

Lothar of the Hill People's RF Connector Torque Recommendations

Since we all seem to have stepped up our game here by using torque wrenches lately and I got a new VNA capable of pretty precise measurements that will even show errors in calibration due to connector torque, I decided to summarize the best available information from my paper library and the intertubes and try to comb out the minor differences in recommendations I spotted among the cited sources.

In my web travels looking for best practices for doing 2 port SOLT VNA calibration, I came across a 2022 Anritsu Guide for connecting DUTs to VNAs and the proper use of torque wrenches to enable repeatable VNA measurements. I was surprised that there were correct and incorrect ways to hold a torque wrench and align a torque wrench at a less than 90 degree angle to the holding wrench. I've attached an abridged version of that document here.

Table 1 – Correct Torques for common RF Connectors

Connector	Material	Recommended Torque
1mm	Stainless Steel	4-6 in-lbs.
2.4mm	Stainless Steel	8 in-lbs.
2.92mm	Stainless Steel	8 in-lbs.
3.5mm	Stainless Steel	8 in-lbs.
4.1/9.5	Brass	89 in-lbs.
4.3/10	Brass	44 in-lbs.
7/16 DIN	Brass	20 in-lbs. test, 221-230 in-lbs. In assy.
SMA	Stainless Steel	5 in lbs. test, 8 in-lbs. In assy.
SMA	Stainless Steel	Aerospace Rated, 15 in lbs.
SMA	Brass	5 in-lbs.
SMC	Brass	2-3 in-lbs.
SSMA	Stainless Steel	8 in-lbs.
SSMA	Brass	4 in-lbs.
SSMC	Brass	2 in-lbs.
TNC	Stainless Steel	12 in-lbs.
TNC	Brass	5 in-lbs.
Type N HEX	Stainless Steel	12 in-labs
Type N HEX	Brass	8 in-lbs.
Type N Knurled	Brass	NA – Hand Tight Only.
Type F	Brass	CATV OSP ONLY, 30 in-lbs.
Type F	Brass	15-20 in-lbs.

Sources: Anritsu, Keysight, (Agilent), CentricRF, RF-Lambda, CommScope, Pasternack, Fairview and SCTE.

Instruction Sheet

RF and Microwave Connector Care

Inspection and Cleaning
Protection from ESD
Pin Depth Measurement
Proper Connecting Methods
Protection from Over-power and Over-voltage
Connector Torque Settings and Tools



Chapter 4 — Tightening and Disconnecting Connectors

4-1 Introduction

This chapter provides tightening and disconnecting with proper torquing instructions for making a repeatable connection and avoiding damage to the connector.

4-2 Warnings

A connector must be correctly torqued to ensure an accurate RF measurement but not so tight as to damage the connector's center pin.

Caution	Never use pliers or adjustable wrenches to tighten connectors. Use the correct torque wrench with the correct setting to tighten the connector.
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Figure 4-1. Do Not Use Pliers or Adjustable Wrenches

4-3 Pre-connection Steps

1. Before touching instrument connectors, make sure you have grounded yourself and eliminated all static charge by following proper ESD handling procedures that conform to ANSI/ESD S20.20-2007.
2. Verify the power and voltage levels of the test device you are connecting to.
3. Verify all the input limits of your test equipment.
4. Visually inspect the connectors for damage, cleanliness, and center pin concentricity as described in [Chapter 2](#).
5. The coupling nut should move freely. If necessary, clean the connectors.
6. Measure connector pin depth if the connector is new or of unknown condition. Refer to [Chapter 3](#) for details.

Warning

Some RF components may not have precision type connectors. Mating a precision connector with a non-precision type can result in connector damage or degraded performance. Ensure the connectors are compatible before proceeding. Refer to the section [“Connector Types and Cross-mating Compatibility”](#) on [page 4-9](#).

4-4 Initial Connection

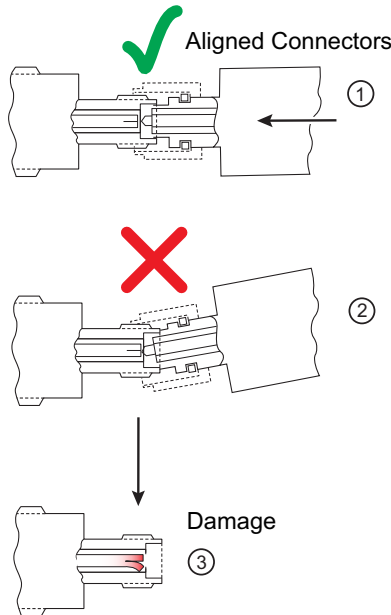
1. Carefully align the connectors as shown in [Figure 4-2](#).

Align the connectors center pins so they slip concentrically into the contact fingers of the female connector. You should never have to apply excessive force when making a connection.

2. Push the connectors straight together.

Do not twist while pushing them together. As the center conductors mate, there is usually a slight resistance.

Warning Having to apply excessive force to a connection is a reason to suspect the compatibility or quality of the connector and indicates a need to measure the pin depth.



Index	Description
1	Aligned connectors
2	Misalignment can cause pin damage
3	Damaged pin

Figure 4-2. Avoid Pin Damage Due to Misalignment

Chapter 4 — Tightening and Disconnecting Connectors

3. Finger-tighten the connection first by turning the connector nut.

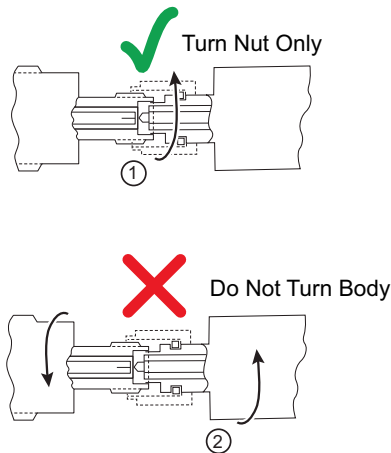
Do not turn the connector body.

Do not pre-tighten so much that there is no rotation of the nut when using the torque wrench.

4. Back off the connection by turning the connector nut counter clockwise 1/4 turn.

The final tightening is done using the appropriate torque wrench as described in [Section 4-5](#).

Caution Do not turn the connector body. Major damage to the center conductor and the outer conductor can occur if the connector body is twisted.



Index	Description
1	Turn nut only
2	Do not turn body

Figure 4-3. Tightening the Connector Nut

4-5 Torquing the Connection

Connectors must be properly torqued to their required specifications to assure an accurate RF measurement. Applying proper torque will improve connection repeatability, reproducibility, as well as maximize connector life.

Caution **Never** use pliers to tighten connectors. Use the correct torque wrench with the correct setting to tighten the connector. For Type N connectors, finger-tight will be sufficient.

1. Select a torque wrench of proper size and rating for the connector and an open end wrench. The open end wrench is used to prevent the body of the connector from turning. Refer to [Table 4-1](#) for torque specifications.
2. Place the two wrenches at an angle of less than 90° as shown in [Figure 4-5](#).
3. Hold the torque wrench at the end as shown below.

Caution Holding the torque wrench anywhere but at the end applies an unknown amount of torque and can damage contacts and/or connectors.

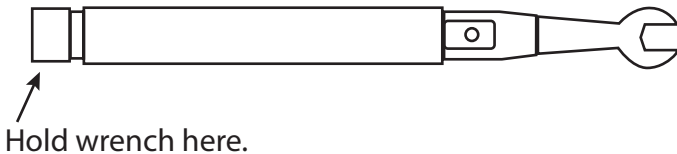


Figure 4-4. Correct Place to Hold Torque Wrench

4. Provide support for long, heavy pieces of equipment such as cables so there is no lateral pressure on the connection.
5. Hold the connector body while rotating and torquing *only* the connector nut when making connection.

Caution

Using two wrenches with an angle greater than 90° causes the devices to lift up, which tends to misalign and stress the connectors. This becomes more of a problem when multiple devices are connected together.

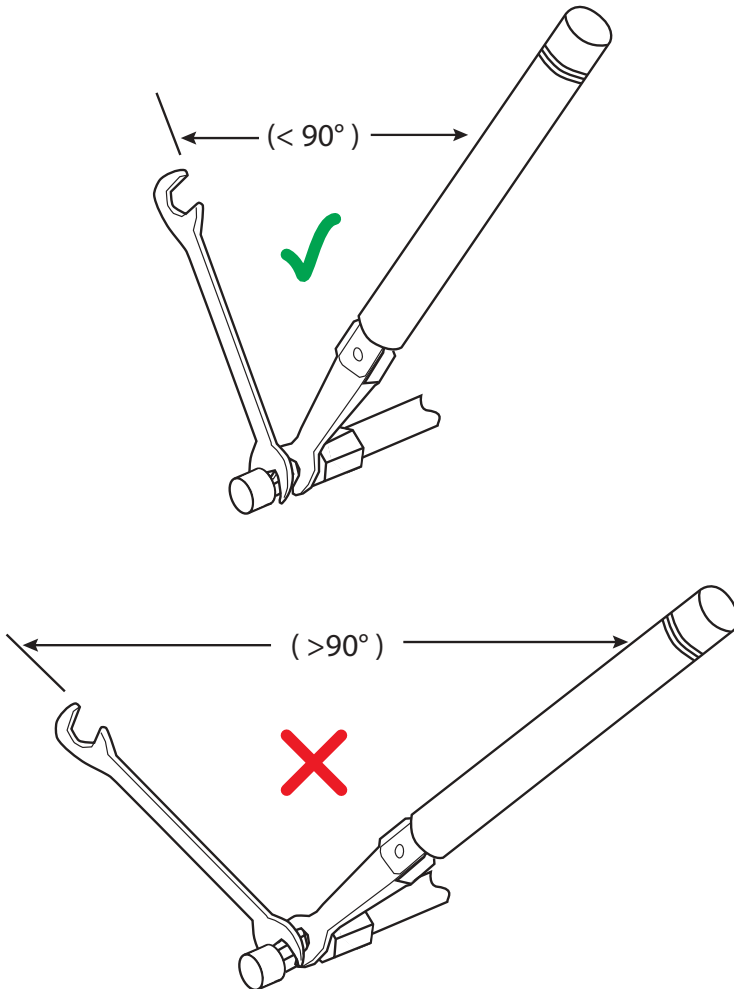
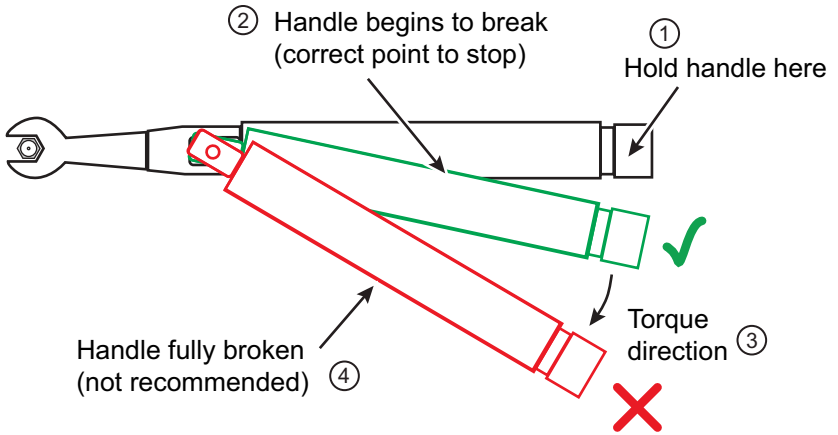


Figure 4-5. Using Wrenches at Proper Angle

Chapter 4 — Tightening and Disconnecting Connectors

Caution Breaking the handle fully can cause the wrench to kick back which may loosen the connection.

6. Apply torque to the fitting until the handle begins to break as shown in [Figure 4-6](#).



Index	Description
1	Hold handle here
2	Handle begins to break - Stop torquing
3	Torque direction
4	Handle fully broken - Avoid torquing this far

Figure 4-6. Using a Torque Wrench