**Training & Certification Process:**

1. **Training**  - Training materials are identified as the Procedure (at a minimum) and any supporting workmanship standards as identified by the trainer
2. **Verification of training & Certification** - is documented per completion of training which will signify certification to this process documented per **TA30 Training**
3. **Re-certification** – Accomplished every two years (at a minimum per procedure revision) by review of the procedure and documented per **TA30 Training**
4. **Audit** – as defined per **QA03**

**Procedure:**

### TOOLS & EQUIPMENT

* Tools (i.e. tweezers, scalpels, side cutters, wire cutters) used in Assembly should be, at a minimum, cleaned by wiping with alcohol to prevent contamination during the assembly process.
* Make sure tools are appropriate for the designated job.
* Ensure that tweezers are not bent or broken.
* Ensure cutting tools (i.e. side cutters, scalpel blades) are not dull, nicked, or broken; replace as needed.
* Make sure that the microscope is clean and focused properly.
* Make sure all equipment is working properly (i.e. grounded, charged batteries) prior to use.
* Equipment calibration: Ensure that equipment requiring calibration (per QA132 and identified by a green calibration system sticker), has not passed its due date.
* For wire stripping and cutting to length, refer to TA1062.
* NOTE: The following cable winder accuracy tests are performed by a PM technician or delegated representative.
* For hand cable winder accuracy verification (NY and NC):
  + CAUTION – Do not run any twisted pair cable that is unprotected by a jacket (i.e. 031/035) through the cable winder as it will damage cable.
  + Cable winders are verified with a calibrated scale or measuring tape per the Maintenance database and verification is recorded in the Maintenance Log issued from the Maintenance database.
  + Verification process.
    1. Assure that all wheels are moving freely.
    2. If the wheel is steel, use a calibrated 1” wide steel measuring tape of good quality and condition (no kinks or bends), and of sufficient length. If the wheel is coated, use a verified cable of sufficient length (~30 ft.) with a 2 ft. mark and a 22 ft. mark (verify marking with a calibrated instrument). Insert into measurer and pull through until the 2 ft. mark on the tape or cable is at the exit edge of the measurer.
    3. Reset the counter to zero.
    4. Continue pulling the calibrated steel tape or cable through the measurer until the 22 ft. mark on the tape is at the edge of the measurer.
    5. The counter measure should read 20 ft +/- 1 ½”.
* For hand cable winder accuracy verification (with ATE software. NC only) :
  + Start the interface software (controlled as EE216 in the PCB ATE software), select “verify cable length”.
  + Load a calibrated steel tape measure into the winder, with the “0” point even with the exit edge of the hand winder.
  + Select “OK” to reset the encoder and software.
  + Pull the tape measure through until the 25ft mark is even with the exit edge of the hand winder, select “take reading” in the software.
  + If the software shows a measurement of 300in +/-1.5in the winder passes verification, and the “in tolerance” option should be selected.
  + If the software shows a measurement out of the range 300in +/-1.5in the winder passes fails, and the “out of tolerance” option should be selected.
    - The software will calculate an offset factor and apply it to the measurements.
    - The verification steps should be repeated until the measurement is in tolerance.
      * If the winder fails verification more than 3 times, contact engineering.
* For Schleuniger PS9500 and PS9500RS cable winder accuracy verification (NC only):
  + Twisted pair cables may be run through the Schleuniger PS9500.
  + Verifying accuracy of Schleuniger PS9500RS.
    - Process to verify rotary stripping head.
      * While running the Interface software (controlled as EE219 in the PCB ATE software), Select “Engineering Functions” from the main menu.
      * From the engineering menu select “Cut Verification”.
      * Load PCB 002 cable in the machine and verify that the cut and strip lengths match the prompt specified in the software, with a tolerance of +/-1/16”.
    - Process to verify length accuracy
      * Setup a 20ft 034 cable with blunt cuts on both ends, per the “manual entry” section of TA1066.
      * Run the cable and check the length using a calibrated tape measure of sufficient length.
        + Given the design of the software, an automatic 6 in of cable is added on top of the 20 ft. The cable should measure 20ft 6in +1”/-0.

**PARTS**

* Precision parts must be clean (reference TA Cleaning Procedures **TA1051**, **TA1061**), smooth, flat, and have parallel or curved interface surfaces to match preload parts to prevent contamination during the assembly process.
* Visually check parts for cleanliness, burrs and specks to prevent foreign object debris during the assembly process.
* Inspect holes or cavities for visual contamination to prevent foreign object debris during the assembly process.
* Visually check any threads for imperfections.

**FIXTURES**

* Fixtures should be used as documented in the assembly procedure, router, and or BOM for proper assembly and alignment of parts for production consistency (visual alignment of parts is to be avoided as much as possible).
* Fixtures can wear over time and should be inspected prior to use and replaced as necessary.
* Fixtures should be cleaned prior to use, at a minimum, by wiping with alcohol to prevent contamination during the assembly process.

**READING CABLE MODEL NUMBERS**

**Note:** Cables should always be cut to the length that is on the BOM. The model number can be used to double check.

**Note:** Units on the BOM are ft=feet, ea=feet, mtr=meter

* Standard cable
  + 002A10

002 – Describes cable used (002 cable)

A – Describes connector configuration (EB – EB)

10 – Describes length of cable **(FEET)**

* **M**002A10

**M** – **METRIC** length

002 – Describes cable used (002 cable)

A – Describes connector configuration (EB – EB)

10 – Describes length of cable **(METRIC)**

* Configured Cables (See the description in the job for the complete model number)
  + 052BRxxxAC

English (**FEET**) 052 cable

BR – sensor connector

xxx – cable length in feet

AC – terminating connector

* + **M**052BRxxxAC

Metric (**METERS**) 052 cable

BR – sensor connector

xxx – cable length in meters

AC – terminating connector

* + - Armor cables (See the description in the job for the complete model number)
  + NOTE: If no armor length is specified in the model number, the armor length is equal to the length of the cable
  + 047BRxxxAC-yy

English (**FEET**) 047 cable

BR – sensor connector

xxx – cable length in feet

AC – terminating connector

-yy – armor length in feet

* + **M**047BRxxxAC-yy

Metric (**METERS**) 047 cable

BR – sensor connector

xxx – cable length in meters

AC – terminating connector

-yy – armor length in meters

* + - Specials (See the description in the job for the complete model number)
  + XXX**M**YY/xxx

**M** refers to a SPECIAL product not METRIC cable length

English (**FEET**) XXX cable

xxx – cable length in feet

* + XXXMYY/**M**xxx

Metric (**METERS**) XXX cable

xxx – cable length in meters

* + - Ebara (See the description in the job for the customer drawing number anc cable length)
  + CUSTOM CABLE PER EBARA DWG **XXXXXXX**-xx

**XXXXXXX** – customer drawing number

xx – cable length in inches

**TESTING**

1. All finished cable assemblies shall be tested per **TA1043**.

**LABELING**

1. Labels are applied after testing is complete. Labels have the following information, unless the router speficies a different label configuration.

* Job orders
* Labels will be printed out using the bar code label maker, through Syteline, and have the following
  + Model #
  + Job #
* Job repairs
* Labels will be created as per Figure 1**.**

|  |
| --- |
| PCB RPR  (Model #) (RMA #) |

Figure 1

* Integral and shop order cables
* Labels will be created per product group requests.
* If required information can fit onto a single label, then a single label may be applied even if multiple labels are specified in the assembly instructions.
* Labels will be placed on the cable one of two ways.

1. Place label on the cable opposite the attached sensor..
2. Place the label on the side of the cable that the connector is listed last in the part descriptiuon. (ex. 002C30 10/23-BNCplug). The label would be placed on the BNC plug side of the cable.

**JOINING**

Joining can involve welding, soldering, epoxying or screwing parts together. Before any joining operation it is important to clean the parts to be joined. Finger cots must be worn when handling all titanium parts that are to be welded.

For proper Welding techniques reference **TA1003** **General Workmanship Procedure for Laser Welding**.

For proper Spot Welding techniques reference **TA1000 General Workmanship Procedure for Spot Welding.**

* It is critical to ensure spot welding does not occur within 2 feet of an exposed AMP.

For proper use of Epoxy/Sealant reference **TA1210 Storing, Mixing and Transfering and Disposing Epoxy Sealant Components Procedure** or individual assembly procedures for specifics on epoxy use.

* When mixing or stirring epoxies, stir from the bottom of the container up. Components tend to settle over time and need to be remixed for best results. **Reference TA014 for epoxy information.**
* Use enough epoxy to properly cover all bond areas (mating surfaces), if enough epoxy is not used the transducer performance (low resonance or weak connections) can suffer.
* For proper drying time reference **TA074 Epoxy cure times.**

For proper Hand Soldering techniques reference **TA1004** **General Workmanship Procedure for Hand Soldering.**

Only use high temp solder when specified, all other times use low temp (ie 63/37) solder.

**INSPECTION**

Sound practice for routing and securing of connection wires is either in the assembly procedure or should be part of the training for the specific assembly. How the wires are attached and secured to the connector and ground is critical. Before installing the potting or housing that will hide critical components, check all wires for damage that may lead to failure.