

SUBJECT SOLDERING PROCESSES FOR CAPS
AND BASE PINS

SUPERSEDED DATE 12/11/45

Processes for soldering lead wires to contact caps and to base pins are described herein.

1. PRINCIPLE OF SOLDERING

Solder adheres to a metal by combining with it to make an alloy. Solder which is melted to a liquid form is heated to the required temperature to dissolve the surface of the metal, at which time the solder flows onto or wets the metal. The solder and metal must be free of dirt and oxides and it is the function of soldering flux to maintain the clean surface. Certain metal surfaces as nickel plating, aluminum and chromium plating are difficult to solder because they are not readily soluble in tin-lead combinations. The alloy formed by the solder and metal has greater strength than the solder so that a thin solder joint is stronger than a thick one.

2. EQUIPMENT

Automatic cutters such as Model 739-H for shell octal bases, Model 739-G for wafer octal bases and rotary circular cutter on basing machine for regular shell bases.

Hand cutter such as Wiss Co. No. 625 shears.

Acid resistant container for holding fluxing pad.

Felt pads such as made by Aetna Felt Co. Grade*2481S white stock.

Round pads - 1-3/8" in diam. x 1/4" thick with 1/2" hole in center.

Rectangular pads - 3"x2"x1/4" or 2"x1-1/2"x1/4" with 1/2" hole in center.

Gas fired metal soldering pots for base pins about 2-3/4" diam. x 7/8" depth.

To limit depth of pin insertion into solder, pots for bases with lugs are provided with cylindrical stops in which lug fits and pots for bases without lugs are provided with metal strip across top of soldering pot, in which a suitable hole has been drilled. Heating fires for pots must be enclosed on all sides by asbestos sheets.

Suitable acid resistant container for holding water used for removing liquid flux after soldering.

Soldering iron for caps should be a copper rod 1/4" diam. cut off or filed at 45° angle to give a large contact surface which should be tinned with solder before use. Heat rod with a gas-air flame.

3. MATERIALS

33-F-9 Liquid flux is standard for tin, tin-lead and cadmium-zinc solders for all contact cap soldering except that for metal tubes and for all base pin soldering except on regular shell bases and on certain types of tubes such as power or cathode-ray where electrical leakage resulting from liquid flux is a factor. Deviations from this standard, calling for the use of 33-F-11 paste flux will be noted on page 1a of construction notices.

33-S-105 solder is the temporary standard alternate solder for all types of soft solder such as 33-S-3, 13 and 23.

33-S-115 40/60 Cadmium zinc formerly designated as 24-4-4 is standard for cap and base soldering where a hard solder is required for such power tubes that operate at high temperatures. It can be used on tubes where temperature of soldered pins and caps does not rise above 265°C.

33-S-3 a pure tin solder is used at present only on tinning acorn tube leads and certain governmental types where corrosion protection is necessary.

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4. APPLICATION OF FLUX TO PADS

a. Liquid Flux - 33-F-9

Soak pad in liquid flux. Drain off excess flux and place pad into an acid resistant container of a suitable size. There must be no excess flux on pad or in container. Pad must be kept moistened during soldering but no flux must be present which is not absorbed by the pad. Add flux at intervals, as determined by experience, from a corked bottle with a glass spout.

b. Paste Flux - 33-F-11

The paste flux should be applied to a 2" x 3" 1/4" thickness felt pad. Using a knife, the flux is first applied to a pad in thin layers and is worked into it to a depth of about 1/16". At the end of the application any excess paste above the surface of the pad should be removed by scraping lightly with the knife, the idea being to use the paste from within the pad and not from above the surface. Add additional paste to pad in the same manner to replenish paste used during the soldering operation. If there is paste above the surface of the pad an excessive amount of flux will be applied on pins, particularly on the sides, and when this flux is heated by the solder, it will run up on the pins and discolor them when corrosion takes place. If a greater cushioning effect is desired, 1 or 2 pads of the same size may be used as a mounting below the fluxed pad. Pads can be used several days or until they become worn so much that, due to an uneven surface, a uniform amount of flux is not applied to each pin.

Note-Both types of flux are corrosive, the liquid more so than the paste, consequently gloves, hands and working table must be free from flux. If any flux gets on flesh immediately wash off with water.

5. SOLDERS, AND SOLDERING CONDITIONS

	Optimum Temp. Range	Time	Flux
33-S-3 (Sn)	290-300°C	2	33-F-9
33-S-23 60/40 Sn-Pb	250-270°C	3	"
33-S-13 40/60 Sn-Pb	350-370°C	3	"
33-S-105 ST20A	390-410°C	3	"
33-S-115 40/60 Cd-Zn	350-370°C	3	"

→ This flux is standard for all of the above solders, **except for metal tube cap and regular shell base soldering where 33-F-11 is specified. For other deviations from this standard for 33-F-11 (paste flux) or any other flux refer to construction data.

Remarks - Maintain solder temperature within range specified, as lower temperatures slow operation unnecessarily and too much solder is used and higher temperatures cause (1) excessive amount of dross on surface of melted solder, which results in poor soldering, and (2) solder to run out pins due to reduced surface tension.

Only add one piece of solder at a time so as not to lower the temperature of the molten solder too much.

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Remarks - (Cont'd)

When the oxide which forms on surface of the solder becomes so thick that flux will not dissolve it readily as evidenced by poor soldering, it must be removed by skimming. Oxides must be removed more frequently from solders of low tin content than those of high tin content. Save dross for reclaiming.

6. PROCEDURE

A. Cutting Lead Wires

All wires projecting from bases or caps must be cut to within .010" from ends of pins whether cut by hand or mechanical cutters. On inspection after soldering, ends must not protrude thru solder. For Lancaster Only **In case of dumet top leads, the lead should be cut in such a manner that about 2 mm of the lead projects above the top of the depression of the cap.

B. Fluxing and Soldering Procedure

1. Base Pins

Apply flux (liquid or paste) to contact pins by pressing pin ends evenly against pad. This brings ends of pins and a short length on side of pins in contact with flux. To avoid discoloration, an excessive amount of flux should not be applied. Immediately dip pins into solder at proper temperature, keeping pins in solder for length of time as specified in item 4. Base pins should not be dipped into solder any further than necessary to obtain good soldering. Solder should preferably coat pins at ends, i.e., solder must not extend onto the straight side of pins in an amount which will increase diam. of pin more than .008" greater than its center diam. in the case of regular shell bases, and more than .005" in the case of shell octal and wafer octal bases. In the case of bases using the RL832 pin (at present used for certain C.R. and power tubes), the diameter of soldered pin must not be greater than .105".

Good soldering is indicated by flat or concave surface due to solder's shrinking on solidification. At least one-half of the pins in any one base must possess this flat appearance, indicating proper wetting of inside of pin. If solder is considerably concave from an excess, it is difficult to distinguish between holes and good soldering and is objectionable. If solder is convex or rounded it is good only on the tip.

PRECAUTION - When using liquid flux, DO NOT REFLUX HOT PINS for resoldering IMMEDIATELY AFTER THE FIRST ATTEMPT AT SOLDERING.

Allow pins to cool and then resolder. When pins are fluxed while hot, the liquid flux splashes on pins and base, and may cause electrical leakage. This is especially true of tubes that operate at high frequencies (power tubes) and at high voltages (cathode-ray tubes). The more porous the base material the greater is the chance for electrical leakage.

After soldering, dip the pins to a depth of 1/4" in clean water for not less than 5 sec. Quantity of wash water must not be less than 2 liters and must be renewed after every 4 hrs. of use. The latter condition must be rigidly observed when basing power and cathode-ray tubes. A subsequent quick contact of pins with a sponge should be made to remove excess water.

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6. PROCEDURE

B. Fluxing and Soldering Procedure

2. Contact Caps

Heat soldering iron to such a temperature that soldering wire will melt instantaneously. Rub end of solder wire across pad containing liquid flux and touch lead wire in center of contact cap which has previously been positioned directly under end of solder iron and about 3/16" away. In case of dumet leads press the cap against the end of the soldering iron in such a way that the end of the lead is bent down flat against the top cap depression. Press solder wire against solder iron until a sufficient amount of solder has been melted onto cap to give a strong contact. Do not allow to run down the sides of cap. The exact amount will have to be determined from experience. In order to have solder cover the entire cap, press soldered cap lightly against end of soldering iron and work solder over untouched surface by moving cap. Since the cap is not dipped into the flux or pressed against a flux soaked pad, the cap need not be washed after soldering as done when soldering base pins with a liquid flux. Caps need not have well rounded caps for appearance sake. The only criterion to be observed is that electrical contact between cap and lead be of sufficient strength.

Clean soldering iron, when necessary, by immersing end in paste flux for a moment. Occasionally use file to smoothen end but always tin end with solder after cleaning.

7. QUALITY CRITERIA - For Base Pins

* (For types 2E24 and 2E26 only)

- a. Solder must be continuous with no holes.
- b. Soldered pin diameter must not exceed 0.098 inch. Maximum difference between solder diameter and pin 0.003 inch.
- c. Lead wire may protrude through solder only if the protruded lead does not extend beyond end of pin.
- d. Flat or concave soldering of pins is the desired condition. However, convex soldering is acceptable if the height of the solder above end of pin does not exceed 0.020 inch.
- e. Sharp edges or sharp points are acceptable as long as they meet the specifications outlined in items b and d above.
- f. Solder must have no scale or incrustations (embedded dirt). Discoloration to be criticized.
- g. Solder must not extend more than 1.5 mm on outside circumference of pin.

STANDARDIZING SECTION
ENGINEERING DEPT.