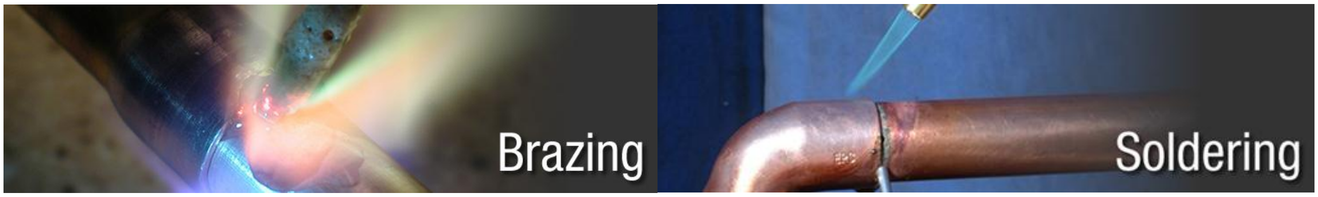
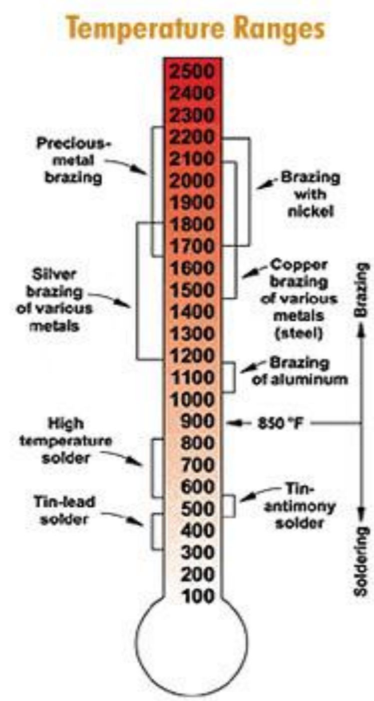
Technical Bulletin

BRAZING & SOLDERING



BRAZING VERSUS SOLDERING



<u>Brazing</u> - The American Welding Society (AWS), defines brazing as a group of joining processes that produce coalescence of materials by heating them to the brazing temperature and by using a filler metal (solder) having a liquidus above 840°F (450°C), and below the solidus of the base metals.

<u>Soldering</u> - Soldering has the same definition as brazing except for the fact that the filler metal used has a liquidus below 840°F (450°C) and below the solidus of the base metals.

HOW BRAZING WORKS

A brazed joint is made in a completely different way from a welded joint. The first big difference is in temperature. Brazing doesn't melt the base metals. So brazing temperatures are invariably lower than the melting points of the base metals and, of course, always significantly lower than welding temperatures for the same base metals. If brazing doesn't fuse the base metals, how does it join them? It joins them by creating a metallurgical bond between the filler metal and the surfaces of the two metals being joined. The principle by which the filler metal is drawn through the joint to create this bond is capillary action. In a brazing operation, you apply heat broadly to the base metals. The filler metal is then brought into contact with the heated parts. It is melted instantly by the heat in the base metals and drawn by capillary action completely through the joint.

Advantages of Brazing and Soldering

Some of the major benefits in the employment of the brazing and soldering techniques for the joining of parts are:

1. Since the brazing and soldering alloys in use have much lower melting points than the metals being joined, the heat source can be much cooler than that required for welding.
2. The parts may be joined permanently or temporarily. Since the base metal is not mutilated, only the application of heat is required to disassemble the joined parts when desired. Thus they can be reused. The joint formed by brazing or soldering is almost as strong as one formed by welding.
3. Consistent and strong joints can be produced that are resistant to liquids and gases.
4. The quality of the joints can be determined simply by a visual inspection, and the defects can be easily rectified. Since low temperatures are involved, distortion of work piece, changes in crystalline structure, and induction of thermal stresses is minimized. The lower temperatures involved increase the speed of joining, and limit the amount of energy required to form the joints.
5. Joints normally have smooth beads that do not require further finishing work.

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PROCEDURES FOR BRAZING PIPE AND TUBING

1. Cut pipe square
   Cut to the exact length required using a tube cutter or hacksaw. If a hacksaw is used, a sawing fixture should also be used to ensure square cuts. Remove all inside and outside burrs with a reamer, file, or other sharp edge scraping tool. If tube is out of round, it should be brought to true dimension and roundness with a sizing tool.
2. Clean tube end and inside surface of fitting
   The joint surface areas should be clean and free from oil, grease, or oxide contamination. Surfaces may be properly cleaned for brazing by brushing with a stainless steel wire brush or by a stiff rubbing with emery cloth or Scotch Brite®. If oil or grease is present, clean with a commercial solvent. Remember to remove small foreign particles such as emery dust, by wiping with a clean dry cloth. The joint surface MUST be clean.
3. Select Brazing Alloy (See Forney Technical Bulletins for Specific Brazing Alloy Information)
   Refer to the Forney® Filler Metal selection chart (under development).
   a. When brazing copper to copper, alloys such as Forney® Super Sil-Flo is recommended. This alloy contains phosphorus and is self- fluxing on copper.
   b. When brazing brass or bronze fittings, Forney® Bare Brass is recommended and RubyFluid® flux is required with this alloy.
   c. When brazing iron, steel or other ferrous metals, select Forney® General Purpose brazing alloy. Do not use phosphorus bearing alloys as the joint may be brittle.
   d. To estimate the amount of brazing alloys needed, see the Forney Estimated Amount of Brazing Alloy chart.
4. Selecting Solder (see Forney Solders Selection Chart)
   a. **Tin-lead 50/50, 40/60, 60/40** meet ASTM B32. With some exceptions, the tin-lead solders can be used to solder copper and most copper alloys, lead, high-nickel alloys, and steel. Tin-lead solders are not recommended in high stress or vibration joints in the cooling industry due to lack of sufficient elongation properties. Heat sources include soldering guns, irons, and torch applications.
   b. **Tin-antimony 95/5** meets ASTM B32. The 95/5 tin-antimony solder is useful for applications where moderately elevated temperature is a factor. It has a higher electrical conductivity and is sometimes used where lead contamination must be avoided. The tin/antimony solders are not recommended for use on brass.
   c. **Flux, tin-lead, and tin-antimony solders**. Both RubyFluid® Paste or Liquid soldering flux is recommended except on electrical or electronic applications which require the use of a non-corrosive flux.
5. Proper Fluxing
   Flux is important because the flux absorbs oxides formed during heating and promotes the flow of filler metal. When using RubyFluid® flux, apply it only with a brush. To prevent excess flux residue inside refrigeration lines, apply a thin layer of flux to only the male tubing. Insert the tube into the fitting and, if possible, revolve the fitting once or twice on the tube to ensure uniform coverage. Fluxing is an essential step in the brazing operation. This is generally true, yet there are a few exceptions to the rule. You can join copper to copper without flux, by using a brazing filler metal specially formulated for the job, such as Sil-Fos. (The phosphorus in these alloys acts as a fluxing agent on copper.)

For optimum soldering results:

1. Remove any oil, grease, or other contaminants from the surface to be soldered.
2. Apply flux to joint by dipping, spraying, dragging, swabbing or brushing to area being soldered.
3. Preheat or air-dry area to be soldered after flux has been applied to activate the flux and yield optimum soldering characteristics and reduce or eliminate spattering.
4. Apply solder, dip part, place torch or iron to area being soldered.
5. Clean flux residues from soldered area using de-ionized, distilled, reverse osmosis (RO), and in some cases tap water heated to a temperature of 60°C±5°C /140°F±10°F for best results. Room temperature water may also be used.

a. **RubyFluid® Soldering & Tinning Flux (Liquid)** is a water-soluble flux formulated for soldering. The flux is a non-fuming, self-cleaning soldering flux. The flux exerts a strong scavenging action to remove oxide coatings and other impurities from the metal surface to produce strong joints. Pre-cleaning is not necessary under most conditions. Ruby Fluid is excellent for use on Copper, Brass, Ferrous Alloys and many more metals. It is not recommended for Aluminum and Magnesium.

RubyFluid may be applied with a brush, swab or by dipping. The flux exhibits the best activity between 95-315°C/200-600°F. Post-solder residues are water-soluble and hot water rinses (140°F or higher) may be adequate for most applications. To insure complete removal of flux residues, first use water containing 2% HCl followed by as many hot water rinses as necessary. Ruby Fluid should be shaken or stirred prior to use, as some settling of solids may occur.

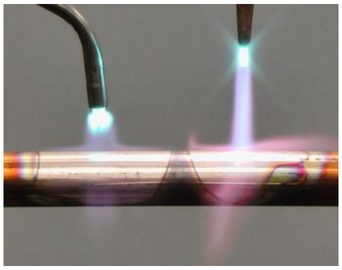
6. <u>Assemble tube and fittings</u>
Insert the fluxed tube end into the fitting. Maintain support to ensure the proper alignment until the brazing alloy solidifies. After brazing maintain support for a few seconds (or more) depending upon the size of the joint area. The assembly is now ready to braze, using brazing alloy in rod, wire, or in coil form manually fed into the joint.
7. <u>Gas Torches Used For Brazing & Soldering</u>
Commonly a gas torch is used to braze or solder with three (3) types of torches being available to achieve the desired results. However, each of these processes has certain benefits and limitations that must be considered. Each process requires the use of regulators, hoses, torch handles and tips, but components are unique to each type of system.

a. Oxygen/Acetylene
For most brazing jobs using oxygen-acetylene gases, a carburizing (reducing) or neutral flame should be used. The neutral flame has a well-defined inner cone. Avoid an oxidizing flame. Excess acetylene removes surface oxides from the copper. The copper will appear bright rather than having a dull or blackened surface due to an improper oxidizing flame. Requiring oxygen and acetylene cylinders, this process delivers flame temperatures of up 5,400 degrees F.

b. Air/Fuel with Swirl Combustion
Brazing with air/ acetylene torches is a popular alternative to oxygen mixed fuel gas. The fuel gas flow aspirates air into a mixer that contains an internal vane that spins the gas to improve combustion and increase flame temperature. This process requires only an acetylene cylinder since oxygen is swirled into the flame for atmosphere with contains 21% oxygen.

a. If the tank has a delivery pressure gauge set the delivery pressure at 14-15 psi.
b. If the tank has only a contents gauge delivery pressure is preset at the factory so open the regulator adjusting screw all the way by turning it clockwise until it "bottoms".
c. Open the torch valve. Opening about 3/4 of a turn will provide sufficient fuel gas delivery. Do not try to meter pressure, (reducing the flame), by using the torch handle valve. If a higher or lower flame is required change to a different tip size.

c. **Air/Fuel without Swirl Combustion**
For applications where swirl combustion is too much such as soldering.



Flame characteristics and brazing

The fact that an oxygen/acetylene flame has a higher temperature has already been mentioned. The important consideration is not temperature by itself, but how heat is distributed.

In welding or cutting, the oxygen/acetylene-focused flame is necessary because the heat needs to be concentrated at a small point. For brazing, a different mechanism called "capillary action" is required to pull melted brazing alloy into the space between the parts. To achieve uniform capillary action, both parts must be evenly heated before adding rod. This broad preheat promotes heat conduction through the joint and brings both pieces to correct brazing temperature.

Since the highest temperature is focused at the end of the inner cone, if oxygen/acetylene is being used for brazing, the torch must be kept in motion to evenly distribute heat. The torch also needs to be located farther away or the flame intensity will overheat the part—especially troublesome on brass or aluminum.

The swirl air/fuel gas flame is more forgiving. The inner cone can be placed closer to the part and be left there longer with less chance of burn through. The broader flame tends to wrap around the tube/fitting and provides wider heat distribution. Many in the industry feel these features make brazing easier, especially for new technicians.

8. Heating the joint area. Always keep your torch moving with short continuous motion especially when using oxy/acetylene torches to prevent burn through. Swirl torches will tend to bend around the material to be joined.

    1. Start heating the tube, first applying flame at a point just adjacent to the fitting. Work the flame alternately around the tube and fitting until both reach brazing temperature before applying the brazing filler metal.
    2. When a flux is used, it will be a good temperature guide. Continue heating the tube until the flux passes the "bubbling" temperature range and becomes quiet, completely fluid and transparent and has the appearance of clear water.
    3. Direct the flame from the tube to the flange-base of the fitting and heat until the flux that remains in the fitting is also completely fluid.
    4. Sweep the flame back and forth along the axis of the assembled joint, tube, and fitting to get and then maintain uniform heat in both parts.

What do melting point, melting range and working temperature mean?

Brazing Temperature

A strong, safe and durable brazed joint requires that the joining area and the brazing material be heated to the recommended working temperature.

Melting point

Only pure metals and eutectic alloys have a definite melting point. Above this melting point, the material becomes liquid – and remains solid below it.

Melting range

Brazing alloys usually have a melting range (also referred to as melting interval). This melting range is limited at the bottom by the lower melting point – the solidus temperature – and at the top by the upper melting point – the liquidus temperature.

After reaching the solidus temperature, the brazing alloy changes from a solid to a liquid state within the melting range and are completely liquid when it reaches the liquidus temperature.

Working temperature

The working temperature is the lowest surface temperature on the parent metals to be joined at which the brazing alloy moistens. This means that the brazing alloy as well as both of the materials to be joined in the brazing process must at least reach this temperature. The working temperature is always higher than the solidus temperature. It can lie below or above the liquidus temperature or fall with it.

Apply the brazing alloy.
Feed the alloy into the joint between the tube and the fitting. Only after the base metals have been heated to brazing temperatures should the filler metal be added. At that time, the flame may be deflected momentarily to the tip of the filler metal to begin the melting process. Always keep both the fitting and the tube heated by playing the flame over the tube and the fitting as the brazing alloy is drawn into the joint. The brazing alloy will diffuse into and completely fill all joint areas. Do not continue feeding brazing alloy after the joint area is filled. Excess fillets do not improve the quality or the dependability of the brazed joint and is a waste of material.

Do not overheat the joint. Keep fitting and tubing uniformly heated. Feed alloy into joint...the torch flame will help melt the alloy, but the heat of the joint must flow the alloy into capillary.

When making vertical alloy-up joints heat the tube first then apply heat to the fitting. It is important to bring both pieces up to temperature evenly. Keep the flame directed toward the fitting. If the tube is overheated, the brazing alloy may run down the tube rather than into the joint.

When making horizontal joints heat the circumference of the tube first, then apply heat to the fitting. Deciding where to start feeding the alloy will depend on the size of the pipe and operator preference. On large diameter pipe, however, sometimes the best approach is to start at the bottom of the pipe. As the alloy solidifies, it will create a “dam” and help prevent the brazing alloy from running out of the joint as the remainder of the connection is filled. When adding alloy, make sure both the pipe and fitting are up to temperature.

Clean after brazing. All fluxes residues must be removed for inspection and pressure testing. Immediately after the brazing alloy has set, quench or apply a wet brush or swab to crack and remove the flux residues. Use emery cloth or a wire brush if necessary.

To take a brazing joint apart first flux the visible alloy and all adjacent areas of the tube and fitting. Then, heat the joint (tube and fitting) evenly, especially the flange of the fitting. When brazing apply becomes fluid throughout the joint area, the tube can be easily removed. To re-braze the joint, clean the tube end and the inside of the fitting and proceed as directed for making a new brazed joint.

BRAZING AND SOLDERING ALUMINUM
Aluminum can be soldered or brazed if correct procedure is followed. Pre-cleaning is essential to break up the tough aluminum oxide film. Thorough brushing with a stainless steel wire brush is recommended. Most common aluminum alloys such as 1100 and 3003 can be readily soldered or brazed. It should be noted some alloys are difficult to join. Soldering or brazed aluminum to copper or brass is not recommended because:

1. Brazed joints may be brittle
2. Combination of base metals creates a high potential for galvanic corrosion

Aluminum
When brazing copper, phosphorus-copper-silver rods melt at a temperature significantly below the base metal's 1981°F melting point. An industry shift to aluminum coils and other components is being seen. Repairing aluminum is different. The base metal melts at approximately 1200°F, but most filler metals used for aluminum melt just below this temperature, often providing only a 130°F difference.

The lower aluminum-melting temperatures means the heat input must be reduced and focusing the flame on one spot must be avoided. Use oxygen/acetylene with care— the higher flame temperature, especially close to the inner cone, can quickly melt the aluminum tube. Air/acetylene's lower heat input and wider flame pattern often makes this job easier.

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ESTIMATING AMOUNTS OF BRAZING ALLOYS REQUIRED

1. Locate the tube diameter to be joined and the wire size to be used. Where the row and the column intersect is the approximate length (in inches) of alloy required per joint.
2. Multiply the length of the alloy needed per joint by the total number of joints.
3. To convert the total length to pounds or troy ounces, divide by the inches of alloy/lb in row A or the inches of alloy/troy oz in row B.

Tube Diameter	3/64” Wire	1/16” Wire	3/32” Wire	1/8” Wire	Tip Size	Estimated Acetylene Use (CFH)
1/4”	1-1/4”	3/4"			4	6-14
3/8”	1-1/2”	1”			4	6-14
1/2"	2”	1-1/2”	3/4"	7/8”	5	8-18
3/4"	3”	2”	1”	1-1/8”	5	8-18
1”		3”	1-1/2”	1-5/8”	6	10-20
1-1/4”		4”	2”	2-1/2”	6	10-20
1-1/2”			2-1/2”	2-3/4”	7	13-25
2”			3-3/4”	4-1/2”	8	16-32
2-1/2”			6”	7-1/2”	8	16-32
3”			10”	11-1/2”	9	20-37
3-1/2”			12”	13-3/4”	9	20-37
4”			14”	16”	10	24-42
6”			21”	23-3/4”	10	24-42
A -Phos/copper/ silver alloys	1900”	1069”	475”	513”	Inches of alloy/lb.	
B - Silver Brazing alloys	118”	67”	29”		Inches of alloy/troy oz.	

The above figures are approximate and will vary depending on joint clearance, depth, and operator technique.

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BRAZING & SOLDERING TROUBLESHOOTING:
In spite of the suggestions and cautions we have noted, the art of brazing is relatively simple, and the rules are common sense rules. Occasionally, however, things do go wrong, and the brazing process fails to do its job satisfactorily. The check lists below have been prepared to assist in such instances. They are intended to give practical tips on what to try and what to look for.

Problem	Issue	Remedy
If brazing alloy does not flow into the joint, even though it melts and forms a fillet	The outside of the joint is hot, but the inside is not up to brazing temperature.	Review correct heating procedure
		Remember to heat the tube first to conduct heat inside the fitting
	There is a flux breakdown due to excessive heat. If overheated, the flux can become saturated with oxides, and the brazing alloy won't flow	Try using a softer flame and/or applying a heavier coating of flux
If brazing alloy does not wet surfaces but balls up instead of running into the joint	The base metals are not up to brazing temperature, and the alloy has been melted by the torch flame.	Review correct heating procedure
	The joint has been over-heated and the flux is no longer active	Review correct heating procedure
	Base metals have not been properly cleaned	Re-clean the base materials
If brazing alloy flows away from instead of into the joint	Improper heating of the base metals	Make sure fitting is up to temperature and the flame is directed towards the fitting
		Review correct heating procedure
If the filler metal cracks after it solidifies	When brazing dissimilar metals, the different coefficient of expansion may put the filler metal in tension just below the liquidus temperature during cooling	This sometimes occurs in a copper-into-steel joint. The copper expand and contracts at a greater rate than the steel. Brazing alloys are stronger in compression, so a steel-into-copper assembly would help alleviate the problem.
	Brazing steel (or other ferrous metals) with an alloy containing phosphorus can lead to formation of a brittle phosphide prone to cracking	Braze ferrous metals with non-phosphorus content alloys
	Excessive joint clearance can lead to filler metals cracking under stress or vibration	Make sure clearances are held to .002"-.006" at brazing temperature (depending on alloy
	Too rapid quenching can sometime cause cracking	Let joint cool more before washing off flux residue
If joint leaks in service	Improper (uneven) heating of joint. The effect of this is inadequate or incomplete penetration by the filler metal	Review correct heating procedure
	Overheating, causing volatilization of elements (phosphorus, zinc, etc.)	Review correct heating procedure
	Incorrect torch flame adjustment leading to deposition of carbon or causing excessive oxidation	Review correct heating procedure

REPAIR OF LEAKERS
Pinhole leaks in copper-to-copper joints brazed with phosphorus/copper or phosphorus/copper/silver filler metals can often be repaired. If care is taken, you can re-braze the joint with without re-melting the original braze. Be sure to use a carburizing flame.

We DO NOT recommend brazing over joints previously soldered with tin/lead solders. The low melting elements in the solder may prevent proper filler metal/base metal alloying. Pinhole leaks in joints brazed with either the phosphorus or high silver alloys can usually be repaired with Forney® solder. Clean the joint thoroughly before soldering.

MORE ABOUT BRAZING ALLOY SELECTION
Probably the most widely used brazing filler metal is an alloy of copper and phosphorus, often with silver added as a third element. The role of silver in these alloys is often misunderstood.

Both phosphorus and silver have significant effects on the properties of these filler metals. Of the two, however, phosphorus is, by far, the more potent. On average, 1% of phosphorus will lower the liquidus temperature (the point at which the alloy is entirely molten) by 100 to 120°F. On the other hand, 1% of silver will lower this temperature by only 10 to 15°F.

The widespread assumption that the addition of silver to the phosphorus-copper filler metals improves ductility is false. Reducing phosphorus content improves ductility. The fact that adding silver in sufficient quantity to lower the melting range permits the reduction of phosphorus has perpetuated this myth.

Forney® Silver Solder The addition of silver in significant amounts also tends to widen the melting range when phosphorus is reduced. This characteristic enables an operator to fill larger gaps more readily than with the more fluid alloys of just copper and phosphorus.

Silver's high market price has prompted many users to seek braze filler metals with a lower silver content than the traditional 15% silver alloy. An alloy of 6% silver and about 6% phosphorus, our Forney® Silver Solder, is now in high demand in the market. It exhibits similar characteristics as the 15% alloy with almost the same melting range, but at considerably lower cost.

Over the years the industry subsequently introduced phosphorus-copper alloys containing as low as 1% silver, but the benefits of these lower silver alloys are, at best, questionable. Most of these low-silver alloys show very little, if any, benefit over the 0% silver alloys, Forney® Super Sil-Flo. The assumption that they are more ductile is unfounded unless the phosphorus content is reduced.

Users would have a much better idea of how a particular composition works if the identity number were to indicate phosphorus content instead of silver content. The American Welding Society (AWS) has adopted a method in which the numbers designate neither silver nor phosphorus, but refer to an alloy with a specified chemical change. The AWS also urges the industry to adopt the term "brazing filler metal" and tries to avoid the term "silver solder."

While both phosphorus and silver tend to reduce ductility in copper, this is mostly the concern of the producer because these alloys are difficult to manufacture. Users of these filler metals are, or should be, more concerned with the characteristics of the joint. Strong, ductile joints can be made with relatively brittle filler metals if other factors are properly controlled.

Brazing requires that the filler metal flow into a capillary between the two closely aligned base metals to be joined. In the case of phosphorus alloys - these metals are usually copper or brass, and joint integrity is dependent on a number of factors in addition to the choice of filler metal. One of the most important is the design of the joint and the thickness of the capillary. An overlap rather than a butt joint is essential for best results. The filler metal must be compatible with, wet and adhere to the base metal.

The temperature at which the filler metal flows and the skill of the operator in adding filler metal at the proper temperature are important. Proper cleaning of the base metal before brazing and avoiding excess oxidation during heating are contributing factors in joint integrity.

All of the factors that contribute to joint integrity must be properly controlled to assure reliability of a brazed joint.

Intelligent selection of the proper filler metal will yield big dividends in both time and money.

Solders

Forney® Product	Forney Catalog #	Diameters	Package Weights	Solder	Tin (Sb)	Lead (Pb)	Antimony (Sn)	Copper (Cu)	Silver (Ag)	Tensile Strength Psi	Solidus	Melting Temp. Liquidus	Forney® Flux	Applications & Usage Information
				Composition & Properties										
Acid Core Solder Wire	38101	1/8"	1 lb.	Commercial	3.3	94.5	2.2	-	-	6,200		594 °F	Self-Fluxing	General Purpose. For non-electrical applications such as galvanized gutters, sheet metal, and radiator repair. A highly active inorganic acid type of flux (zinc chloride free) for general purpose soldering applications where a flux cored solder wire is desirable. Rapid soldering can be accomplished on all common metals except aluminum and manganese. Acid core solder is particularly useful for soldering excessively oxidized metals. Please be advised that acid core solder is NOT recommended for electrical or electronic soldering applications due to the corrosive nature of the residue.
	38102		1/2 lb.	30/70	30	70	-	-	-	6,140		379 °F		
	38103		1/4 lb.	40/60	40	60	-	-	-	6,320		460 °F		
Rosin Core Solder Wire	38070	1/8"	1 lb.	Commercial	3.3	94.5	2.2	-	-	6,200		594 °F	Self-Fluxing	Electrical repair, non-conductive. A multi-purpose solder. Rosin-core solder is the recommended solder when working with electrical wiring and certain metals, including copper and tin.
	38071	3/32"	1/2 lb.	30/70	30	70	-	-	-			379 °F		
	38072	3/32"	1/4 lb.	40/60	40	60	-	-	-	6,320		460 °F		
	38073	1/16"	1/4 lb.	60/40	60	40	-	-	-	6,400		375 °F		
General Purpose Tinning Solder Wire	38106	1/8"	1 lb.	Commercial	3.3	94.5	2.2	-	-			575 °F		Not suitable for aluminum
	38107		1/2 lb.	30/70	30	70	-	-	-	4,500		461 °F	Ruby Fluid® Liquid or Paste	
	38108		1/4 lb.	40/60	40	60	-	-	-			460 °F		
General Purpose Solder Wire	38109	3/32"	1/4 lb.											General tinning & repair, not suitable for aluminum
	38110	1/8"	1/2 lb.	50/50	50	50	-			6,450		420 °F	Ruby Fluid® Liquid or Paste	
	38111	1/8"	1 lb.											
Lead-Free Solder Wire	38060	1/8"	1/4 lb.							5,900		464 °F	Ruby Fluid® Liquid or Paste	Potable water pipe joints, plumbing, refrigeration, non-electrical. Meets ASTM B32. The 95/5 tin-antimony solder is useful for applications where moderately elevated temperature is a factor. It has a higher electrical conductivity and is sometimes used where lead contamination must be avoided. The tinantimony solders are not recommended for use on brass.
	38061		1/2 lb.											
	38062		1 lb.	95/5	95	-	5							
Flow-Temp Lead-Free	38050	1/8"	1/4 lb.											Potable water pipe joints, plumbing, refrigeration, non-electrical, no
	38051		1/2 lb.	95/4.5/.5	95	-	-	4.5	0.5	6,400		650°F	Ruby Fluid® Liquid or Paste	
	38052		1 lb.											
Self Fluxing Silver Solder	38116								6%	20,000		431 °F	Self-Fluxing	All metals except aluminum, magnesium and zinc die cast, non-toxic