3A" and "3AA" do not provide any provision for "side stamping". Therefore, any cylinders manufactured to the above specifications that are stamped on the sidewall should not be retested or refilled. They must be removed, from service and condemned, even if they have passed a pressure test.

This includes sidewall stamping that may have been imprinted by the manufacturer, customer, or even a misplaced requalification stamp from a hydrotest facility. SIWS

Safety

Eye Protection

One of the key components, to your safety arsenal, is the lens that provides eye protection. For this article we have split eye safety into four categories of protection:

Impact
Splash
Ultraviolet (UV)
Infrared (IR)

Moderate Impact protection, from flying debris, is your first line of defense, in eye protection, for employees and visitors alike. Though inches from disaster, spectacles (safety glasses) with side shields and impact resistant lenses, will assist to keep your eyes safe. The look of safety, in a 1950's Metal Shop class, didn't change much until the late 80's. Black frames (offering three basic side-shield options; solid, perforated, or metal screen) with 48mm heat-treated glass lenses of various shades were the basic offering. The glass lens provided only

light impact protection. A small scratch or abrasion, on the lens surface, could greatly diminish the impact resistance ability, and since the lens material was of glass the lens could then fragment. There is “no glass” in our safety glasses.

During the 80’s, plastics with greater optical clarity were developed. Polycarbonate lenses, now the standard (pg569 & 570), provide moderate impact resistance and the ability to add style. These days, with all of the different styles, it is often hard to tell whether someone is wearing sunglasses or safety spectacles. To insure that your spectacles are impact resistant, always look for the ANSI marking of “Z87.1”, to be permanently marked on your spectacles. This “operator appeal” has helped in reducing eye injures, since a worker may be more likely to be wearing their safety spectacles when disaster strikes. Safety spectacles do not provide unlimited eye protection. To maximize protection, be sure that the lenses fit snugly around your eyes. Lens angle adjustment are available (through extending or reducing the temple arms) on the; CUDASpree® Series, Harley-Davidson® 100 & 600 Series, Crews Tomahawk® Bifocal Series, Uvex Astrospec® Flip & Flashback Series, and the 48mm Series. Lens inclination adjustments are provided on the Crews Tomahawk® Bifocal Series, Uvex Flip® & Flashback® Series, Crews Winchester® Series. If you require prescription glasses while working, the Uvex Ultraspec® OTG & Guest-Guard® visitor spectacle will fit over most prescription glasses, providing moderate impact protection. For those who still haven’t left the 50’s, we still provide a 48mm spectacle series (pg570), in basic black, now with polycarbonate lenses. Full or bifocal safety glasses are now available in diopters +1.00 through +2.50 (up to +3.00 for full lens).

Goggles, (pg568) with frames made of see-through vinyl and a one-piece polycarbonate lens designed for light impact, are normally secured to the head by an elastic strap. Venting is accomplished either through: 1) Direct vent with perforated holes, providing comfort through maximum airflow. 2) Indirect vent, or Splash goggles are worn when liquid hazards are present, providing airflow through vent caps that protect against dust or liquids. Full-face impact protection is also available with a face shield/visor (pg568), ANSI requires that you also wear a pair of spectacles or impact goggles. Splash protection from liquids can be provided through indirect vent splash goggles or face shields.

All shaded spectacles listed in the Stoody Catalog provide ultraviolet radiation protection. Amber, vermillion, light green, gray (smoke), or mirror tints, are available on various spectacles. Light & dark green tints, for outdoor sun protection, are also available on vinyl impact goggles and visors, and will not protect against welding radiation. Infrared (IR) light, “the unseen danger”, requires eye & skin exposure protection (when welding). Safety equipment to protect against IR is available in various forms and shades, depending on the hazard type: Gas cutting, welding, brazing & soldering protection is available via spectacles, welding goggles, face-shield visors, or place a low shade lens into a welding helmet. Shade #3 is the lightest shade, listed on the lens chart (pg567)

in the Stoody Catalog, and can be used when soldering, brazing or light oxy-fuel cutting. For “Flash” protection around welding rays it is also recommended that visitors and employees wear shade #3 spectacles or opaque welding goggles, with a minimum shade #3 lens. (If they are present, when someone else is welding or cutting with electricity, and they are not close to, or watching the arc.) Additionally, flash spectacles are recommended under the helmet to protect the weldor. Shade #5 is the most common shade used for gas welding or cutting. Gas welding goggles, listed in the middle of (pg568) are shipped standard with a shade #5 lens. The flip down cobalt blue spectacle lens of part #S214, (pg569) is an alternative for: furnace operators, foundries, aluminum gas welding & glass blowers. Filter lens shade #8 is about the darkest to be used with gas welding equipment.

Filter lens shades #8 to #14 are normally reserved for welding or cutting with electricity. Shade #10 is the most popular for general purpose welding (when an arc is present) therefore, in the Stoody Catalog, when a welding helmet is supplied with a lens; it’s a shade #10. Be sure to verify, with the lens selector chart, for your requirement (pg567). Pick a lens, too dark, and you’ll have trouble seeing your work, get the shade too light, and that night, your eyes will get to meet the “Sandman”, if not sooner. Sometimes an eye solution & lubricant can help ease the pain (part #2465015, pg595), or a cold damp towel & sleep. This should not replace medical assistance. Warning: The lens must state the shade of protection (such as shade #3), or it may be tinted for UV protection only. Do not use welding goggles as your primary protection when welding or cutting with electricity, goggles will not protect your face and neck skin from harmful rays or spatter. Therefore, there is no reason to insert filter lenses, above shade #8, into goggles. Unlike goggles, that only protect the eyes, welding helmets (pages 562-565) also protect the face from harmful rays & molten spatter that is present with the arc processes. (Except the 700 series helmet, that should be used for gas welding or cutting only, since it does not cover enough of the neck & face area.) When an arc is present, a dark filtering lens, of the proper shade, must be installed into a helmet, suitable for arc ray & spatter protection. A hand held shield (part #25000, pg563), supplied with a shade #10 filter lens, can also be used for low amp/spatter welding processes, such as MIG, or for visitors who wish to “watch the arc”. For MIG, there is a convenient lens shield (shade #10) that can be used instead of a welding helmet, and can be mounted on the handle of all MIG guns (Part #MIG-IT, pg233). Filter lenses, for welding goggles & helmets, are most commonly made of heat-treated glass, with standard dimensions of 2” x 4-1/4”. Large lenses with a viewing area of 4-1/2” x 5-1/4” (horizontally) or 5-1/4” x 4-1/2” (vertically) are also available. An optional gold coating, on a filter lens, reflects much of the harmful rays and heat, while redirecting available light, creating more illumination of your work. Gold-coated lens are available in both standard & large lens sizes, made of heat-treated glass (for best optical performance) or polycarbonate allows the weldor’s view to be true color instead of the green tint viewed through regular filter lenses. Do not use glass cover lenses, on gold polycarbonate, small particles of glass can get

between the two lenses and scratch off the gold coating, use a clear resin cover lens or polycarbonate safety plate.

The problem of using a dark filter lens is that “until you create an arc, you cannot see your work”. So you must lift your helmet, or (if your helmet is equipped) you must flip up your filter lens to be able to see. If your timing (of flipping down your helmet or lens) is off, you’ll get the full arc in your face. This risk can be avoided with an automatic darkening helmet (pages 564 & 565), or lens (pg566.) These lenses change (from a light flash protective shade into a dark shade) in a fraction of a second and are available in standard & large sizes. Depending on preference, the liquid crystal lenses are energized by battery or by solar (room & arc light) power. Options (such as: Variable Darkening, Sensitivity Adjustments, Multiple Sensors, Off Delay, and Waterproofing) assure that there is an automatic lens for every welding environment, even underwater! The solar powered Auto-Change lenses are so slim that you can drop them right into your existing helmet.

If you spend a long time “under the hood” you may wish to buy a complete Auto-Darkening helmet such as the 9002V & 9002X Series (pg565). This (variable shade & sensitivity, battery powered) helmet breathes. Four exhaust vents allow exhaled air to vent, without allowing the welding smoke to come in. For weldors who keep their helmet in the down position for prolonged periods of time, this greatly reduces the build-up of carbon dioxide (CO_2). Filtered or Supplied Air versions are also available for this series.

Cheaters (or magnifying lenses) can reduce eyestrain and increase production (pg567). These lenses magnify the view of the weld zone, are in size (some large lens helmet manufacturers provide optional lens adapters to accommodate the 2” x 4-1/4” size) and are available to be inserted into standard welding helmets or goggles. Diopter strengths start at .75 and increase by .25 increments up to 3.50. The clearest view is with the glass style, though more expensive than the lighter, break resistant polycarbonate style.

When wearing a welding helmet (hood) be sure that the clear lens, closest to your eyes, is a safety plate made of polycarbonate (pg567), and not plastic (cast resin) or glass. Clear plastic, or glass, cover plates should only be used to protect the filter lens from spatter. Also, don’t forget your first line of defense; be sure to wear a pair of impact/flash spectacles under your hood. You cannot combine the shades of lenses to create your required final shade. (Example: You have determined that a shade #12 Filter lens is the best shade for your application. If the filter lens (in your welding helmet) is a shade #9, you cannot add the protection (of your shade #3 safety spectacles) to achieve shade #12 protection.) Replace pitted, or scratched, lenses, or safety plates to prevent reduced vision and impact protection. Clean only with mild soap (no solvents) and lukewarm water or with pre-moistened, individually wrapped, towelettes produced specifically for lens care. (Part #S468, pg570)

Q: I have a part #04-0012-31 3M Speedglas® Automatic Darkening Helmet. When I am welding, I can smell smoke [from the weld pool], since this helmet exhausts, is this OK?

A: Remember, this helmet is made with vents, to exhaust carbon dioxide when you exhale, without letting welding smoke back in. Though some of the harmful fumes may also exhaust, this does not provide proper ventilation for the harmful fumes that may work their way around the helmet. OSHA / NIOSH recommends that you properly vent and remove these fumes from your work area or use a (properly rated & worn) respirator. You can find reusable and disposable respirators (on pages 574-577, that will fit under most welding helmets - to remove harmful welding fumes prior to inhaling them. If you wish to have a positive airflow inside your helmet (to help keep the fumes out of the helmet) order a 3M Speedglas® Auto-Change helmet / Adflo® Powered Air Respirator Combo System such as #15-3301-31 (pg565). This system is supplied (standard) with a battery powered filter/blower cartridge (worn on the small of your back) and a connector hose with the Auto-Change helmet. This cartridge collects fresh air from behind you, filters it, then sends this filtered and pressurized air, up the hose and across your face. Combo systems are also available with supplied air. Just run a hose from a low-pressure breathable air source. This system combines the 3M Speedglas® helmet with a Fresh-air II ®supplied air (Temperature Regulating –Warming or Cooling the input air by ± 45°F) system #14-5801-31 (pg565).

To comply within OSHA regulations, emergency eyewash and shower equipment must be installed in close proximity to any location where hazardous materials are handled. As a rule of thumb, the ANSI standard suggests that the distance from the hazardous materials to the emergency equipment not exceed 100 feet or 10 seconds walking time. However, emergency equipment should be located closer to the hazard if particularly injurious chemicals are being handled. In such cases, equipment should be located within 10 to 20 feet of employees. The location, which is selected for emergency equipment, should be free from obstructions and should be accessible from three sides. Users of the equipment should not have to walk around machinery or other obstacles to reach the unit. A gravity flow eye wash unit allows quick installation, since it requires no plumbing. The 6 gallon, FDA green polyethylene portable eye wash station (#90306 on page # 595) will flow for 6 minutes, at a minimum flow rate of .4 gallons per second. This unit is supplied with a bacteriostatic additive so that wash will remain fresh (from bacteria, fungus, algae and acanthanoeba, should you need it. When you mount this, be sure to keep the spray heads approximately 42” from the floor.

Need a Material Safety Data Sheet?

As part of our hazard communication MSDS's are available for all catalog items conveniently marked "MSDS Available", most are accessible on the Stoody Data Base (loaded into your PC via C.D. or down loaded from the web-site). To retrieve an MSDS: search the data base, to identify the item (requiring an MSDS), double click (to the far left of that item), the parts detail, for that item, will appear. Click on "MSDS", then "VIEW", if you wish a paper copy, press "PRINT".

An MSDS is part of the "right to know" in understanding the hazards of a particular product (and how to handle, use, and store it.) The information in MSDS's & Emergency Response Guides can assist in you in preparing your total Hazardous Materials Plan, however they are not a substitute for your plan. Consumer distributions of consumer chemicals (or quantities) are exempt from an MSDS requirement. For this article we will be exploring the American National Standards Institute (ANSI) format version, though we're provided MSDS's, to forward to you, in various layouts &Formats. ANSI formatted MSDS's contain the following sections:

The first section of an MSDS provides the identity of the chemical by: product name, chemical name, chemical family, formula, synonyms, hazard rating, usage, manufacturers name, address, and phone number, including an emergency phone number.

The Second section tells the composition and percentage of ingredients, including; the Chemical
Abstracts Service (CAS) number for each ingredient that contributes to the hazard, and the Permissible Exposure Limits (PEL's), as per OSHA, Threshold Limiting Values (TLV) or Time Weighted Average (TWA).

The Third section illuminates the hazard identifications, starting with an emergency overview, describing the immediate hazards for emergency responders. Then the potential heath effects are explored, such as; The routes of exposure (inhalation, eye, skin, ingestion), chronic effects, aggravated medical conditions & other effects of overexposure, and carcinogenicity.

Fourth provides instruction for first aid treatments on the previously mentioned routes of exposure, including any special notes to a physician.

Section Five - "Fire Fighting Measures" identifies the fire and/or explosive properties of the product (flash point, flammable limits in air, extinguishing media, special fire fighting instructions, and unusual fire/explosion hazards. It also includes any hazardous combustion products, or presents any other sensitivity such as static discharge & mechanical impact).

The Sixth section - tells the steps to be taken, by trained emergency responders, if the material is released or spilled (distinguished by large or small releases),

including containment techniques, cleanup procedures, and should list any required specialized equipment.

Handling & Storage, listed Seventh - is where you can find out if the material requires any special handling, such as ventilation, frostbite prevention, acceptable angles of storage, confined space permissibility, etc.

Eight lets you know what are the engineering controls, like building ventilation requirements, and recommended personal protective equipment. A distinction is made, if there is one, between routine work and emergency response.

Nine avails the reader of the possible physical & chemical properties: molecular weight, boiling point, specific gravity, freezing/melting point, vapor pressure, density, evaporation rate, solubility in water, expansion ratio, pH, appearance, odor, physical state, co-efficiency of water/oil distribution, and odor threshold.

Number Ten - tell of any stability and/or reactivity concerns.

The toxicological information is shared in section Eleven - (irritancy, reproductive affects, teratogenicity, synergistic materials, sensitization to material, and mutagenicity.

Section Twelve - provides the warning of any possible ecological concerns resulting in the release of the material.

Thirteen will tell you the waste disposal methods for the material.

Transportation information is in section Fourteen - sharing: the hazardous materials shipping name, class, identification number (UN), placard information, and any additional or special shipping information.

Regulatory information, number Fifteen - list the known regulations concerning this material.

Sixteen is reserved for any other information the may be useful.

As part of our hazard communication, MSDS's are available for all catalog items conveniently marked "MSDS Available". Most are accessible on the Stoody Data Base (loaded into your PC via C.D., or down loaded from the web-site). To retrieve an MSDS: search the database, to identify the item (requiring an MSDS), double click (to the far left of that item), the parts detail, for that item, will appear. Click on "MSDS", then "VIEW", if you wish a paper copy, press "PRINT".

Leather, Cotton, or KEVLAR®?

One of the key components, in your defense on safety, is your apparel. In this article we will be exploring safety wear, to protect your arms, legs & body during

the welding or cutting process. Comfort is an important consideration “a relaxed weldor, is a good weldor.” Therefore, we provide a variety of clothing styles & materials to accomplish varied goals (see pg595 & 596): Leather (normally cowhide *for general purpose* or pigskin *for less weight*) is the most common protective choice “when metal crosses the arc”, or when, splashing molten metal (slag) is common to the process. Leather yields the highest protection barrier. The down side, of leather, is that it weighs more than the other materials and it does not breathe.

Fire resistant cotton should only be used when minimal or light spatter is present. (Spatter refers to a molten metal mist that rises from the welding, gouging or cutting pool.) Fire resistant is not fire proof. Fire resistant breathable cotton material is lightweight (adding to the operator’s comfort.) The green color of the fabric absorbs, rather than reflects, high intensity arc rays. (Other colors are available, contact us for info.) This is especially important when applying the T.I.G. or M.I.G. process (see pg151 for process definitions) on reflective metals such as Stainless Steel or Aluminum. Infrared arc rays are much stronger than Ultraviolet sunrays, so be sure to keep all exposed skin buttoned up. Those, who didn’t button up, all to well understand the meaning of “weldor’s freckles” at the base of their neck. Now Hybrid apparel is available, combining the best of spatter protection (with leather sleeves) with the comfort of a cotton body. KEVLAR® (a material originally designed for radial tires) is lightweight like cotton, yet can protect against molten metal splash. Worn alone it can loose its shape and sag. Therefore, it is not often worn alone as a garment, but used to reinforce other materials such as thread to sew our leather apparel, or as a slip-on sleeve to protect the forearm from sparks, burns, cuts and abrasions. This KEVLAR® sleeve can be used alone, when a low spatter hazard exist, or worn in conjunction with other apparel, as an added barrier from molten metal. (part #KK18S, pg595). The hazard type should direct the style or type (leather or cotton) of apparel chosen: A Full Jacket protects your arms, neck; you’re front & back. A Cape Sleeve w/Bib yields freer arm movement while covering the same areas as a jacket, except your back. So if there is a possibility of spatter (or more) going down your back, better stay with a jacket. Sleeves only cover your arms and are sold in pairs (except the KEVLAR®, which is sold each) fire resistant cotton is available with either; shoulder straps, or with elastic on both ends. Aprons hang off of the neck and are available with a squared bottom (bib style), or split leg (chap style.) Pants are also available. High top non-fabric shoes should be worn. Additionally, leather barriers over your shoes are called Spats, (sold in pairs part #UB625, pg595), Small leather Bibs, with clips, hook onto the bottom of your welding helmet to provide further protection of your neck area (part #HB, pg595), for sever molten metal, a full leather welding Helmet is available w/flip lens (part #860P, pg562). Contact us if you require extreme temperature clothing such as is used in foundry or fire fighting work.

Tools

The METABO…

…line of power tools, featured on catalog pages (pg472-492) Featured on catalog pages (pg472-492) reflects our goal of *"Providing The Finest Professional Grade"* of tools, gases, supplies & services (to you) at the *"Best Total Acquisition & Life-Cycle Cost".*

Take, for instance, the 4-1/2 inch Quick Grinder (part #00715, pg487) at a weight of 4.8 lb. it provides 21 inch pounds of maximum torque, operates on 120 volts AC (or occasional DC), offers 8.0 amps and 900 watts of double insulated power, with a no-load speed of 10,000 rpm and an *S-Automatic Safety Clutch* to protect you and the tool "just in case the wheel jams or hits a major obstruction". This grinder outlasts other common brands, as much as 6 to 1. One of the reasons for this tool's durability is its long lasting, *super-efficient ball & roller bearing motor*. A *Winding Protection Grid* provides the first line of defense that deflects harmful airborne debris away from armature windings. It is further protected, from damage and overheating, by a special winding protection coating that makes it extremely resistant to destructive grinding dust. Those who grind under heavy loads appreciate the *epoxy resin powder coating* on the field coil, which is free of air inclusions. An, easy to change, *Auto-Stop Carbon Brush System* further protects the electronics. The ability to adjust the guard location or to *"Quick" change grinding wheels* (without tools) provides speed & versatility. (Often eliminating the requirement of multiple power tools.) The *contoured handle* reduces operator fatigue, while the safety--thumb--switch helps to prevent accidental startups! Though provided with a grinding wheel for steel, you can support your tool with abrasive products & wire wheels (for multiple finishes) on a variety of materials, from concrete & masonry to aluminum & stainless (pg406-420 & 436-443). You can turn your METABO 4-1/2" angle grinder into a metal cutting machine with Slimcut/Slicer Wheels (part #DCW45A, pg410).

With METABO, cost savings abound. The operational cost of the 9-inch (*Twister 3-position handle*) angle grinder with *tooless guard adjustment* (part #W23-230, pg487) was tested against a top competitor's 9-inch tool. The results, under full-load conditions, showed that METABO's angle grinder removed .036 pounds of stock per minute. The top competitor's grinder, at full load, removed stock at a rate of .021 pounds per minute, giving the METABO tool a performance advantage of 42%! If the tool's user is paid a wage of $10.00 per hour, and the tool is used 4 hours per day for 230 days a year, the labor cost of operation will equal $9,200 per year. By multiplying the cost of operation ($9,200) by METABO's performance advantage (42%) yields the [additional] labor cost savings of $3,864 per year!

Q: When I switch from grinding to cutting (with my 7“ METABO angle grinder), I don’t want to have to stop “to change wheels”, is there a wheel that will both grind & cut?

A: Pipe-Line style abrasives are thinner than regular grinding wheels, so you can turn your grinder on edge, to cut, or hold at an angle to grind. (part #’s 175677 & 175699, pg412).

Reciprocating Saw Cutting Tips.

Many reciprocating saw machines (such as the Metabo Model PSE1200 (part# 01300, pg490) are equipped with an adjustable “shoe”, or stop plate, which is held tightly against the work as the cutting is being performed.

By adjusting this shoe, different parts of the blade can be used. (To spread out the wear across the blade surface.) For instance, if you are cutting a relatively small material like 3/4” pipe using a 6” blade from (page 456), with the shoe in the fully retracted position. Only a small length of blade, near the tang, is used (about an 1-1/8” for the Metabo model.)

The amount of the blade length used is dependent on the stroke length of the machine. After the blade has seen use and begins to dull or break teeth, the shoe can be adjusted out to bring the unused portion of the blade into play.

Preparing pipe, or tubing…

…for an angle joint fit up onto an existing pipe, tube, bar or plate) can be aided by various layout & marking tools. (Shown on pages 548, 550-556) One of the easiest ways to duplicate a shape, for a lateral, is with the Contour Pipe/Tube Gauge by PipeMaster® (pg558). No more complicated math formulas, or wasted time and material (with the “cut & try” method.) Transfer the exact outline of all shapes at any angle, instantly. Available for nominal pipe sizes - from 1” to 6” - and for tubing with Outside Diameters of 3/4” through 6-5/8”. The tempered Stainless Steel (Shape Transfer) Pins are held by a 6063-Aluminum Inner Shell, covered in a rugged ABS Housing.

Welding & Metallurgy

Arc-he-ology; History of Man Through Metalworking - The first Metalworker?

No, It is not Noah, even though God told him to “Make thee an ark [arc].” Actually, the first historic mention of metalworking is found, in the Bible (Genesis 4:22 KJV), as we trace the lineage of Cain. Tubal-Cain, the fourth in the line of Cain’s pre-flood descendants, was recorded to be “An instructor of every artificer [fabricator] in brass & iron.” Though short, his epitaph read much better than his father’s (the first polygamist)! The subject (of brass & iron) has caused some to

challenge the historical accuracy of this verse, since these events occurred prior to the “bronze-age”. It didn’t take much checking to find out that, in Hebrew (the original language of most of the old testament) the word “nechosheth” was used interchangeably for copper, brass, and bronze. Therefore, it can be assumed that he worked with native copper, or a copper ore that may have naturally had an alloying ore in it, such as tin. Unless pre-flood man knew more about metalworking than we realize, we can also assume that the concept of “iron” was really “out of this world.” Archeologists have found that early man used a type of “iron” that was gleaned from fallen meteors. This collectable “iron” was high in nickel and was easily worked.

Basic Electricity & Duty Cycle

Previously we explored the difference between Constant Voltage and Constant Amperage welding power sources. This article will help you to understand some of the other terms commonly thrown about in the welding industry:
Voltage: The measurement of electricity’s ability to travel.

Amperage: A measurement of the strength or force electricity has.

Duty Cycle: The rating of the performance of electrical equipment. For the welding industry, this rating tells us how long a machine can run at a particular setting. A duty cycle rating is provided for a consecutive 10-minute period of time and is read in percentage. A rating of 60% duty cycle means that your welding machine is made to weld for no more than 6 minutes, and will require 4 minutes of resting time. (For every 10-minute cycle.) You cannot save resting cycles (welding for 6 straight hours then resting for 4.) If a manufacturer claims that their machine can yield 250 amperes of welding current, but it is only rated at 10% duty cycle then this tells you that it is a weak machine compared to one that is rated at 40% duty cycle at the same amperage. The Pro-Wave® 185TSW TIG welder’s data on (pg157) shows that it is rated at 40% duty cycle when the output is set at 160 amps, and is 30% at 185 amps.

A typical welding operator is doing good to yield a duty cycle of 40% on Stick & TIG, and 60% on MIG, due to fit up, change of positions, weld preparation & post weld work such as chipping flux or reloading electrodes

Cycles or Hertz: Numbers the times per second that “alternating current” changes from a positive to negative state. In the U.S. we have standardized on 60 cycles per second (known as Hertz). This is why city lights tend to flicker when you look at them from a mountaintop.

Inverter type welding machines (pages 154-158, 161-162, 268) take standard 60-cycle power, then immediately step up the cycles into high cycles. This high cycle power is then converted into controllable welding power.

Converting power at high cycles is more efficient. Traditional welders waste energy through the loss of heat, due to resistance. Inverted power is converted more efficiently; therefore the loss of power, through heat resistance, is minimized, allowing the machines to be much smaller.

Poor Man's Metal Identification Tests!

When attempting a repair, the first step (in understanding how to weld something) is to identify what type of metal it is. Laboratory equipment can often be complex and expensive. When ever possible, try to find out (from the original manufacturer of the part) what kind of metal it is, and what are the recommended welding procedures. When you can't find out, from the manufacturer, here are a few test (you can do) to help identify common metals, without breaking the bank:

Visual - What color & texture is it? (A porous texture, on a break, often shows a casting.) Does it rust? What service is the material being used for? (Structural, corrosive, pressurized?) What kind of part is it? (A spring, a shear blade, a manifold, or...?) If you scratch the thin surface, (or grind thicker coatings) is the material underneath the same? Is the filler metal, on any existing welds, the same color/texture as the base metal?

Example: If you are trying to identify a; porous, magnetic, grey metal, that shows signs of rust, it could be Cast Iron or Cast Steel. Knowing that the service requirement was decorative, and not for structural strength, would lead you to believe that the Casting was of Iron & not Steel.

Magnetic Permeability - After removing any surface corrosion or coatings, does a magnet stick firmly, lightly, or not at all? Is the filler metal, on any existing welds, magnetic? Non-ferrous metals contain little or no iron. Steels are; alloys of iron and carbon, with modest quantities of manganese, silicon & other trace elements. Manipulating the ratio of the components will change the ferrite level of the steel. Other elements are added to the mix, yielding various specific properties such are; Chromium (at least 11-1/2% for Stainless), Nickel, Molybdenum, etc. Steel with a higher ferrite level is normally more magnetic than steels with lower ferrite structure. (Such as fully "Austenitic" [containing Iron but non-magnetic] types of Stainless Steels) Common magnetic metals are: Cast Iron, Cast Steel, Alloyed/Low-Alloy Steels, Mild & Carbon Steels, and some Stainless Steels (312 & all 400 series.) Some Steels are slightly magnetic due to a low level of ferrite. (Such as with Stainless Steels Types: 308, 309, 316 & 347.) Popular non-magnetic metals are: Gold, Copper, Brass, Bronze, Silver, Nickel, Lead, Cobalt, Manganese, Magnesium, Zinc, Aluminum, Chromium, Tin, Titanium, and some Stainless Steels. (Types: 304, 310, 320 & 330.) (Though non-magnetic, some lower alloyed grades of Austenitic Stainless Steel, such as Type 304, can have magnetism induced by subsequent cold working.)

Spark - When held against a grinding wheel, does the material spark a little, a lot, or not at all? Non-Ferrous metals do not spark. Steel & Cast Steel will give

off a fairly brilliant yellow spark with a long forked tail. Wrought Iron will be the same except the color is more orange or red. White Cast (silver colored and not weldable) & Gray Cast Iron (weldable) also have an orange/red color, however the tail length is much shorter and appears more like thin hair rather than a fork. Not sure? Attain a piece of known material, grind and compare to the unknown.

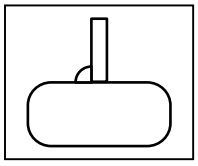
Acid/Flux - Not only etches copper based alloys (so you can view the natural color), it can also tell you if you have a "white metal" with a high level of magnesium in it. Simply drip one drop of any acid type liquid soldering flux (such as Stay-Clean liquid soldering flux, pg376) directly onto the metal. If the material is (or has a high level of) magnesium, the dot will immediately turn black. If the drop remains clear, like water, it is probably another "white metal", such as aluminum or pot-metal.

The File Test - A hand file can be used to identify metals by hardness. A simple file comparison to the Rockwell "C" Hardness Scale is:

Filing Characteristic	**=**	**Rockwell**
The material is easily filed;		Below 30
A file removes little material;		35 - 50
A file glides over material;		Over 50

Common Mild Steel reads a Rockwell hardness of 10, so it can be filed easily, High-carbon Steel (used on springs, dies & railroad ties) is around 40. Most weldable Cast Iron is below 30. A file skips over unweldable White Cast Iron & most Tool Steels (except flame hardened Chrome-Moly at a 48). Most Stainless & Nickel Steels show a reading of 30 and above.

Weld Test - Finally try welding to check for filler metal compatibility, such as on Cast Iron. Using your best choice of filler metal, weld one edge of a test plate (1/4" thick x 2" x 2"), with a fillet weld. (On an area of the base metal that will not be seen and is not structural.) Hit the plate, with a hammer, on the welded side until it breaks. If the plate and weld zone pulls away with some of the base metal, the filler metal you have selected will hold. If the weld metal pulls away from the base metal directly in the fusion zone and the break surface is clean and shiny, the filler metal would not be compatible.



If you still are not sure what to use, one of the Universal Filler Materials in the following list will cover most applications:

Universal Filler Materials

Metal	**Arc/Stick Part #**	**Page #**
Common Steel	80TAC*	341
All Steels	S600*	354

Cast Irons	55*	352
Aluminum	345*	355

T.I.G./M.I.G.

Metal	Part #	Page #
Common Steel	70S6*	379
All Steels	03SMW*	394
Cast Irons	55*/00SIB*	388/392
Aluminum	05356*/04043*	400

Oxy/Fuel Brazing

Metal	Part #	Page #
From Common & Tool Steels, to Cast Irons	17FC*	366
Stainless & Nickel Alloys	56K	370
Aluminum	AFC-18	373
Copper to itself, or to Brass	1562F	369

*Specify diameter or package size.

MIG welding without gas.

Though commercially available in the 1940's, Metal Inert Gas welding was not applied on a large scale until the 1960's. It continued to gain popularity during the 1970's. Operators began to prefer this welding process, to the others, due to the ease at which a bead could be laid and the minimal (or no) post-weld cleanup required. Since a joint could be created (at low heat) base metal distortion was minimized and amperage requirement (for the input power circuit breaker) was reduced. This process increased production output since the weldor didn't have to keep stopping to change electrodes, as required by "stick" welding. This created such concern, that some operators (fearing that their jobs were in jeopardy) actually sabotaged test machines. The MIG process allows you to weld by simply pulling on the trigger of the gun that feeds a small diameter consumable electrode wire from a continuous spool of wire. Bottled gases such as Carbon Dioxide, Argon, Helium, or a mixture of these gases, and others most commonly protects the molten weld puddle.

Variations such as Submerged Arc use powdered flux materials, instead of bottled gas, to protect the weld area and to add additional elements to the molten pool. Combining the speed and convenience of MIG with the freedom from bottled gas provided by Sub-Arc, has lead to another associated process; Flux-

Cored Arc Welding (FCAW), where the flux (instead of being poured on the weld area) is conveniently applied through the melting the consumable wire containing a flux cored center. As with Sub-Arc the melting flux creates a protective gas, and can also add enhancing elements to the molten pool. The down side of FCAW is that the weld deposits generally have a slag covering that requires removal. Since the FCAW wire is tubular, rather than solid, weldors have found that it can be applied using even lower power requirements than MIG. At first these wires were only available in diameters of 1/16" & up.

In the late 80's technology increased allowing the manufacturers to shrink flux-cored wire diameters down to .030". When this happened a small welding revolution started. Up until this time you were required to have 208/220 volts of power to get a decent weld. The "Buzz Box" was the most common welding machine (to have in your garage) prior to the manufacture of small diameter flux-cored wires. This stick welder earned its name from the "buzzing" sound created when welding current passed through its primary transformer (provided that you had enough amps, of 208/220-volt power, to support it). Now, since FCAW it requires no gas, and very little electricity (to melt an .030"/.035" diameter tubular wire), small 120 volt MIG welding machines have become the standard for the garage or light duty welding or installation (see MIG welder part #100038B-001, pg167.) There are machines available (for those who have 208/220-volt, or higher, power), to feed large diameter tubular flux-cored wire offering even greater penetration, when compared to its solid wire counterpart.

Until recently welds with gasless FCAW, small diameter (.030"-.035") wires, were limited to joining carbon or mild steels (pg380). Now, using wire as small as .035" diameter, without bottled gas, you can weld on Stainless Steels & some Tool Steels (pg385). Now you can apply hard-surfacing materials, even with a 120-volt MIG machine! Large areas of hard overlay can be quickly accomplished (to protect materials subject to wear) with the new Ranomatic D .035" diameter tubular gasless Hard Facing wire (pg363).

Note: In addition to the wires above, some FCAW wires, provided in our catalog, require additional bottled gas coverage. These particular filler materials have been specifically created to yield the speed and cleanliness (less smoke & slag) of MIG, with the penetration benefits of FCAW.

Apply Solder with a Syringe.

Another welcome addition from Messer/Eutectic's is their (430^0F) low temperature silver bearing soft solder & flux, mixed into a paste form. For added convenience, this paste is provided in a 1-ounce application syringe. (Part #MG120PS, pg372) Everyone should keep one of these syringes handy. Many small repair jobs can be completed with a simple flame cigarette lighter, or a match. A "Universal Solder." With this solder you can join: Steel, Stainless, Copper & Brass to themselves or to each other. It has a real good color match with Stainless. Since it is "Lead Free" you can use it on drinking water & dairy

systems. Using an electric soldering iron, you can even touchup chipped chrome plating. It's also great for filling pinholes, after silver brazing (if the in-service temperature, of the joint, is low enough).

Turn a nail into a chisel.

If you acquire metal (that's hard) it tends to be brittle, if you acquire metal (that's flexible) it tends to be soft. So goes the age-old problem of hard metals "shattering", when subjected to high impact, and soft metals being useless for impact requirements." The solution is to make the surface, of the soft metal, hard. Throughout history mankind has developed different techniques to accomplish this. During the "copper-age" & the "bronze-age", metals requiring a hard edge, were work-hardened mechanically by hammering. Chemically they found that if they added arsenic, to copper, it became harder, the addition of tin yielded bronze, or zinc produced brass. The Iron Age provided the next advances. When hammering impurities from an iron "bloom" (provided from an ore furnace) B.C. man learned that the edge, of the "bloom" became much harder (when the blacksmith used a charcoal furnace to maintain the temperature between 1475^0F- 2175^0F, while hammering.) While heating the iron in white-hot charcoal, the charcoal yielded carbon. This carbon mixed with the iron (on the surface of the "bloom") resulting in the process of "carburizing" or "steeling" the iron. This steel was ideal for making swords, since the "case hardened" edge was hard, yet the center was soft & flexible. To further increase hardening, this steel was often "quenched" by immediately plunging the hot steel into water (or oil). Today you don't need a blacksmith to "case harden" ferrous metals (metals containing iron). Quick Hard powder (Part #QHARD01, pg365) allows you to simply; Heat the part to cherry red, Coat the part evenly by dipping (small parts) or sprinkling (large parts.), Reheat to a light cherry red, Quench quickly in cold water. Follow these steps and you can transform a soft common nail into a tuff-chiseling tool.

Quick Connectors

Air - Many are familiar with air hose quick connect/disconnect couplers & plugs (pg518-520). The first thing to keep in mind, when deciding which connector to use, is to determine "the shape of the plug fitting" of any existing plugs that you may already have. We supply the four most common styles: Industrial (Hansen style), Automotive (Tru-Flat style), ARO style, and the Lincoln style. Of these: Industrial & Automotive are the most popular. The next step is to determine the diameter of the plug end: 1/4", 3/8", & 1/2" series. If you know that your plug requires a 1/4" series female coupler, but are unsure of the shape, we offer a "Universal Coupler" that accepts: Industrial, Automotive & ARO shaped air plugs (part #'s CG441B or CG440B, pg518). The final step is to determine whether you intend to join (the permanent end of the plug, or coupler, to a hose or attachment) with a threaded, or barbed fitting, and what diameter would that fitting be? If threaded, would you require male or female? We supply two barbed end styles:

a) A regular barb that requires a clamping devise to secure it.

b) Easy-Lock barbs simply plug in and do not require added clamping (But must be used only with Easy-Lock type hose only).

When installing it is normally best to connect the compressed air coupler onto the "supply side" of the regulated airflow, this will cause airflow to stop if the plug end is disconnected.

Oxy/Fuel - Quick connect/disconnect gas couplers have also been around for quite some time, and have added convenience, and safety (with built-in check valves) to gas welding & cutting (pg136). However, you may not realize that this security and convenience (of not having to use a wrench) is also available for inert gases.

Inert Gas - With a standard inert male 5/8"-18 right hand thread on one end and a female, of the same, on the other end, you can quickly connect or disconnect your hose, too or from, your equipment. These inert gas quick connectors are available in two styles depending on whether you wish the plug end to be male, or female, with the opposite on the other coupler end. So if you are connecting an inert hose to your regulator, use part #QDB33. If you are connecting your inert hose to your equipment, use part #QDB34 (pg237)

Water – To convert your water cooler/circulator, from screw-on hose fittings to Quick-Connector type, use Quick-Connect Kit p/n C35QR-W (pg258).

Electrical - Welding current passes too, and from, a welding power source machine, through welding cables. Often these cables are permanently connected to the output side of a power source. For convenience insulated quick-connectors are available for welding cables. This comes in handy if you need to extend cable length, change processes, or simply wish to remove your equipment for lockup. For safety, always turn the power off on your machine, (when making connects or disconnects) and use a female connector on the machine side of a connection, leaving the male for the attachment side. Since most cable connectors have been an after-market item, there are a variety of connector shapes and styles. Over the years, the most popular has been the TWECO® style 2-MBP/MPC series (pg189). The next most common has been the International Dinse (3/8" series) style. (Models LDP-50, 70, 95, pages 189 & 190) For stress relief and older style stud welding systems, the cam●lok style connector has been a standard, due to its heat resistant phenolic insulating cover (pages189 & 190). Adapters are available such as the model # LDA that allows you to plug a Tweco® 2-MBP/MPC style male into a International style 3/8" female, or the model 2-CLC that converts a male 2-MBP/MPC style into the large cam●lok style plug (pg190). If you wish to convert a 1/2", NC thread, "lug" type terminal fitting, on your power source, into a Tweco® style female connector see the (AF, OF, or SF) series terminals (pg188). Some welding machines are supplied, from the factory, with a female quick connector built right into their terminal connections. The most common style (of connectors) on new, industrial grade welding machines is the International Dinse type of fitting. (3/8" diameter

for high amperages, normally with a maximum output of 200 amps and higher. Machines normally below 200 maximum amps often require the 1/4" diameter plug.) POWCON power sources, when in production, used the Tweco® 2-MBP/MPC style connection. Some older Miller machines came standard with a female terminal that required a tapered plug. Light duty machines made or distributed by Century, Solar, Powermate, Snap-on &Forney require a universal style tapered plug that is a little larger than the older Miller taper. (pg189 & 191). The TWECO® brand "C" type ground clamp #GC-600-TMP (pg186) is supplied with a male 2-MBP/MPC style plug to directly twist connect into a female connector.

TIG Torch power cable machine connections can be converted to fit either the Tweco® 2-MBP/MPC style or International (1/4" or 3/8") style receptacle, in both air and water-cooled systems (pg253). On an air-cooled TIG torch, you'll be able to quickly and completely remove, or setup, without wrenches (if installed in combination with an inert gas quick connector).

Repair your TIG Torch by yourself!

Though we provide "Industrial Grade" products to support your real world requirements. Frequent usage can cause your TIG equipment to wear out.

The first step towards getting "the most life" out of your TIG Torch is prevention. Make sure all fittings and connections are tight. On water-cooled torches, be sure that your pump is operating properly and has ample clean coolant fluid, part #57-016 (pg259). Protect your hoses, from abrasion and burn through, with a TIG Cable Covers (as shown on pg252). To further protect water-cooled TIG Torches & cables (pg252) also displays a fuse Block Assembly #260FA (up to 200 amps) or #550FA (up to 550 amps.) Install this fuse in-between your power cable adapter and your water/power torch cable. If you run out of water, or loose cooling for any reason, this fuse link will blow, protecting your torch & cable/hoses.

When required, replacement: water hoses, gas hoses and power cables are available. They are listed by TIG Torch model on the chart provided on (pg259). A #53N04 wire tie is provided when ordering a water-in or gas-in replacement hose (except on replacement hoses for the *Crafter* Series & *FLEX-LOC*® brand torches, these use screw-on fittings.)

With "wear" the copper threads in the interior of your torch may strip. Don't throw it away, order a Head Rebuild Kit #TRK-1 (pg251) to rethread your torch. Kits are also available for rethreading your collet bodies & gas lens collet bodies #TRK-2.

A Liquid Cooled Tungsten Grinder!

Tungsten Electrodes are used, in the TIG process only to transfer the arc from the torch to the base metal. Unlike SMAW (Stick) welding (where the electrode is the filler metal and melts as you weld.)

In TIG welding the electrode is known as “non-consumable” since you add filler metal (if required), to the weld pool separate from the arc. Even though it is called “non-consumable” you will still use up Tungsten Electrodes as you TIG weld. Even under perfect welding conditions the Tungsten eventually wears (from the transfer of electricity and heat to the base metal). Most of us are not perfect weldors, so each time the Tungsten is sharpened or accidentally dipped into the weld pool you loose some of the Tungsten.

When using Direct Current welding power, most applications require that you prepare your tungsten with a point (as shown on pg255). This page also shows how a point can be created by chemical reaction using CHEM-SHARP® #DF-600 (pg256) or you can mechanically grind a point. If you use a bench grinder a medium grit (60 or finer) aluminum oxide wheel is recommended, Bench Grinder (pg494) & abrasive wheels (pg415). Since grinding creates tiny grooves in the Tungsten, be sure to grind longitudinally, never radially (across the wheel). An improperly ground tungsten can cause the arc to spin and wander, making the arc hard to direct and control. The dust from grinding all types of Tungsten is not good to breath. However, Tungsten Electrodes containing thorium also yield a radioactive dust when ground (The most common, general purpose tungsten is 2% Thoriated). The Spannfix® tungsten holder can assist you with this manual grind using a bench grinder.

You can avoid the problems created from radioactive dust by using tungsten combined with alternate ingredients, such as those listed by application, on (pages 255-256) included are the new Ceriated, Zirconiated, Lanthanated, or TRI-MIX Tungsten Electrodes.

Grinding, with an enclosed grinder, also provides protection from tungsten dust. The Handi Grinder®, Piranha II & III® (pg257), enclosed (dry grind) tungsten grinders allow you to keep electrode contamination to a minimum by dedicating a grinder specifically for tungsten electrodes. The tooling allows even unskilled operators to get a repeatable perfect point. The enclosure protects the operator from abrasion and traps the dust.

Now available: the Binzel® Wet Tungsten Grinder #W95-1 (pg257) uses a diamond wheel and cooling solution to create the ultimate point. This enclosed grinding system keeps the Tungsten cool, minimizing the possibility of electrode oxidation while grinding. The dust is captured and contained within the solution, preventing accidental release. This grinding system can handle electrodes from .040” to 5/32”.

Tungsten and The Wolf.

Ever wonder why the symbol for Tungsten is a “W”?
The chart “Symbols of the Elements” at the bottom of (page 16) lists Tungsten as “ Wolfram”, therefore a “W” has been assigned as the symbol.

Wolfram; a name given to this metal by medieval German smelters who found that Tin ores (containing Tungsten) had a much lower yield.

It was said that Tungsten devoured the Tin “like a wolf”. In Swedish, the word “Tungsten” translates into “Heavy Stone”. One of the main challenges “to the advancement of metalworking” had been the ability to create furnaces that were hot enough to melt the elements that the metals were made (or purified) from. Given the fact that it melts at 6170 degrees F., Tungsten has only been useful to civilization in recent history.

Credit for isolating pure Tungsten has been given to two Spanish chemists, the Elhujar brothers, in 1783. Since then Tungsten has helped civilization; from the simple task of illuminating the light bulb (as a filament), to resisting the high temperatures of the space age.

In addition to being the TIG welding “Non-Consumable Electrode” (mentioned previously in this newsletter), Tungsten, when added to other elements (such as Cobalt for “Group 5 Surfacing” as shown on pages 360-361) creates filler or hard surfacing alloys that are more wear resistant, even at extreme temperatures.

Tungsten Carbide, the hardest commercially made material, is produced by adding Carbon to the Tungsten. These carbides are often applied to protect metals from extreme earth abrasion (including coating horseshoes.) Some of the rods, or electrodes, shown on (page 361) use soft metals (such as Iron or Nickel) as a medium to deposit the undissolved particles of Tungsten Carbide onto the material to be protected, yielding a surface of undiluted wear resistance. You can also apply Tungsten Carbide particles (in powder form) with the “Hot Spray” torch on (page 364) or “Cold Spray” torch (page 365). The “Cold Spray” torch is used to minimize the distortion on parts, such a shafts, to be applied when parts are turning on a lathe.

Tungsten Carbide material provides solutions found in other catalog products such as:

On Saw Blade cutting edges a coated with Tungsten Carbide grit allows you to cut materials that other blades can’t. These blades are available for; Hole Saws (pg452), Jig Saws (pg455), Reciprocating Saws (pg456), Band Saws (pages 463 & 466) & Hack or Rod Saws (pg535).

Rotary Files, or Burrs (pages 433-435), made of Tungsten Carbide, out perform and outlast those made of High Speed Steel, many times over.

Carbide Tipped drill bits (pages 447, 449-450) combine the yield strength of steel with the cutting benefits of Tungsten Carbide.

The tip of the Part # TS810C Scribe (pg559) allows you to scratch a mark into various metals & materials.

MIG Welding Aluminum?

Aluminum is easy to weld, if you Prepare and have the "Proper Tools"
Years ago, my welding instructor shared two basic rules to achieve a good weld:

> *"Take the time for safety, to prepare your equipment, and the area you are going to weld"*
>
> and
>
> *"A good weldor is a lazy weldor, he [or she] will take the time to get comfortable and will find ways to support his body, arms, and hands."*

Though aluminum can be joined by a variety of other common welding processes (Oxy-Fuel, Stick, Plasma, or TIG), MIG is the easiest to apply. The MIG welding process, originally developed in the 1940's, transfers molten material at the arc (by using a drive motor to feed a thin wire filler material) from a spool and through a gun. The wire is then electrically energized with the proper volt/amp setting prior to exiting the gun (at the contact tip).

Stick & TIG welders are Constant Current (Amperage) AC and/or DC. Most MIG welders provide Constant Potential (Voltage) DC. The difference is in the way that the machine transforms input power into controllable welding power.
A Constant Amperage machine allows you to adjust the output with the amperage controls on the machine. Basically, the welding amperage stays were you set it, while the voltage fluctuates with the welding variables such: as arc length, speed, angle, etc....

Most MIG welders are Constant Voltage. The primary controls, on the power source, read in voltage. Therefore, when you weld the voltage will remain constant (while the amperage can fluctuate with: wire speed, arc length, angle, etc.) Portable MIG welding power sources usually come standard with a built-in wire feeding system and gun (pg167).

Battery Powered MIG Welders are now available. The Ready Welder II® complete systems are about the size of a cordless drill and clamp on to 2 each 12-Volt batteries. This cordless welding system feeds both flux-cored and gas-assisted (1lb or 2lb) spools. This allows for instant repairs and installations (even on aluminum); no set-up time and no additional power source required (part #10000 pg69). Model #10000ADP can also be connected to an existing welding machine should the portability of (battery power) not be required. Polarity indicator lights, on the gun, tell you whether you are properly connected for Flux-

Cored (Gasless) or regular Gas-Assisted MIG welding. With Gas-Assisted, you'll need to supply shield gas & a flowmeter.

Industrial MIG systems are often sold by individual component, to fit each application:

Electric Power Source (pages 161-163,170)
Engine Driven Power Source (pages 164-165)

Push Feeders (pages 163-165)
Push/Pull Feeders (pg166)

Feeder Guns & Controls (pages 166-167,170-176)
Guns, General MIG (pages 219-224)
Guns, Self-Shielded Flux Cored (pages 211-212)

MIG welders, both portable & industrial, that were originally designed to run steel filler wire, can be converted to run aluminum wire (if it has a high enough amperage output and duty cycle (60%, or higher, at the recommended amperage.) See settings for aluminum MIG welding on (pg396). Though you will have to change gas to: Argon, Helium, or a mixture of the two, the conversion primarily focuses on the feed system. A typical wire feeding system requires that the feeder push a thin wire down the center of a gun cable (up to 25' from the point of entry.) This works well when pushing wires that have high column strength, such as mild steel. However, trying to push a thin soft wire made of aluminum *"is like trying to push a string*". Manufactures often provide conversion accessories; such as the #7977943 drive rolls for the Fabricator 131 & 181 (pg168). You will also need a Teflon liner/conduit (to replace the standard steel liner); such as the Tweco® Brand #35TF-40-10 (.030/.035) liner to fit the FABGUN™ supplied on the Fabricator 131 & 181 (pages 219-220). Teflon provides less drag than steel. Some manufacturers provide kits containing drive rollers, liners, and/or aluminum specific tips and gas diffusers.

Though some manufacturers advertise that *"you can weld aluminum"* with a particular push type machine, we don't recommend it! The conversion concept works best in theory. However, in the real world, most people get frustrated (when the wire doesn't consistently feed out of the end of the gun). When the drive motor is turning, but no wire is exiting the end of the gun, a phenomenon known as "bird nesting" often happens, back at the feeder. (This creates a mess of randomly uncoiled wire.)

If I didn't scare you, and you still wish to convert your MIG push type system to aluminum, here are some tips towards reducing feeding problems:

1) Use the gun, with shortest cable length, that you have available.
2) Keep your gun cable straight, no coils, with minimal or no bends.
3) Replace contact tips that show wear, be sure they are installed tight.

4) Replace the Teflon liner frequently (every 5-10 lb. of wire). Remember to remove the Teflon liner, if you change back from aluminum. Don't run steel wires through Teflon liners.
5) Each time, before initiating a new arc, cut the aluminum wire (to the proper stick out length) from the contact tip, and then bend it over. This will help reduce the momentary jarring effect that happens, when the end of the wire hits the base metal, as it initiates the arc.
6) Use the harder alloys of aluminum, such as alloy 5356. The 40XX series contain a high level of silicone, making them soft (pg398).
7) Use the largest diameter of wire that your machine can run. Thicker wires have higher column strength.
8) Use a lighter spool of wire, a 5lb instead of a 10lb. This helps to keep the drag (on the drive rollers) down to a minimum.
9) Remove the oxide layer, from the aluminum material to be welded, by grinding (pg412), using a surface conditioning abrasive product (pg419, 420, 422, 424-429), or use a chemical etching or cleaning solution such as ALUMA ETCH or OX-OFF (pg468). The oxide layer that forms on aluminum acts as a protective skin that makes aluminum harder to weld, if it is not removed.

There are 2 common feeding systems made specifically for aluminum MIG.

Push/Pull Feeders: Use a small drive motor in the gun, along with a slave motor in the feeder to keep the wire feeding smoothly. These units are costly and require high maintenance, therefore are limited to shop or factory work (pg166).

Spool Guns: Are the most universal, cost effective, and trouble free solution for most shop and fieldwork. The gun is the feeder. A small 1 (or 2) pound aluminum (or other alloy) spool fits into the back end of the gun. The aluminum wire is only required to travel a distance of 6"-12" (from the feeder to the weld) this eliminates feeding problems. Electrical resistance only limits the cable length, from the power source, since the cable from the power source, or remote feeder, is not used as the path for the MIG wire. The spool guns shown on (pg171) are supplied, standard, with 50' cables. The negative aspects are; that the gun is bulkier & heavier than a standard MIG gun, and that you have to replace the aluminum spool of wire more often, due to the 1 (or 2) pound spool limitation.

Some MIG power sources are pre-wired with a receptacle for an optional spool gun. See the Fabricator® 251 (pg167). If you think your existing MIG welder has one of these receptacles, call or e-mail us with your machine model, so we can recommend a gun

For other MIG power sources we choose to offer the *PROFAX* line of spool guns. We have found that the other brands are too delicate and cannot hold up to the "drop test". *Drop some brands once and your "welding days are over".* If your

Constant Voltage type machine is not pre-wired to accept a spool gun, a control box #AEC200-1 (pg175) will be required (in addition to the spool gun). If you prefer a solid-state spool gun & control see (pg176).

The #AEC200-3A "Voltage Sensing" control box (pg174), allows you to convert your DC Stick or TIG constant amperage power source into a Spray Transfer MIG supply source. Spray Transfer MIG is similar to regular Short-Circuit (Droplet) Transfer except it runs a little hotter. See (pg377) for the definition of Spray verses Droplet. Be sure to turn off all high frequency circuits if you connect onto a TIG power source. This controller and spool gun combination stabilizes the voltage by causing the feed motor, to speed up, or to slow down, depending what it senses at the arc.

The other benefit, of this controller, is that it does not require you to provide a brain cable back to the power source. Just connect the box to your positive welding lead, plug into any 115-Volt receptacle, run your gas hose, and your ready to weld. (Even a 1000' from your power source.)

"The newest option in MIG welding aluminum, or other metals [including Stainless Steels], is a ***Self Contained Battery Powered Spool Gun".***

Galvanizing after a repair?

Wonder why your chain link fence doesn't rust easily? Corrals or chain link fences are made of common steel. The difference is in the coating. These products have a zinc "hot dipped galvanized coating". When a welding repair or abrasion takes place the galvanized coating will be removed from that area leaving the steel vulnerable to rust. You can restore the finish with a "cold" galvanizing spray (pg469). These coatings are applied like spray paint and can achieve a dull gray finish (part # SUPCGOD) or a bright zinc (part # S00739) color depending on which you apply. This is more than spray paint - these coatings contain zinc. The benefit of a zinc rich coating is the ability of the coating to "foam over" and regenerating itself over small scrapes, protecting the base metal from exposure long after original application. If you wish to reapply a hot zinc finish (with a torch) sticks of galvanizing compound are also available (part # GLVIZ90, pg469).

Welder or Weldor?

Q: In previous issues, you spelled the word "welder" both "welder" and "weldor", was this a typo?

A: No. To differentiate between a machine that provides welding power, and the person who does the welding, we have chosen to call the person who does the welding "a weldor". This way it is clear when we say: "The weldor is happy with his welder."