Flux: Various Types & How To Choose

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Types of Flux

Attempting to divide flux materials into corrosive and non-corrosive categories is a misleading and inaccurate method of classification. Every material used as a fluxing agent is corrosive to some degree. It is this corrosiveness that chemically cleans a metal's tarnished surface creating an environment where solder can flow and bond. A more accurate method of classification is to first classify the available fluxes as rosin based or water-soluble and then either organic or inorganic and then determine the various sub-groups or categories of each of these classifications.

Rosin Based fluxes

Organic Materials (Rosin Based):

These fluxes are made from rosin, (the purified product is known as water-white rosin) which is extracted from pinesap. A wide variety of compounds may be added in order to increase the flux's cleaning and deoxidizing abilities. Therefore this classification can be subdivided into three separate groups, as follows:

R (rosin only. This type of flux is the least active and is generally recommended for use on surfaces that are all ready very clean. It is intended for this type of flux to leave virtually no residue behind.

RMA (rosin mildly activated) This type of flux contains activators that have been added in order to enhance its cleaning and deoxidizing abilities. It will leave a minimal amount of inert residue behind. That residue should be non-corrosive, tack free and be substantially free from ionic contamination after cleaning.

RA (rosin activated) This type of flux also contains activators that have been added and is the most aggressive of the rosin-based fluxes. Although it leaves the most residues behind, these residues can be easily removed by using the appropriate type of flux cleaners.

*These flux groups are the only ones specified for mil spec work (*ANSI/IPC-SF-818 Class 3 or Mil-F-14256E*) in electronic applications.*

Water Soluble Fluxes (The flux itself is not water soluble, but the residue that remains after soldering usually is.)

Organic Materials (Non-Rosin Based):

Non-Rosin based fluxes are more active than Rosin Activated fluxes and can be divided into three groups.

Organic Acids These, being organic materials, are temperature-sensitive. They are slow acting, with only a marginal ability to remove tarnishes. They remain corrosive after use and any condensed fumes must be removed. ***Not all are water-soluble and generally organic solvents are used for clean up***. Included in this group of acids are: oleic, stearic, citric, lactic, and others.

Organic Halogens These, being organic materials, are temperature-sensitive. They are fast-acting with good tarnish removing abilities and are used because of the easily available halogen ion. They are more corrosive by comparison than other organic fluxes. Their condensed fumes must be removed. Cleaning should take place immediately after soldering is completed.

Amines & Amides These, being organic materials, are also very temperature-sensitive. Amines are organic derivatives of ammonia, while combining a carboxylic acid and a nitrogen compound (like ammonia) forms amides. This is a group of additives that are used because they do not contain halogens. Derivatives of amines and amides (like aniline phosphate) are also used as fluxing materials.

Inorganic materials:

This type of flux is the most active, aggressive fluxing material of all and can be divided into three groups.

Inorganic Acids These acids, not often used by them selves, are a vital part of inorganic solder-flux combinations. They are fast cleaning materials and will remove all common types of oxidation. They are stable and active at soldering temperatures and are very corrosive before, during and after the soldering process is complete. Their condensed fumes must be removed (generally by using aqueous solutions) or be neutralized. Cleaning should take place immediately after soldering is completed.

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Inorganic Salts. These salts are less dangerous than acids in fluxes. They are fast cleaning materials that become very active when molten and are stable at soldering temperatures. They are not as corrosive when they are in salt form except in humid atmospheres. Their condensed fumes must be removed (most are water-soluble) or neutralized. It could be necessary to soak them in a slightly acidic solution to form soluble complex salts and then continue with normal aqueous rinsing procedures.

Inorganic gases. These gases become chemically active at elevated temperatures. Clean surfaces, free of foreign materials, are required for this type of flux to perform adequately. In addition, special equipment will be required, because of the hazardous nature of this group. This group includes materials like dry hydrogen and hydrogen chloride.

Factors to consider in choosing your Fluxing Agent

Understanding the various types of fluxes available is important. However there are some very specific operating parameters that are also required of flux materials in order to maintain soldering as an economical method of joining metal surfaces. As you evaluate these operating parameters, please remember that they are "intentionally" not being listed in any specific order of priority, because their level of importance may change dramatically from one application to the next.

- **Safety** - When the operating parameters concerning safety are being considered, it is extremely important to remember both personal safety and overall plant safety. Be sure that all individuals involved with the use, or handling of fluxes have been properly educated and instructed to follow all safe handling and operating guidelines as determined by the appropriate governing agencies. It is very important to obtain, read and fully understand; any directions that have been supplied by the manufacturer; the MSDS covering the materials that are in use, and any other literature or documentation that may be available.

  Personal Be sure that all of the necessary safety equipment and materials are provided for and they are being properly used. All work should be done in a safe and properly ventilated area. All operating personnel should be properly trained in whatever method of soldering is being performed. They should also understand and be familiar with the proper handling of all of the materials that are being used during the soldering application and the possible hazards that may be encountered.

  Plant In order to minimize many of the potential risks that may be encountered the flux material you intend to use should be inert to the various materials it might normally be expected to come into contact with during use and should have a high flash point with a sufficient margin for safety. It should also have a slow decomposition rate to prevent the possibility of explosions in the event of overheating.

- **Economics -** When evaluating your total operating costs, you should be considering not only the initial price of the flux, but also the time required for soldering, the cleaning materials that are needed, and any other expenses, that may often outweigh the flux materials cost. Consider also that the more expensive flux may in fact save you more money over time with increased reliability and fewer instances of rework.

- **Time & Temperature –** Time and temperature will often go hand in hand and the requirements of each should be determined and evaluated both separately and together. There may be specific instances where a higher level of heat may be utilized to decrease the amount of time needed to perform the desired soldering application. The faster the intended soldering process takes place, the less time there will be for any excessive heat to travel into unwanted areas. This will help to eliminate the possibility of thermal damage to any temperature sensitive components.

  Time The shortest soldering times possible, without jeopardizing safety, quality or efficiency, are preferred in all applications. This is especially true where there is the possibility of exposing heat sensitive components to longer soldering times, which can be detrimental. The flux that is selected for the application should be one that will rapidly affect the solder system, allowing for the quickest and most efficient method of soldering to take place.

  Temperature It is important to always match the thermal characteristics of the flux to the overall temperature range required for the entire soldering process. The temperature range required is determined by the solder alloy that is being used and also by the method and equipment that are being used, to perform the soldering application. If there are unique considerations that cause a specific flux to be required for the soldering process it may be possible to use the flux outside of its recommended range, provided the flux reaches a temperature high enough to activate its cleaning and deoxidizing function, but not high enough to cause it to breakdown, or deteriorate.

- **Corrosion** - As discussed earlier, every material used as a fluxing agent, is corrosive to some degree. This corrosion must be controlled or the solder joint may be weakened and eventually fail. In electrical connections, the problem may be

magnified because of changes that affect the electrical characteristics, like increased resistance caused by a decrease in the diameter of a conductor. Therefore if the corrosiveness of a flux cannot be controlled or avoided, it becomes necessary to ensure that its products, or byproducts can be easily and adequately removed after the soldering process is completed.

CLICK HERE to view our selection of flux and solder products.

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