Connector & Adapter Torque Application

TABLE OF CONTENTS

PURPOSE & SCOPE

The purpose of this work instruction (WI) is to provide an acceptable and consistent approach to applying torque to adapters and connectors on cable assemblies. It defines responsibilities, describes how to use common cable torque tools, how to prepare and apply torque, and describes application of thread locking compounds.

Torque values are defined on the product drawing or in Torque Specification 60083155 in Teamcenter. Torques may also be listed for reference in manufacturing work instructions (MWI) in SAP ME, or in the Component Analysis Tool (CAT). The torque specification defines documentation order of precedence for determining torque values.

This work instruction applies to product within the L3Harris Communication Systems - West (CSW) facilities.

WORK INSTRUCTION

1. TERMS AND DEFINITIONS

Clocking	Orientation of the connector master key in relation to the adapter or cable
CSW	L3 Communication Systems - West
ESD	Electrostatic Discharge
In-Lbs	Inch Pounds
IPA	Isopropyl Alcohol
MN	Material Number
MPE	Manufacturing Process Engineer
MWI	Manufacturing Work Instructions (In BOPs and SAP ME Routings)
QMS	Quality Management System

SAP ME	SAP Manufacturing Execution
WI	Work Instruction
WSM	Workmanship Standards Manual

2. RESPONSIBILITY

Only L3Harris Technologies, Inc. (CSW) approved torque tools, displaying current calibration, will be used for mating torque applications.

- CSW personnel are responsible to ensure torque is applied properly, all work performed is documented in the Shop Order and the applicable tools are properly logged according to procedure.
- Personnel moving or handling tooling or equipment will maintain its integrity and report any actions and/or conditions that may affect its function and/or calibration.
- It is the responsibility of the person applying torque with a calibrated tool to ensure that:
    - The equipment under use is within the allowable calibration date range; and
    - The torque value applied by the equipment is within the applicable calibrated torque range.

3. EQUIPMENT AND MATERIAL

Torque Tool No.	Mfg Number	Description
C100577	BT-A-6010	Strap, Soft Rubber, Black, Replacement, ½ inch
C100578	BT-A-6010W	Strap, Hard Rubber, White, Replacement, ½ inch
C100884	BT-A-6175	Strap, Hard Rubber, Black, Replacement, 5/8 inch
C93682-000	UTICA 529-10C	Connector Pliers
C100839-000	DRP-08	Circular Ring Pliers
C100336-000	TG69-P	Pliers, Slip Joint, Soft Jaw
ETX451580-000	BT-BS-611	Strap Wrench, Large
ETX451580-001	BT-BS-609	Strap Wrench, Small
ETX450634	———	Coax Wrench (Open end) Dial Torque Set
ETX459988	BT-ST-701	Torque Meter Assy with Base, Analog

Torque Adapter No.	Cabinet - Drawer	Mfg Number	Connectors used for
ETX451681	2-2	CM-S-264	MIL-C-26842 SERIES I & II
			MIL-C-83723 SERIES I Connector Plugs
ETX451682	2-2	CM-S-389L	MIL-C-38999 SERIES 1 PLUG
ETX451683	2-2	BT-S-389S	MIL-C-38999 SERIES 2 & 3 (even sizes) Connector Plugs
ETX451684	3-2	CM-S-5015M	MIL-C-5015 Connector Plugs (Box 1 of 2)
			MIL-C-5015 Connector Plugs (Box 2 of 2)
ETX455063	3-2	CM-S-229	MIL-C-22992 Plugs, Straight
ETX460395	3-1	CM-S-264R	MIL-C-26482 SERIES 1 and 2
			MIL-C-38999 SERIES 2 Receptacle
ETX460466	3-1	CM-S-389LR	MIL-C-38999 SERIES 1 Receptacle, Bayonet
ETX463808	3-1	CM-S-389B	MIL-C-38999 SERIES 4 Connector Plugs
ETX464372	3-1	CM-S-389BR	MIL-C-38999 SERIES 4 Receptacles, Breech Lock
ETX467802	2-1	CM-S-389T	MIL-C-38999 SERIES 3 Threaded Plugs

ETX468989	2-1	CM-S-389TR	MIL-C-38999 SERIES 3 Receptacle
ETX469523	2-2	CM-S-837	MIL-C-83723 SERIES II
ETX471304-*	2-3	———	Glenair Mighty Mouse 40006357-*
ETX471305-*	2-3	———	Glenair Mighty Mouse 40006585-*
			Glenair Mighty Mouse 45001066-*
ETX471434-*	2-3	———	Glenair Mighty Mouse 40006629-*
ETX471435-*	2-3		Glenair Mighty Mouse 40007126-*
ETX471436-*	2-3	———	Glenair Mighty Mouse 40006612-*
			Glenair Mighty Mouse 40006684-*
ETX471721-*	2-3	———	Glenair Mighty Mouse 40007163-*
			Glenair Mighty Mouse 45001065-*
ETX477839-*	2-3	———	Glenair Mighty Mouse 40010350-1
			Glenair Mighty Mouse 40010630-*
			Glenair Mighty Mouse 40011554-*
			Glenair Mighty Mouse 40011559-*
ETX478407-*	2-3		Glenair Mighty Mouse 40010936-*
ETX478966	3-1	CM288R	MIL-C-28840 Connector Receptacles, A & B, 9 each
ETX479936	3-2	CM288	MIL-C-28840 Connector Plugs, A & B, 9 each
ETX480420	3-3	FGW.LM.91.U1104	LEMO, LM Plug, N KEY, 40012290-023, 40012290-024
ETX480420-1	3-3	FGN.3M.91.U1104	LEMO, 3M Plug, N KEY, 40012290-022, 40012290-025
ETX480420-2	3-3	DCN.2M.91.U1104	LEMO, 2M Plug, N KEY, 40012290-14,-16,-18,-20,-32
ETX471319-12		600-146-10	Glenair Socket Connector Tool
ETX476212*	3-3		L3Harris
ETX487463*	3-3		L3Harris
ETX478187-1	3-3		L3Harris
ETX478187-2	3-3		L3Harris
1000415136	1-1	———	Special torque tool secondary, prior to assembly.
1000436223	3-3	———	Special Torque Tool, 7193240-033 Adapt
1000436251	3-3	———	Special Torque Tool, 7193240-XXX Adapter – Secondary
1000436821	3-3	———	Torque Tool for 7193240-XXX
1000439900	3-3	70221345	ITT Cannon
1000216805	3-3		L3Harris
* *All dash numbers*			

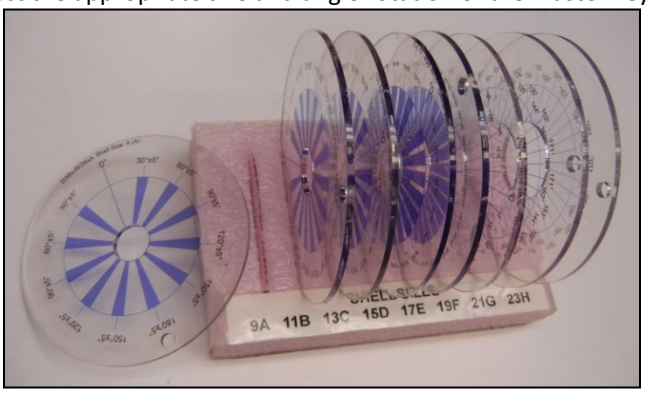
L3/Glenair No.	**Cabinet - Drawer**
Series 800	
600M005-07PN	1-1
Series 801	
600MM005-05PA	1-1
600MM005-07PN	1-1
600MM005-016PA	1-1
600MM005-017*	1-1

Series 804	
600-141-6RA	1-1
600-141-8P	1-1
600-141-9PA	1-1
Series 805	
600-185-8*	1-2
600-185-9*	1-2
600-185-10*	1-2
600-185-11PA	1-2
600-185-12*	1-2
600-185-15*	1-2
600-185-18*	1-2
600-185-19*	1-2
ETX489547 (600-185-23R) - 40014310-009, Receptacle	
* *All dash numbers*	

4. TOOL USE

4.1. Clocking Aids

Clocking Alignment Shop Aids are used to help set the clocking of the keyway to meet drawing requirements. Select the appropriate size and angle rotation of the master keyway per the print.



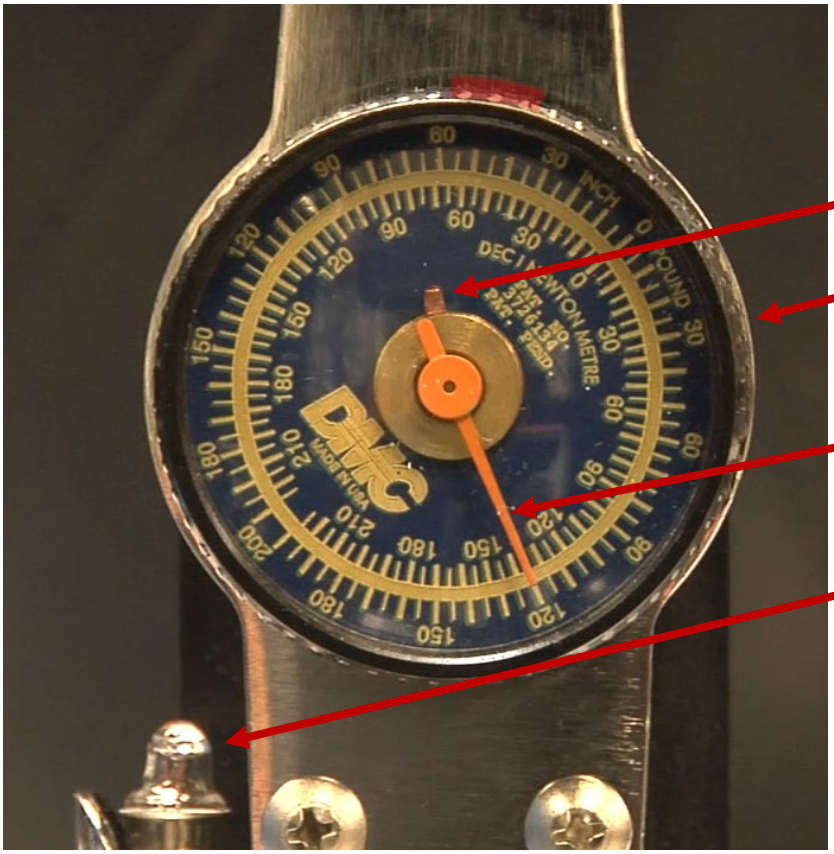
Clocking Alignment Shop Aid

4.2. Dial Torque Meter

Ensure that your vision path is perpendicular to the face of the dial when setting up the meter, to avoid misreading the indicator. Use of the bulb indicator during use will ensure that the proper torque value is reached, regardless if the dial can be read correctly when applying torque.

- Move the set point to desired torque value by rotating the bezel clockwise until the torque value indicator (needle) catches and moves the set point.
- Move past zero and set at desired torque value. Check that the light bulb lights up when the indicator and set point are in contact with each other. If the light does not light up, replace batteries or bulb as needed.
- Zero the torque station by rotating the bezel counter-clockwise until the indicator rests on zero.
- Assemble the cable and torque adapter to the meter.
- Apply torque to the assembly while looking for the bulb to light, indicating when the full torque has been reached.

Note: USE OUTSIDE SCALE, graduations/marks are in 5 in. lb. increments.



4.3. Digital Torque Wrench

- Turn on Wrench
  - Momentarily press POWER button. DMC logo will be displayed followed by torque and angle re-zeroing screens
- Select Measurement Mode.
  - Toggle between target TORQUE and ANGLE screens by repeatedly pressing ENTER button until TORQUE screen is displayed.
- Select Units of Measure.
  - Repeatedly press UNITS button while on target TORQUE screen until IN-LB is displayed.
- In torque mode, set target
  - Use UP/DOWN buttons to change TORQUE target value.
- Apply TORQUE.
  - Grasp center of handle and slowly apply torque to fastener until progress lights display green and a ½ second audible alert and handle vibration alerts you to stop.
- Release TORQUE.
  - Note peak TORQUE reading flashing on LCD display for 5 seconds. Pressing BACKLIGHT button while peak torque is flashing will continue to display value until button is released. Momentarily pressing UP/DOWN, ENTER or UNITS button will immediately return to target TORQUE screen. Reapplying TORQUE will immediately start another TORQUE measurement cycle.
- Recall Peak TORQUE Reading
  - To recall last peak TORQUE measurement, press and hold BACKLIGHT button for approximately 3 seconds. Peak TORQUE will flash for 5 seconds.

User Instructions

- Basic Functions (Quick Start)

PROGRESS LIGHTS

Yellow - First light indicates 40% of target torque or angle reached. Second indicates 60% of target reached. Third indicates 80% of target reached.

Green - Indicates target torque or angle reached.

Red - Indicates exceeded torque or angle target plus 4% or exceeded maximum Preset target.

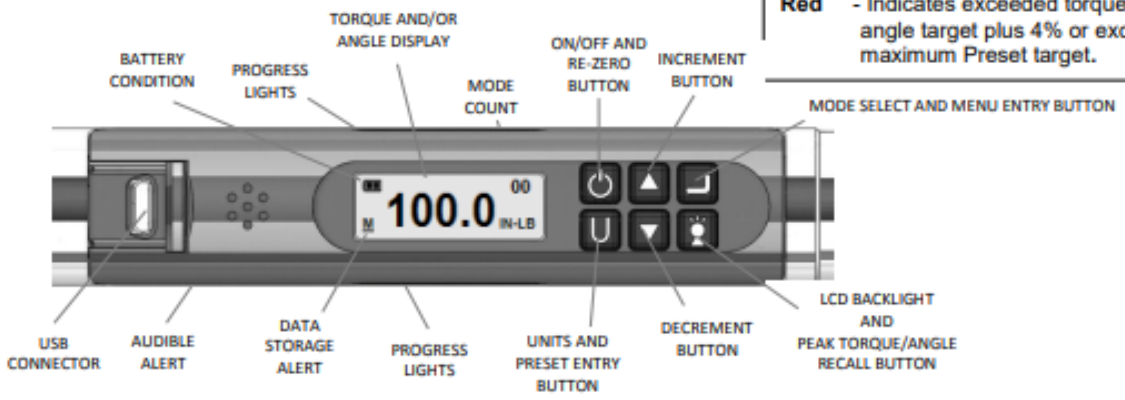
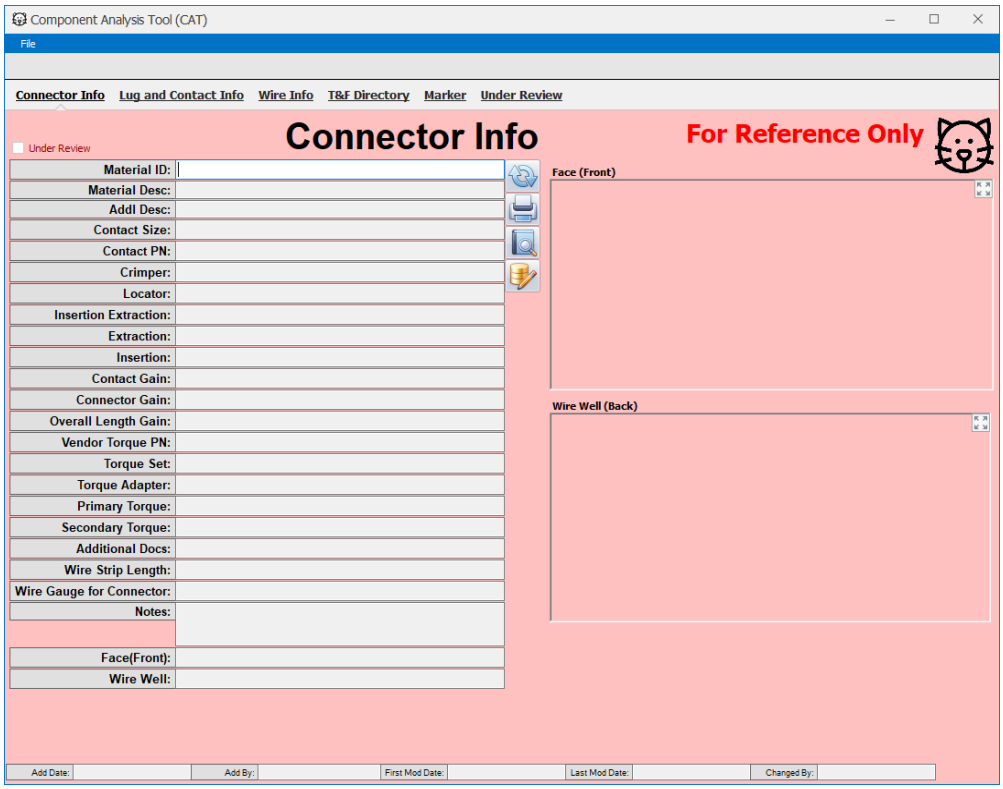


Figure 1

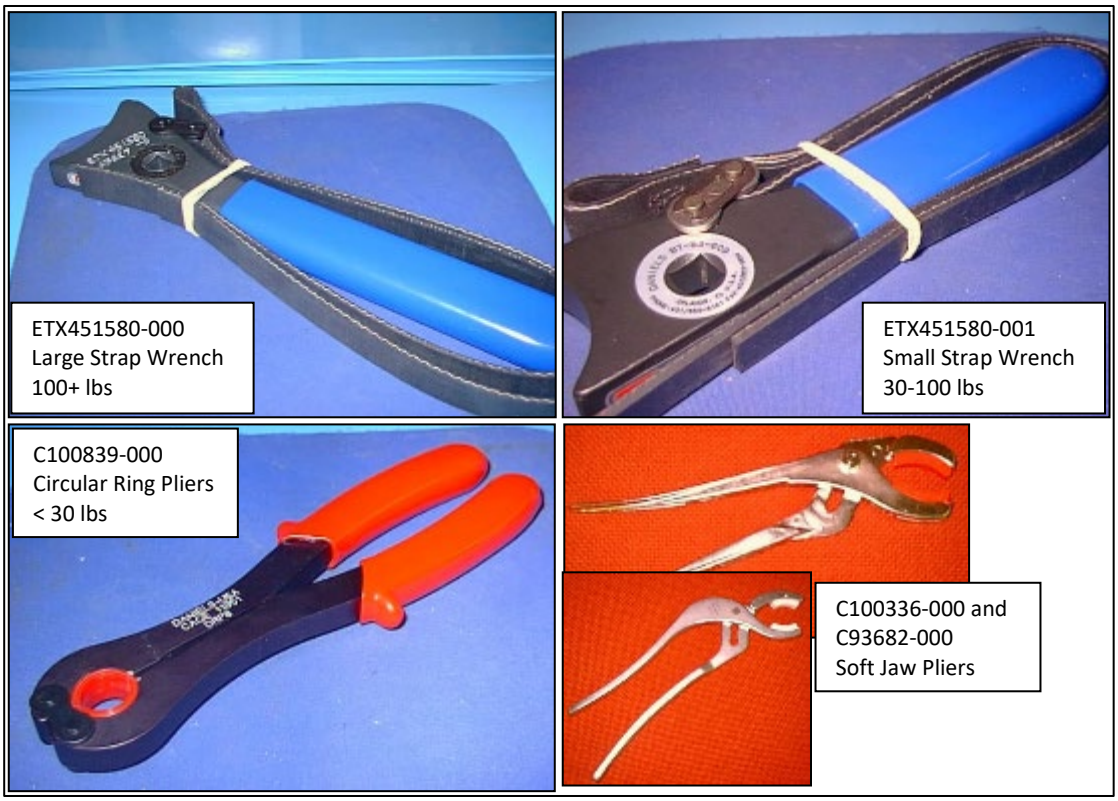
4.4. Torque Adapter

Find torque adapter set ETX number using MWI or by searching for the connector in the Component Analysis Tool (CAT), found in the production toolbox application. If the connector is not found in the CAT program, contact an MPE to help determine shell size. Many torque adapters are listed in section 3 and found in roll-around cabinet drawers at the Cable and Harness torque station.



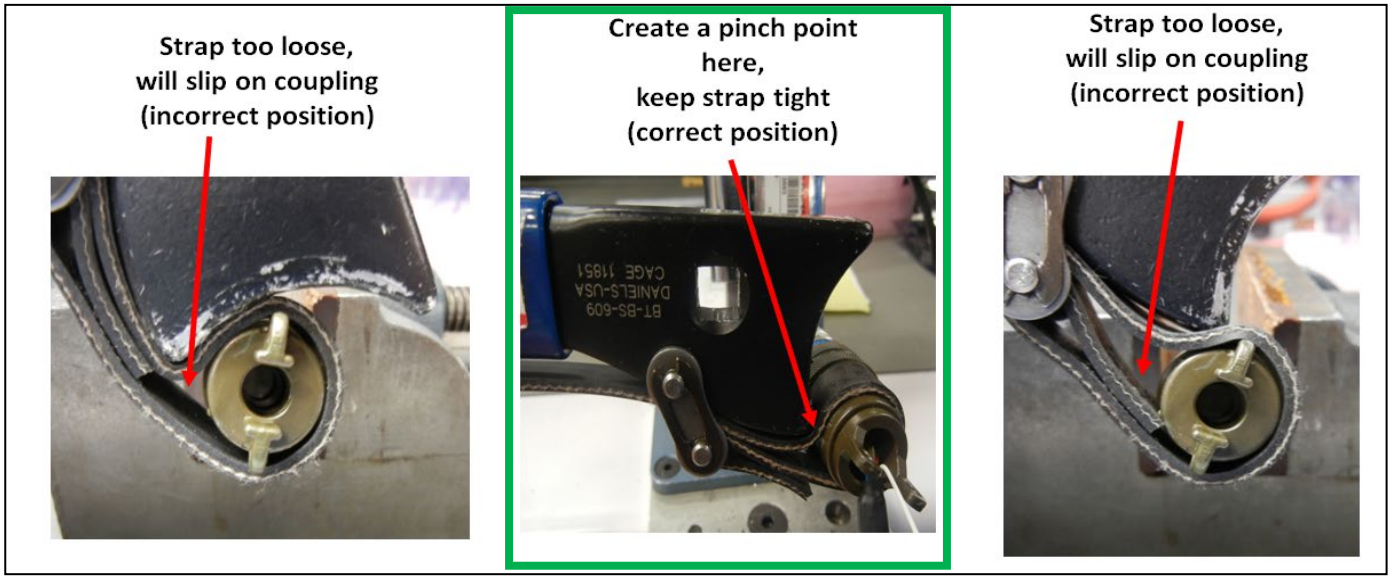
4.5. Strap Wrench Selection

Select the appropriate strap wrench or padded jaw grip wrench based on the torque value required. Section 3 has a list of common torque wrenches.



4.6. Strap Wrench Use

Proper strap wrench application requires a tight pinch point to keep it from slipping.



5. TORQUE APPLICATION PROCESS

See the Connector Torque Application section within P-553 for details on applying torque to the various types of connectors and backshells. The following steps are basic torque application instructions for most single junction cable harness applications.

5.1. Clean Threads:

Clean threads with vacuum and cotton swabs moistened with IPA, or similar. If performing rework, any residual thread lock will need to be removed.

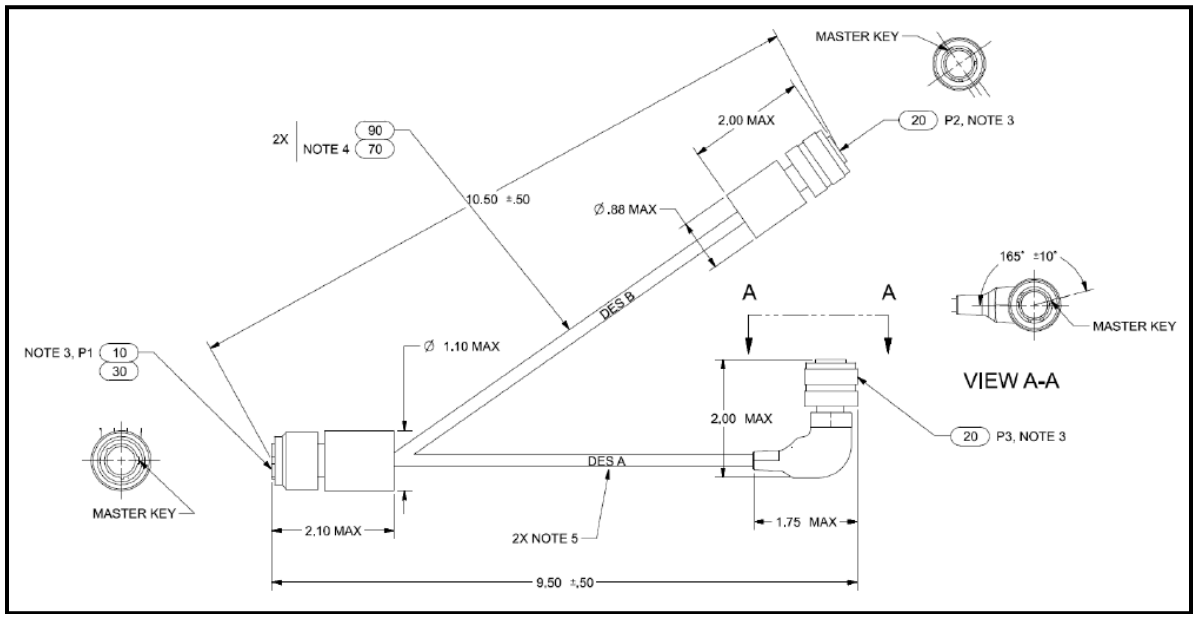
Note – a drop of IPA on internal O-rings will help the adapter mate.

5.2. Determine Master Keyway Location:

Review drawing requirements for the master keyway clocking in relation to adapter or cable.

- If the drawing does not show the master key location, then any clocking is acceptable.
- If a master key location is shown but no angular tolerance is given, then the default tolerance (+/- 45°) is defined in 60102381, Interpreting L3 Cable/Harness Drawings.

Face views of the connectors may be shown near the connectors or in a separate view. Lay the cable out as shown in the drawing, rotate the connector face into view, and verify that the master keyway is lined up with the orientation of the cable or the adapter.



5.3. Apply Non-Wick Thread Locking Compound - Before Torquing:

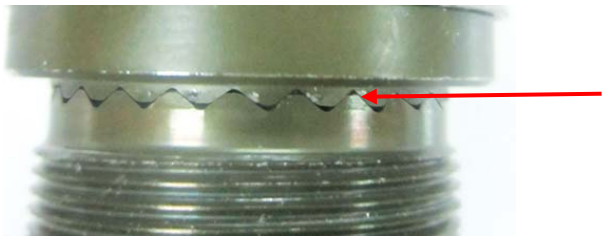
Secondary retention is required for connector/backshell mates. Thread locking compound is the most common secondary retention method used. Thread locking compound might be required to be applied before or after torquing. Verify with the drawing and process for the thread locking compound to be used, and whether it is to be applied before or after torquing.

Skip this paragraph and see section 5.8 if thread locking compound is to be applied after torquing.

If required per the print, apply drops of thread lock to the threads of the connector prior to mating. Avoid putting thread locking compound on the first thread. Do not allow thread locking compound to flow onto the teeth or castellations. See W-587 for Threadlocker Application Guideline.

5.4. Thread on Backshell:

Thread the backshell on to the connector body, taking care to prevent cross threading. Set the master keyway clocking, (if required by drawing) by using the clocking alignment shop aids. Alignment of the connector/adapter "teeth" at this point is critical.



On most adapters and strain relief attachments the threaded ring will be stationary and will not be able to be slid back, so the alignment of the teeth or castellations will not be visible as shown in the photo above. In these cases, every attempt should be made to achieve proper alignment/engagement of the teeth by:

a. Threading the adapter down toward the connector slowly until the teeth can be "felt" to engage.

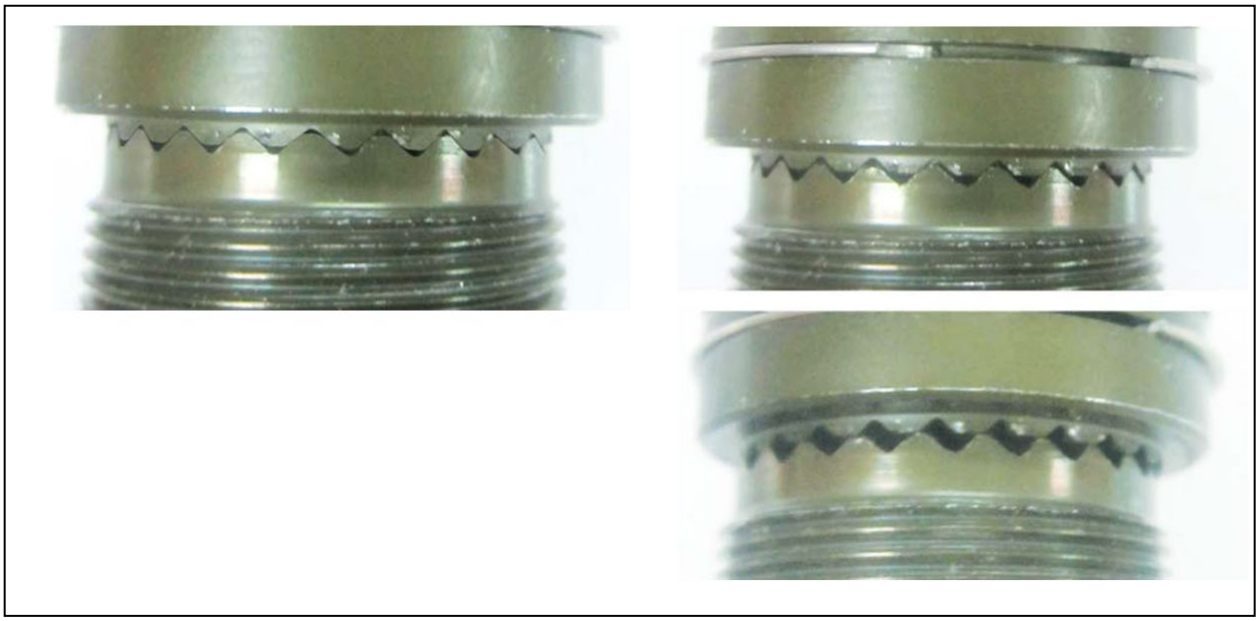
b. Checking the alignment of the main keyway as shown on the drawing, (if applicable for the connector you are applying torque to, ref. drawing), if necessary, back the threaded ring off slightly and align the keyway to the proper orientation.

c. While continuing to thread the ring onto the connector, gently rotate the adapter/accessory clockwise, then counterclockwise, to assure that the teeth are still engaged until the threaded ring is hand tight. Do not rotate the adapter/accessory with too much force or the teeth may slip and the main keyway will need to be realigned; only a light motion is recommended.

d. Once you are satisfied that the teeth are aligned/engaged properly, the connector is ready to have torque applied to the specified value.

The left figure shows an acceptable mating where the alignment teeth are fully engaged.

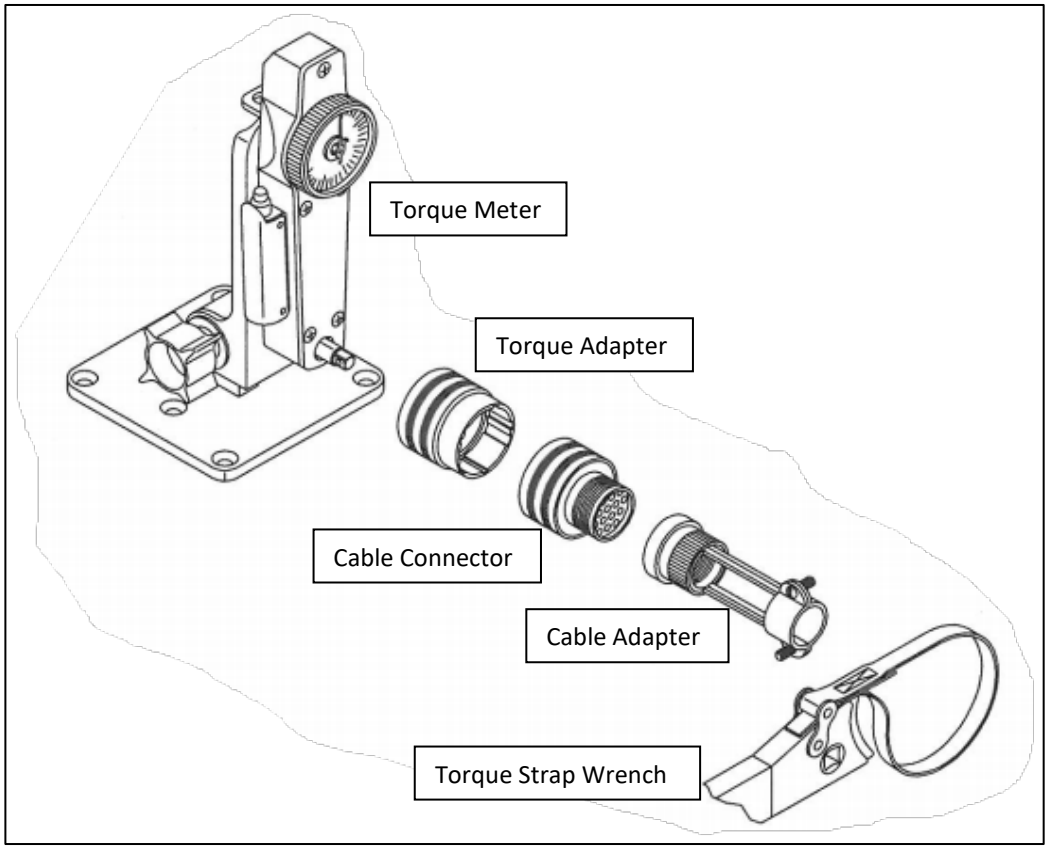
The right figures show two examples of teeth that are not fully engaged.



5.5. Torque Set Up:

Select the correct torque adapter from the adapter sets stored in the cabinet drawers. (For the ETX468989 adapter set, “A” is the preferred adapter, due to multiple key alignments on the adapter and “B” being the alternate, these “B” adapters use only the master keyway to hold the connector during torque operation.)

Line up the main keyway on the connector with the main keyway on the torque adapter, (main keyway should be marked with a colored dot on the torque adapter). The adapter is attached to the square drive on the torque meter, and this arrangement holds the connector while the back shell accessory is torqued onto the connector, with a strap wrench.



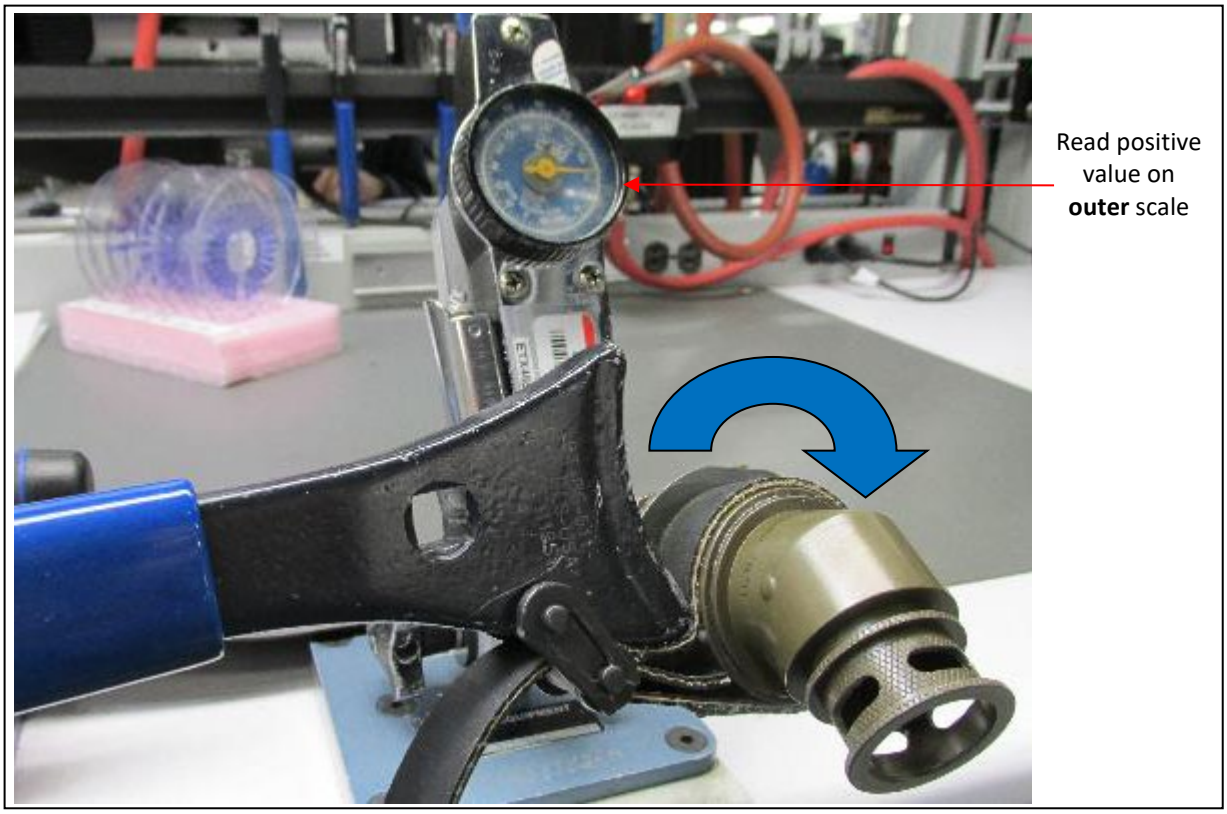
5.6. Apply the Torque:

5.6.1. Standard Application:

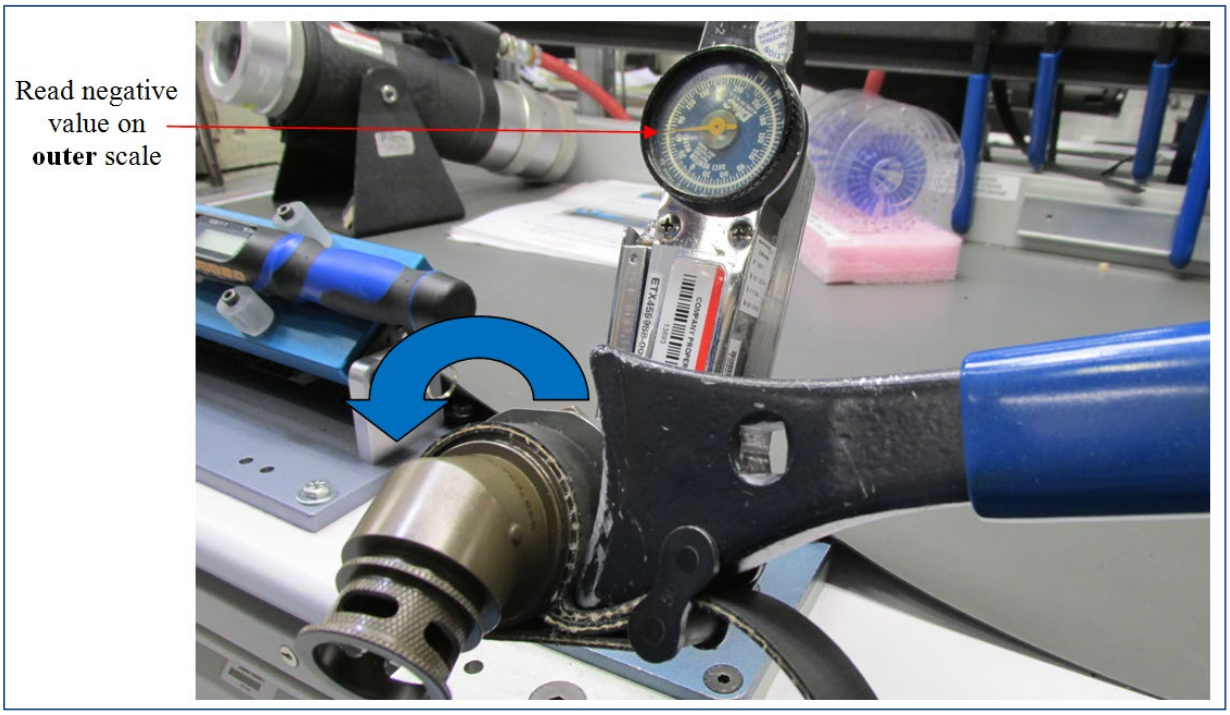
Proper seating of components can be accomplished by first applying torque in the, “positive”, direction until the specified torque is reached, then applying 75% of torque value in the opposite, “negative”, direction. Once 75% torque application has been verified, re-apply torque in the positive direction until the specified torque value is reached (see photos).

On large and heavy cable assemblies make sure the weight of the cable does not drag or bind the threads of the backshell. This could cause a false reading which will result in applying insufficient torque.

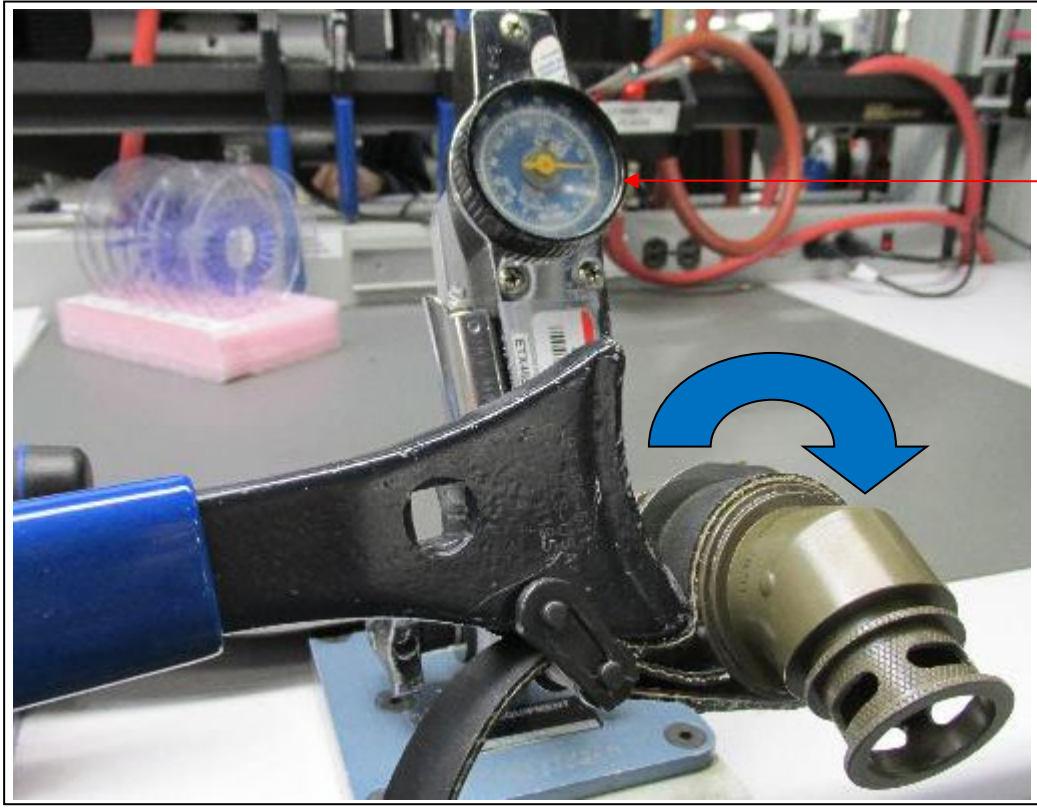
Apply torque in the positive (tightening) direction



Applying torque in the negative (loosening) direction while noting torque value (75% of total value).



And again, applying torque in the positive (tightening) direction.



If the connector breaks free at the 75% negative torque application, begin again with cleaning threads and hand-tightening adapter prior to torquing.

Some connector backshell/accessory combinations have been found to be loose during final inspection, even though the proper torque was applied by the assembler and verified by a MPE or Technician. For these situations, it may be necessary to apply torque---loosen---re-apply torque to the components several times to properly seat the backshell/accessory to the connector body until the proper torque values are achieved.

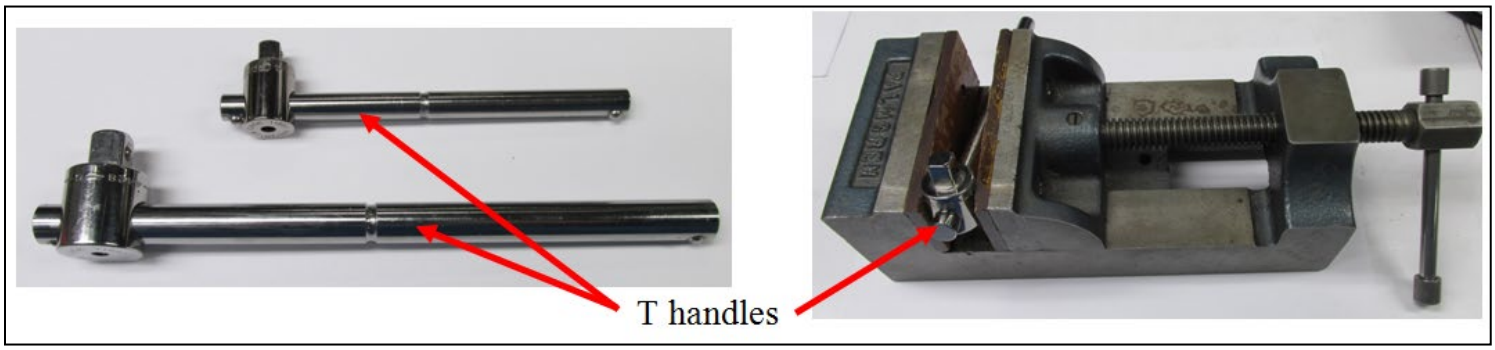
5.6.2. Other Applied Torque Applications:

The methods described above are the basic instructions for all single junction cable connectors . For applications other than single stage backshells, refer to P-553, Torque Application Procedure, for additional information on order of operations.

5.7. Undoing the Applied Torque (if required):

To remove a back shell/adapter/accessory, use a “T” handle mounted in a vice and attach the torque adapter to the square drive on the “T” handle.

Note: If information about the force required to remove the accessory is desired, then use the dial torque wrench.



5.8. Apply Wicking Thread Locking Compound - After Torquing:

Secondary retention is required for connector/backshell mates. IS-001 allows for wicking thread locking compound to be applied to these joints after mating if another secondary retention is not defined on the drawing.

See paragraph 5.3 for thread locking compound application prior to torquing.

After torque application and milliohm testing, apply drops of thread locking compound to the top of the adapter joint around the circumference of the adapter. Do not allow the thread locking compound to flow out of bounds of the joint. See W-587 for Threadlocker Application Guideline.

5.9. Record Applied Torque Values and Tools:

Record applied torque values to each connection in the shop order in SAP ME.

Record the asset number of the torque meter used to measure the torque.

If required, verify that thread locking compounder was applied, and record the material number of the thread locking compound.

6. REWORK

If a torqued connection must be undone to perform rework, then unthread the connector to gain access to the threads for cleaning. Perform the torque process from the beginning as described in section 5 above.

Rework on a torqued joint requires testing to be completed again per EMI specification 60037425, Practices for EMC work instruction W-432 and IPC/WHMA-A-620 section 19.

RECORDS

There are no records associated with this work instruction.

END OF DOCUMENT

DOCUMENT INFORMATION

Responsible Organization:	Operations
Function/Sub-function:	Manufacturing
Governing Document(s):	Y-001, L3 Technologies CSW Quality Manual Vendor Instructions – Various vendors' instructions, pictures and other information for connectors shown are being used. Pictures and information used with permission.

Subordinate Document(s): N/A

Related Document(s): 60083155, Specification of Torque and Retention Requirements for Threaded Hardware
60037425, Spec, Practices for EMC – Electromagnetic Compatibility
W-432, Practices for EMC – Electromagnetic Compatibility
P-553, Torque Application Procedure
W-587, Loctite Threadlocker Application Guidelines
IPC-WHMA-A-620, Requirements and Acceptance for Cable and Wire Harness Assemblies
P-154, Product Handling, Packaging, Storage & Shelf Life Control

Related Training: N/A

Approval Requirements: Technical Expert

Review Requirements: N/A

Revision History Summary

Revision #	Description of Change	Date
00	Initial release	6/8/2015
01	Added second paragraph and image to section 4.9	7/8/2019
NA	Updated point of contact, logo, and proprietary info in footer. No revision upgrade necessary.	4/28/2021
02	Reorganized information and added details to most sections. Added information on thread locking compound application. Removed quality section. Added torque adapter information from W-215 in preparation of obsoleting W-215.	9/23/2021
03	Replaced image with new digital torque wrench in section 4.3.	12/9/2024
04	Rewrote steps in section 4.3.	03/04/2025