CARLISLE
INTERCONNECT TECHNOLOGIES

SPACE GRADE CABLE ASSEMBLY INTEGRATION MANUAL

Connector Care and Mating

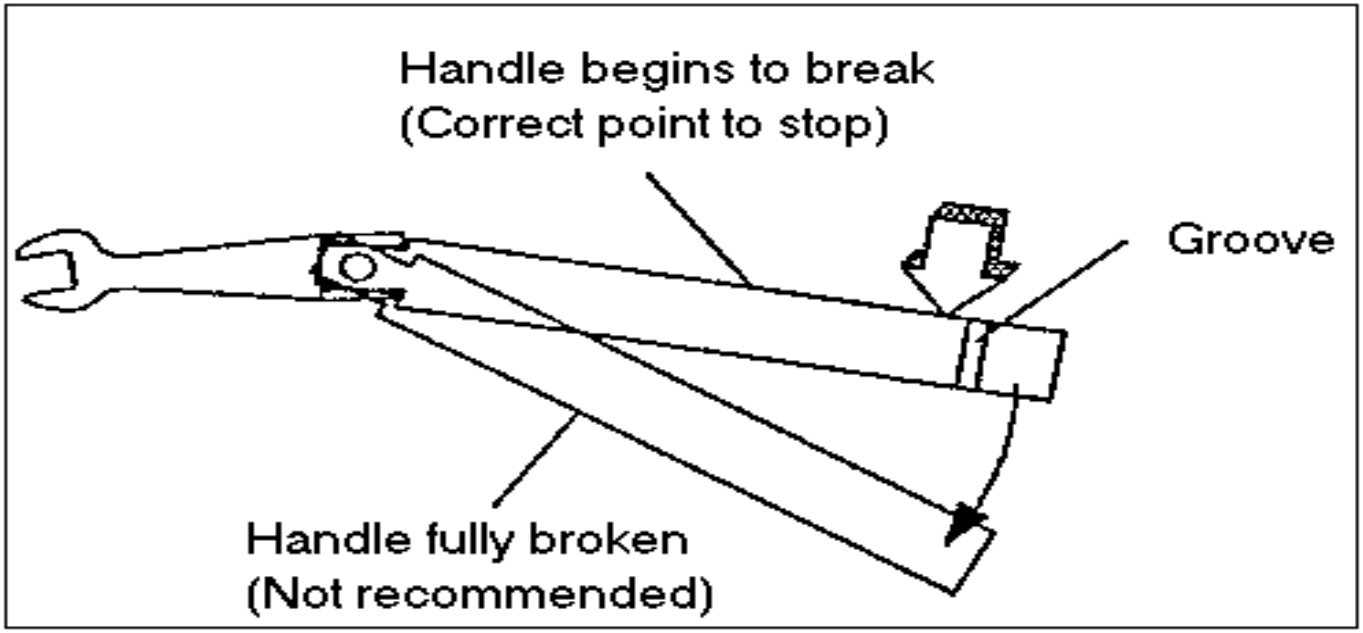
- Microwave cable assemblies are precision components that require proper use, routine inspection and regular cleaning of the connectors to maintain reliable performance. Such care will increase the life the assembly and all associated test equipment as well as ensure more accurate and reliable measurements. Failure to observe these guidelines can result in inaccurate test data or permanent damage to both the assembly and other equipment. In addition to this instruction, an excellent resource for proper care and handling is the archived Hewlett Packard Application Note 326, “Coaxial Systems Principles of microwave connector care”.
- Examine the connectors first for obvious defects, debris or damage: badly worn plating, deformed threads or bent, broken, or misaligned center conductors. Connector nuts should move smoothly and be free of burrs, loose metal particles, and rough spots.
- If debris or loose particles are detected a careful cleaning is essential to assure long, reliable connector life, to prevent accidental damage to connectors, and to obtain maximum measurement accuracy and repeatability. Isopropyl alcohol and lint free swabs and cloths are the recommended cleaning supplies.
- After cleaning it may be necessary to dry the interface. The use of a gentle stream of clean compressed air or nitrogen is recommended. Note that the air/nitrogen may also be used to free loose particles as long as the dislodged loose particle does not cause additional risk elsewhere.

Connector Care and Mating

- Always align connector centerlines before attempting to mate. Take care to perform this step properly as any required play in the coupling nut may allow the threads to mate without proper center contact insertion. This could damage or destroy critical connector components.
- When threading male coupling nuts, ensure the female component is stationary and hand tighten the male coupling nut over the female threads. While performing this operation maintain alignment by supporting the cable exiting the connector being worked with the opposite hand. Otherwise, unnecessary wear will occur on both connectors causing performance degradation. Note that once the threads are aligned and begin to spin normally against each other a slight force along the cable away from the mating interface by the supporting hand will assist with alignment and remove any torque the cable may introduce to the connector interfaces. This action mimics the force applied to the coupling nut when the nut is fully tightened.

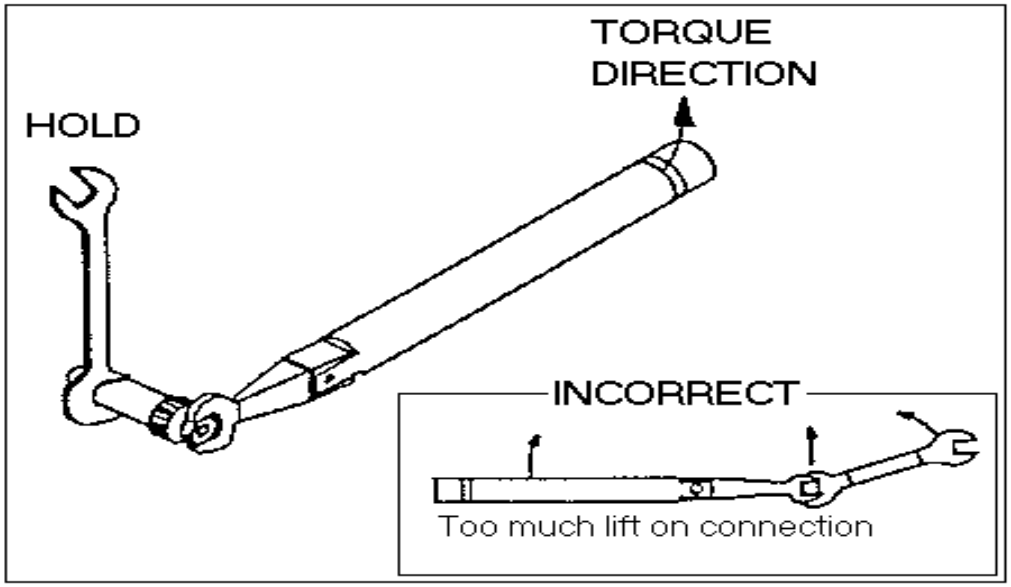
Connector Care and Mating

- After hand tightening, use a properly calibrated torque wrench applied to the flats of the mating coupling nut to fasten the mating interfaces to their rated torque. A “break away” type torque wrench is recommended.



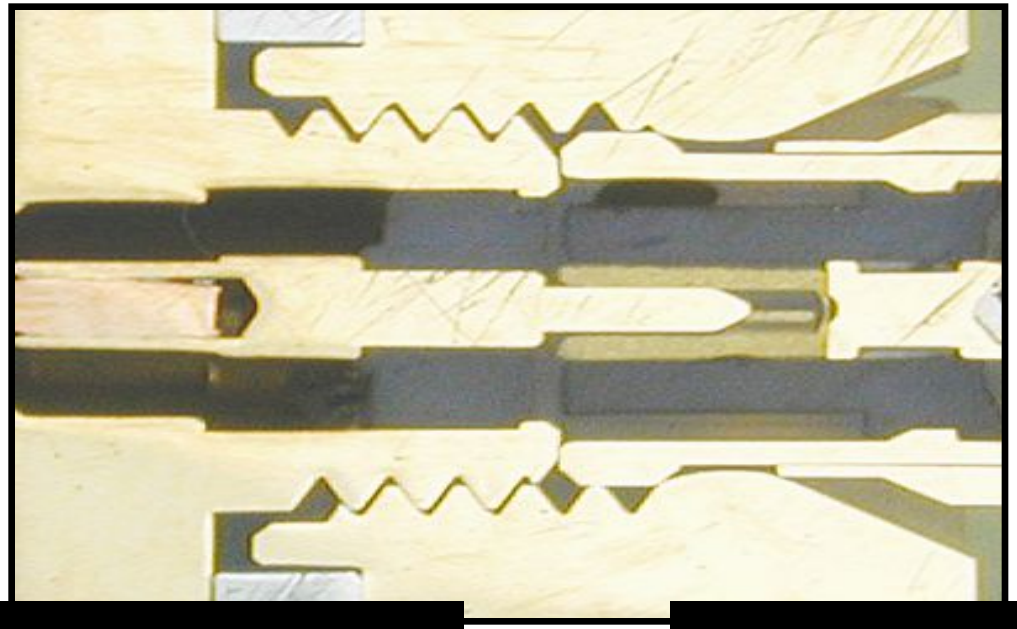
Connector Care and Mating

- To prevent the interfaces from spinning against each other apply a backing wrench to the rear flats of the connector being worked. It is best to apply the backing wrench after hand tightening and prior to applying the torque wrench. Tighten slowly to ensure that the ratchet mechanism on the wrench engages at the true torque value.



Connector Care and Mating

- Do not over tighten connector interfaces beyond their rated mating torque value. Over tightening can lead to damage.



Pin shoulder could damage fingers

Outer conductor could become bent, scratched or compressed

Connector Care and Mating

- After multiple mates and de-mates consider gauging the connector interfaces per the controlling standard. Connector interfaces should be gauged any time a visual inspection or electrical performance suggests that the connector interface may be out of specification. Carlisle Interconnect Technologies (CarlisleIT) has qualified space grade connectors to 50 mates/de-mates with no degradation to performance and maintains a mate/demate log for each space flight cable assembly with a maximum of 10 mates/demates per connector.

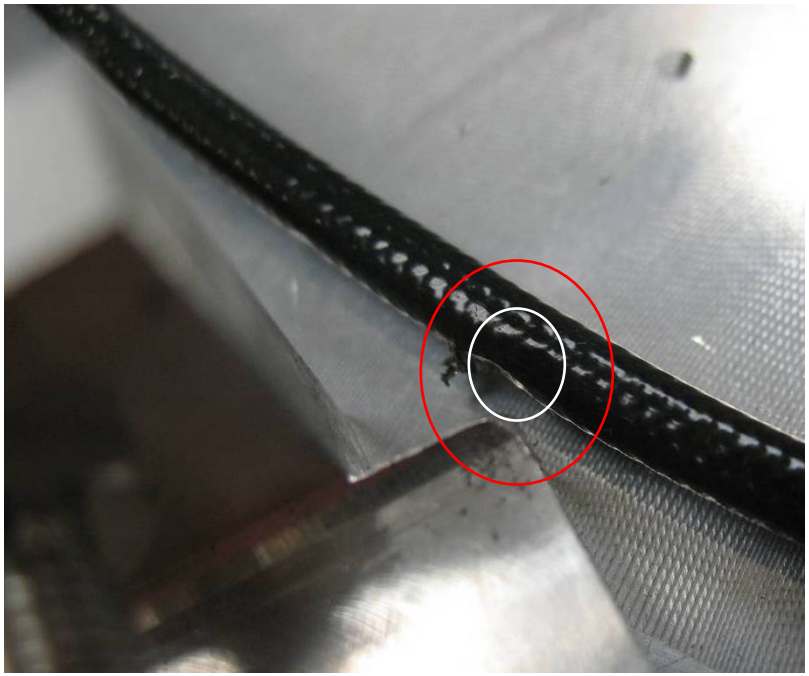
Connector Type	MIL-STD-348A Figure	Contact (inch)	Dielectric (inch)
Standard SMA_M	310.1	+0.0, -0.010	+0.0
High Frequency SMA_M	310.1	0.075 to 0.100	+0.0
SMA_F	310.2	+0.0, -0.010	+0.0
SSMA_M	319.1	0.075 to 0.100	+0.0
SMP_M	326.1	+0.0, -0.008	+0.0
SMK (2.92mm)_M	323.1	+0.0, -0.005	N/A
TNC_M	3131.1	0.210 to 0.231	0.208 to 0.228
TNC_F	313.2	0.186 to 0.206	0.188 to 0.208
TNCA_M	313.3	.208 to .220	N/A

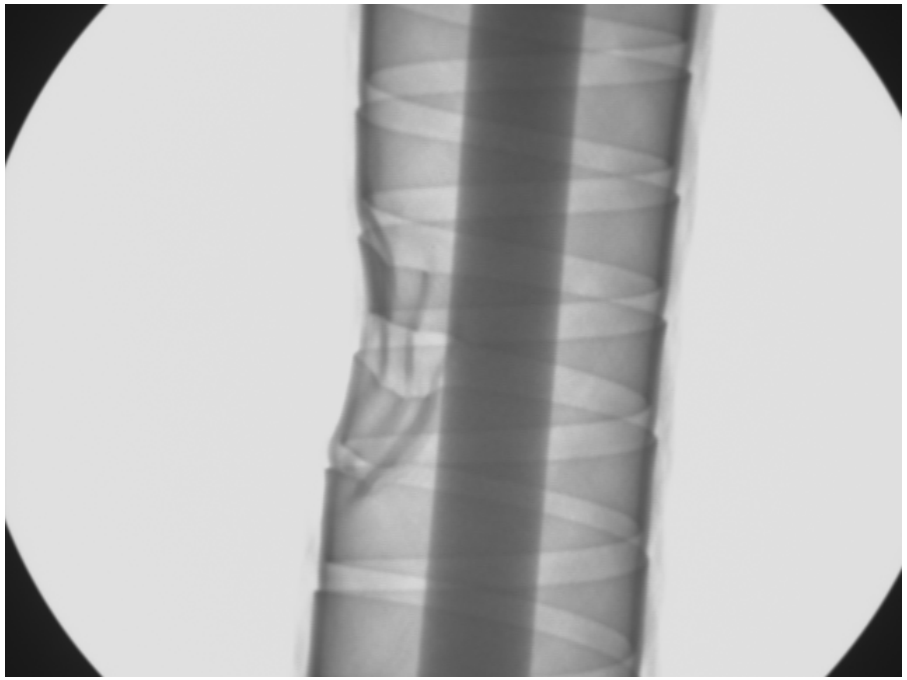
Cable Care and Handling

- Examine the cable length for protrusions, sharp edges, dents, kinks, cracks, unspecified bends, or splits. If debris or loose particles are detected along the cable jacket clean with a slightly damp, lint free isopropyl alcohol cloth. The heat shrink formed elbows with jacket rises along the inner radius of the bend which do not exceed 10% of the cable and heat shrink diameter are acceptable.

Cable Care and Handling

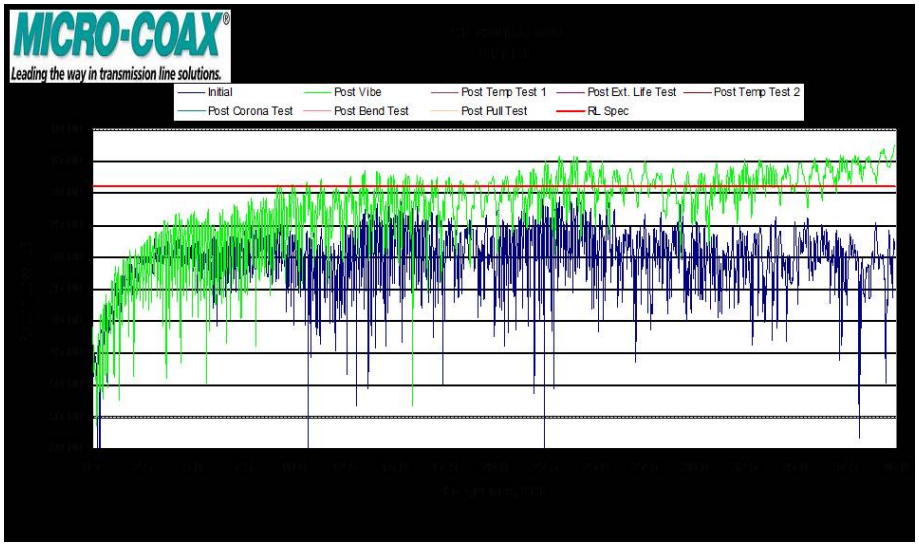
- It is recommended that a cable be replaced when exhibiting a dent which corresponds to greater than 1.0 Ohm impedance spike within a time domain reflectometry trace. Below is evidence of an unacceptable dent with x-ray detailing disturbance to the outer conductor/helical flat wire.

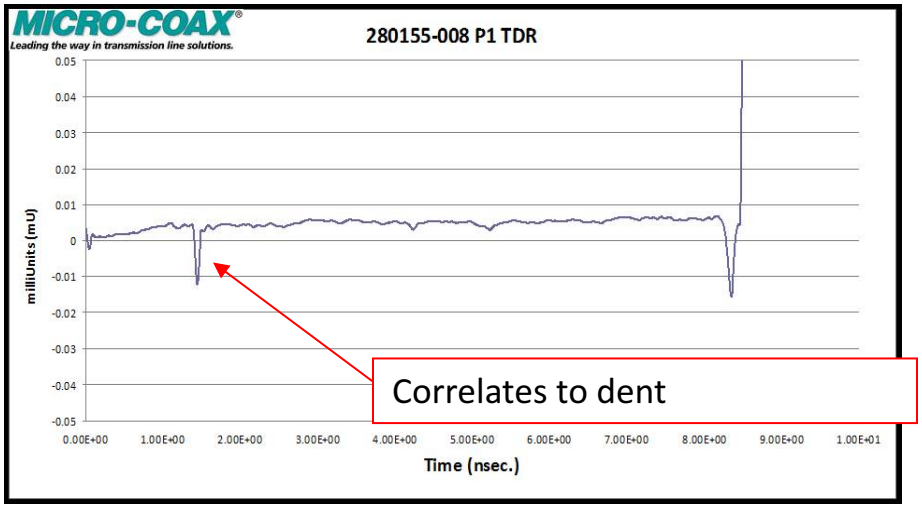




Cable Care and Handling

- Performance degradation due to dent and deformation of the outer conductor.





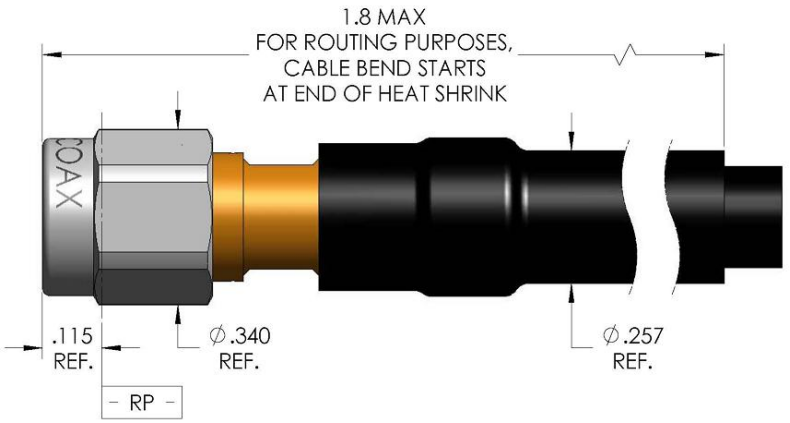
Cable Care and Handling

- After mating the first connector per the previous instruction route the cable by adhering to the prescribed bend radius for the applicable cable type. The table below lists qualified minimum bend radius values formed 10 times around a bend mandrel. Forming the cable to a bend radius less than the values below has not been qualified thus the reliability of the cable cannot be guaranteed if a lesser bend radius is utilized.

Cable Type	Minimum Bend Radius
MCJ311A	1.25 inch
MCJ205A	0.5 inch
MCJ185A	0.38 inch
MCJ142A	0.38 inch
MCJ088D	0.25 inch

Cable Care and Handling

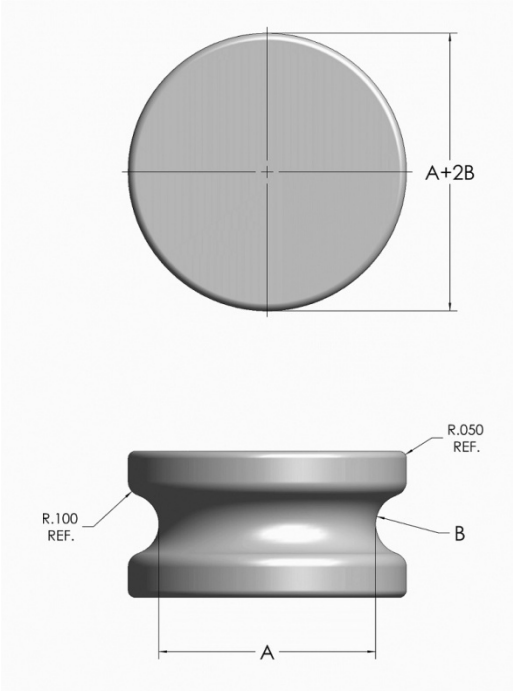
- Manually maintain slight tension along the inner radius of the cable when forming and guide the form with the hands whenever possible as opposed to using the cable as a lever to create the form.
- When bending or forming the cable near the connector the form should begin at the end of the heat shrink sleeve support. If possible support the cable by hand as near to the start of the form ensuring to prevent any force being applied to the connector interface.



Cable Care and Handling

- Per NASA-STD-8739.4, 7.3.21, the optimal bend radius of a single flexible coaxial cable is 10x the diameter with the minimum bend radius being 6x the diameter when forming and integrating the cable assembly. If the integrator must work to the minimum bend radius of the cable it is recommended that a forming mandrel be utilized along with the previous instruction. Warming the cable at the bend area with a heat gun, not to exceed +125°C, can be beneficial. The following figures provide guidance for the form mandrel and its application with various cable types.

Cable Type	Diameter A (in.)	Radius B (in.)
MCJ311A	2.5	0.210
MCJ205A	1.0	0.160
MCJ185A	0.76	0.160
MCJ142A	0.76	0.125
MCJ088D	0.50	0.063



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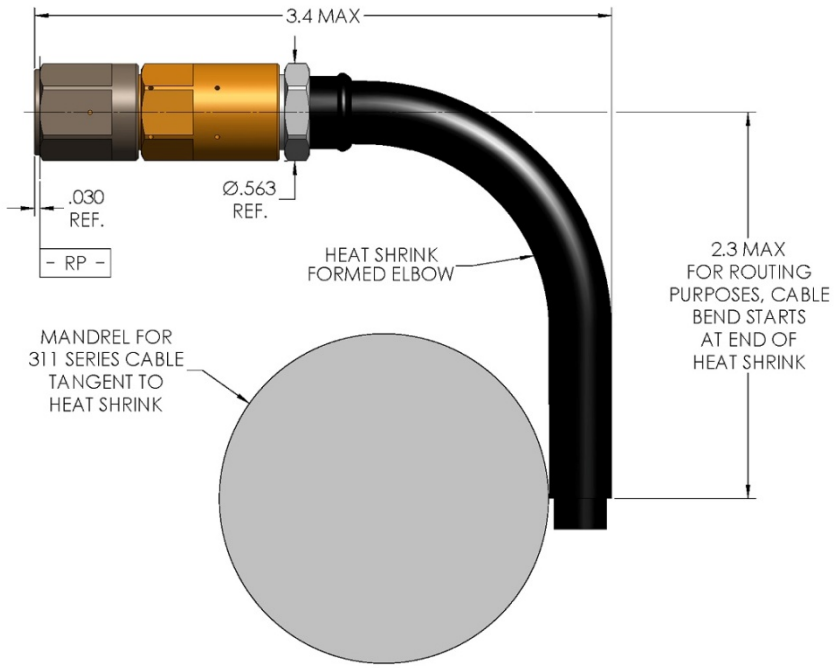

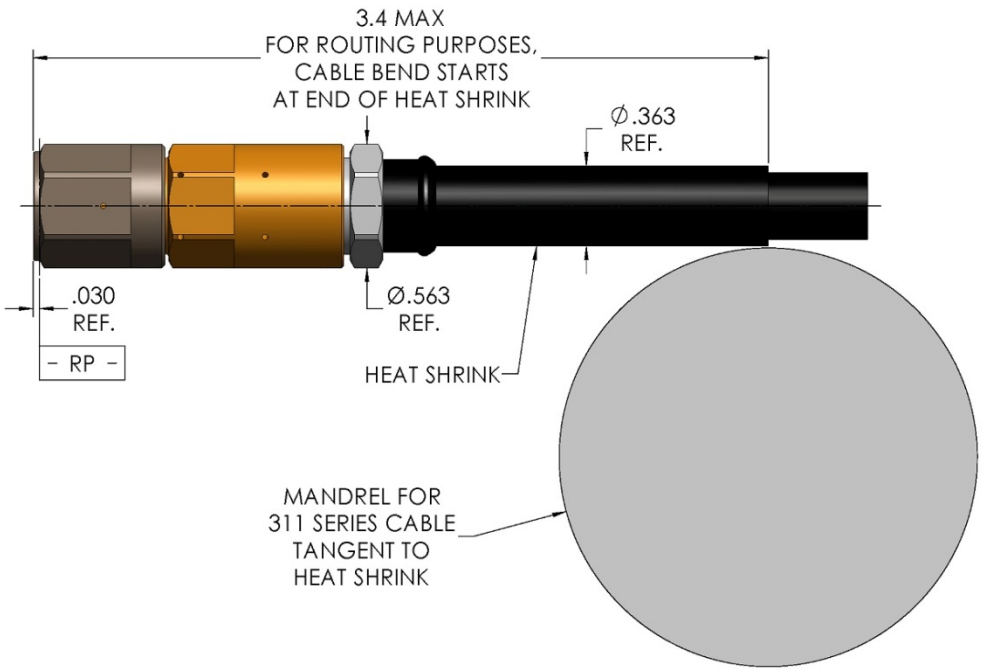

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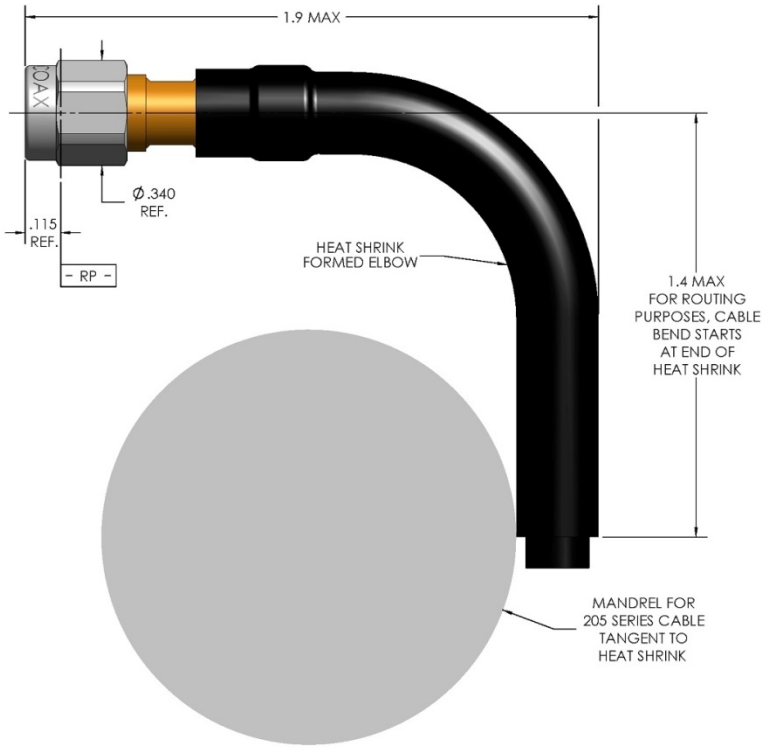

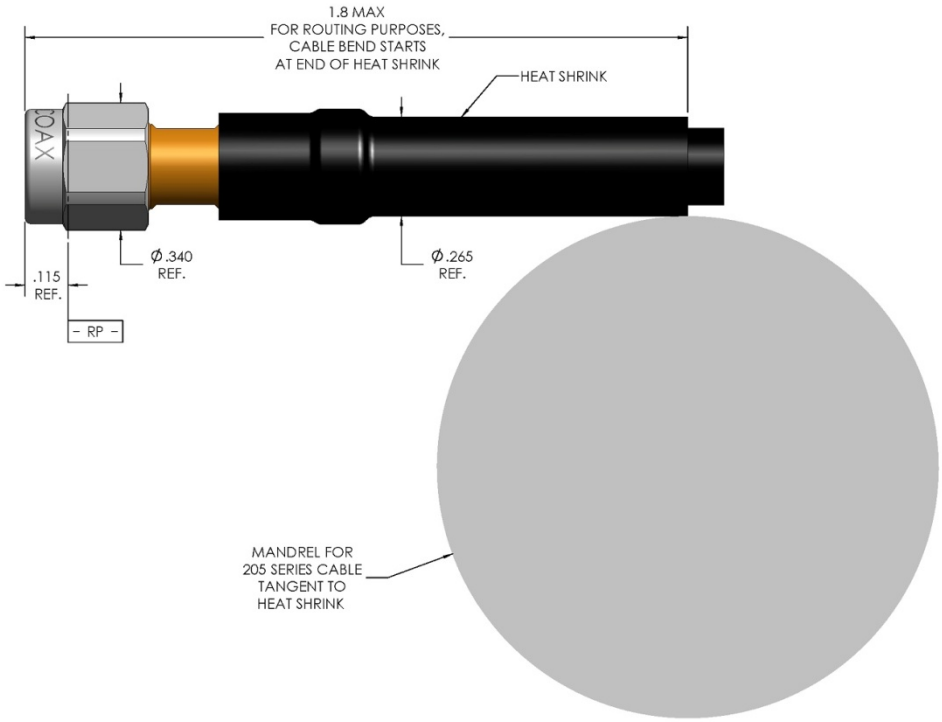

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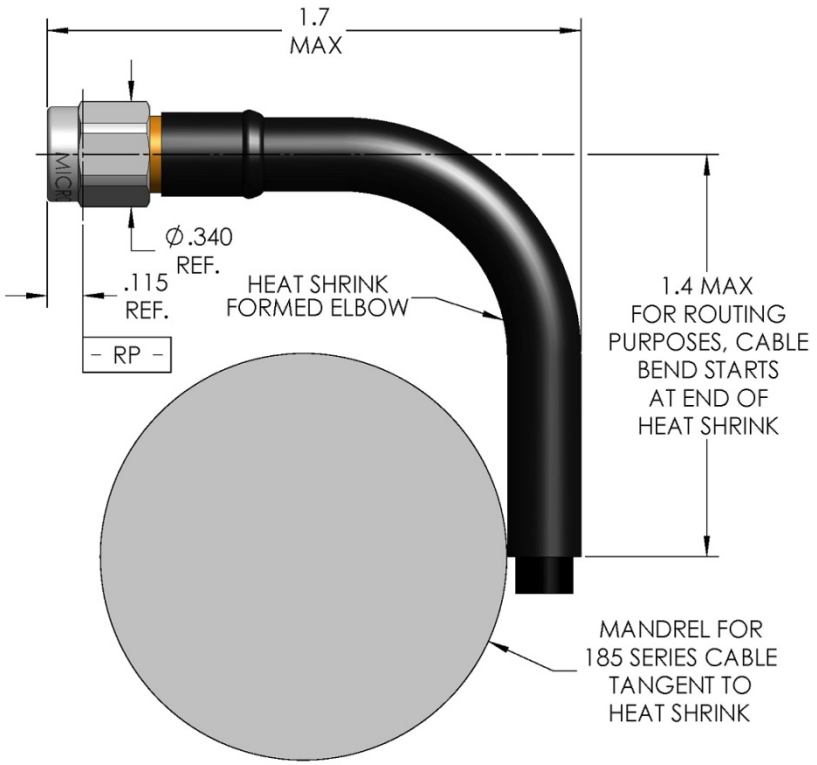

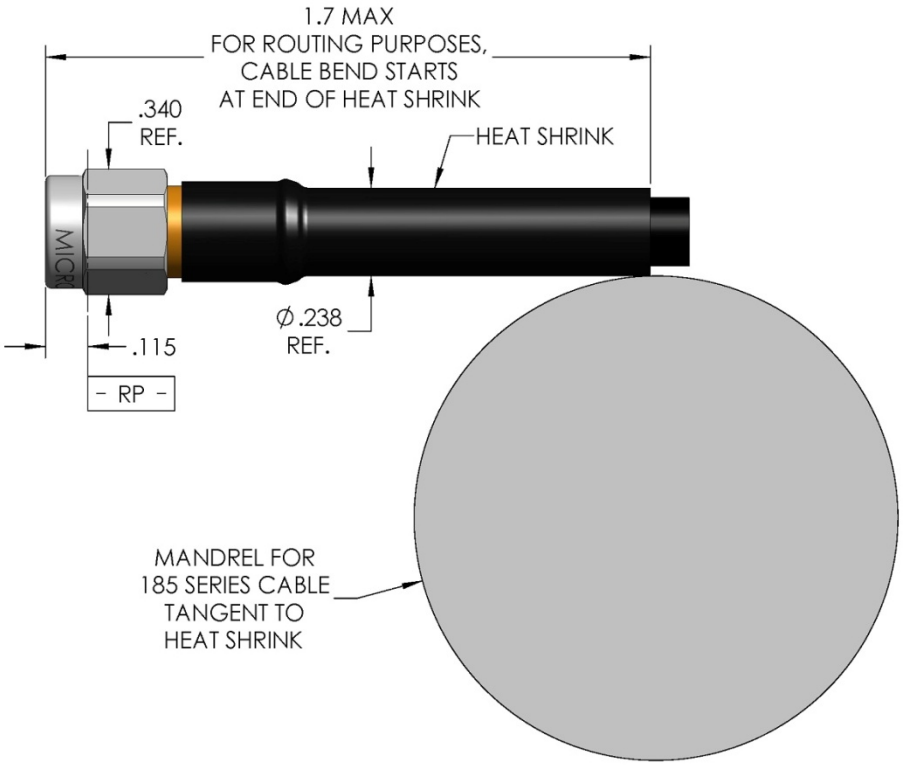

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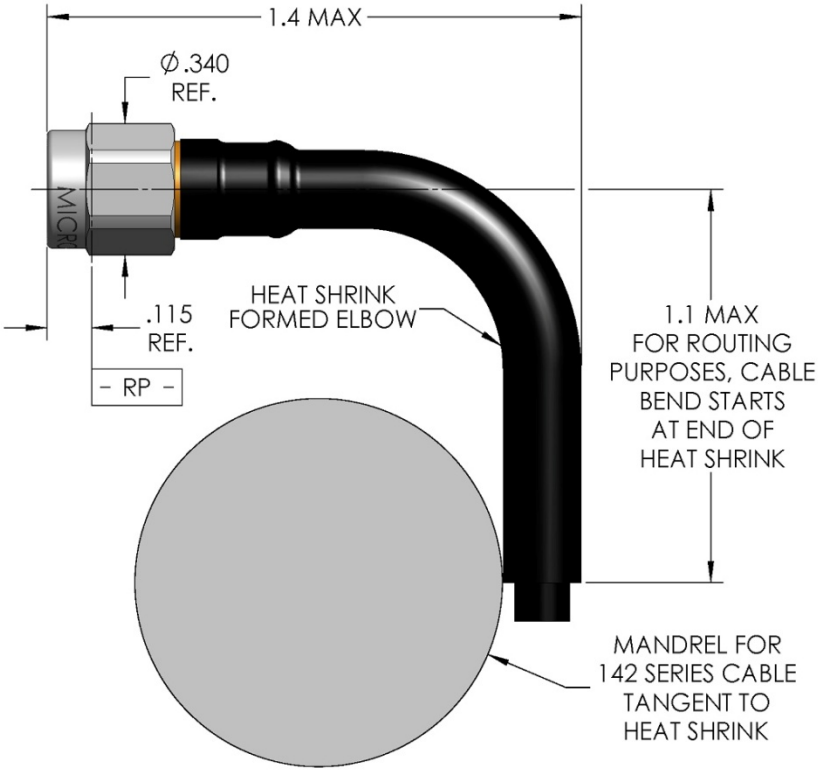

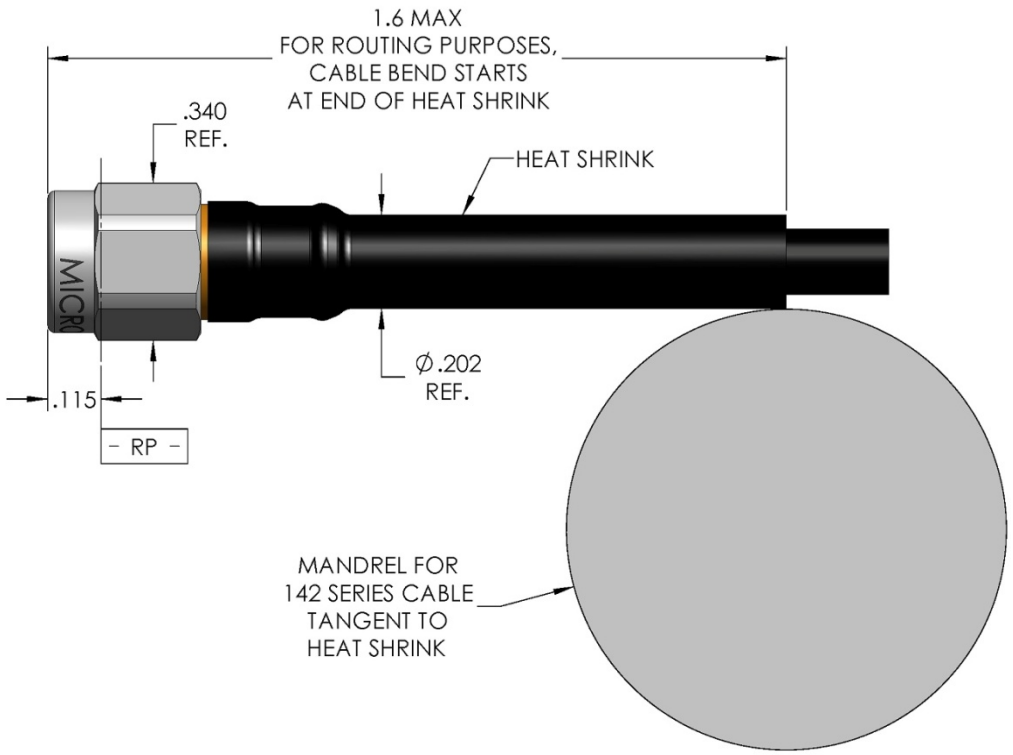

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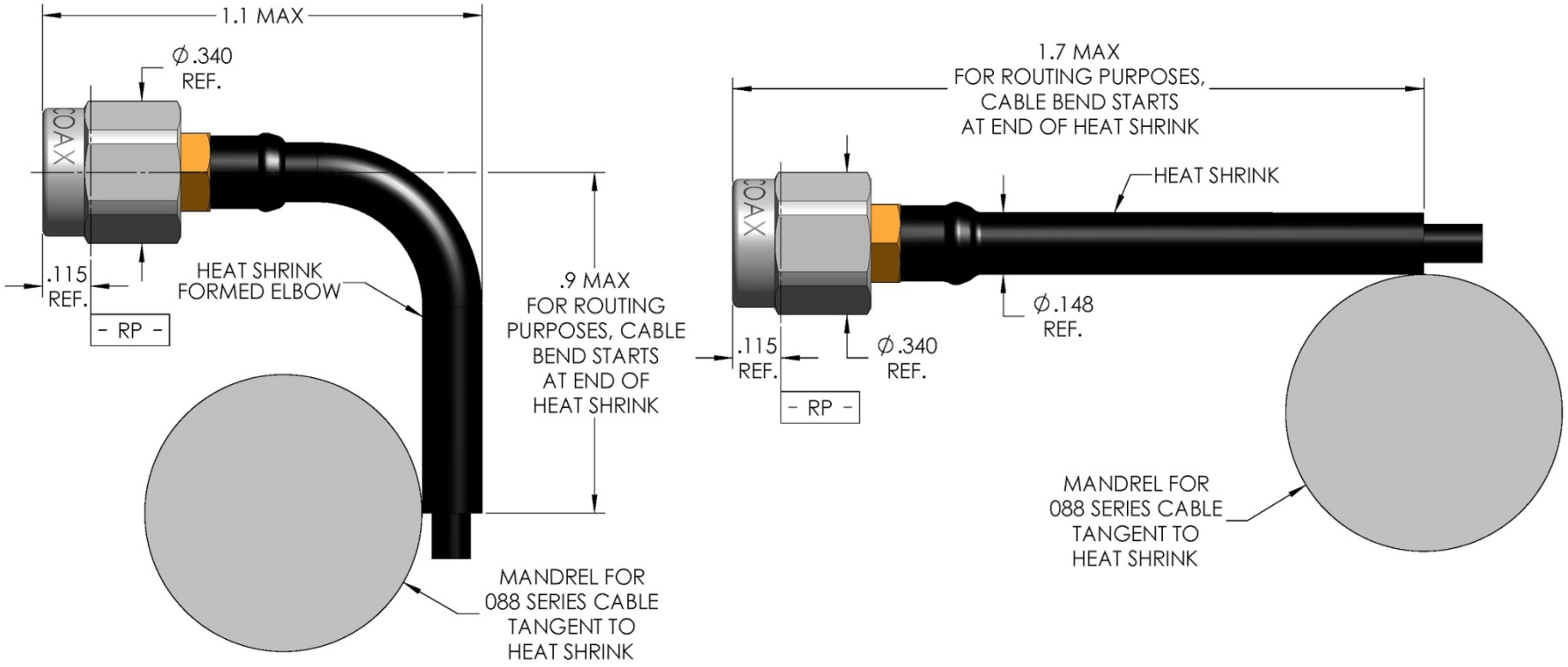
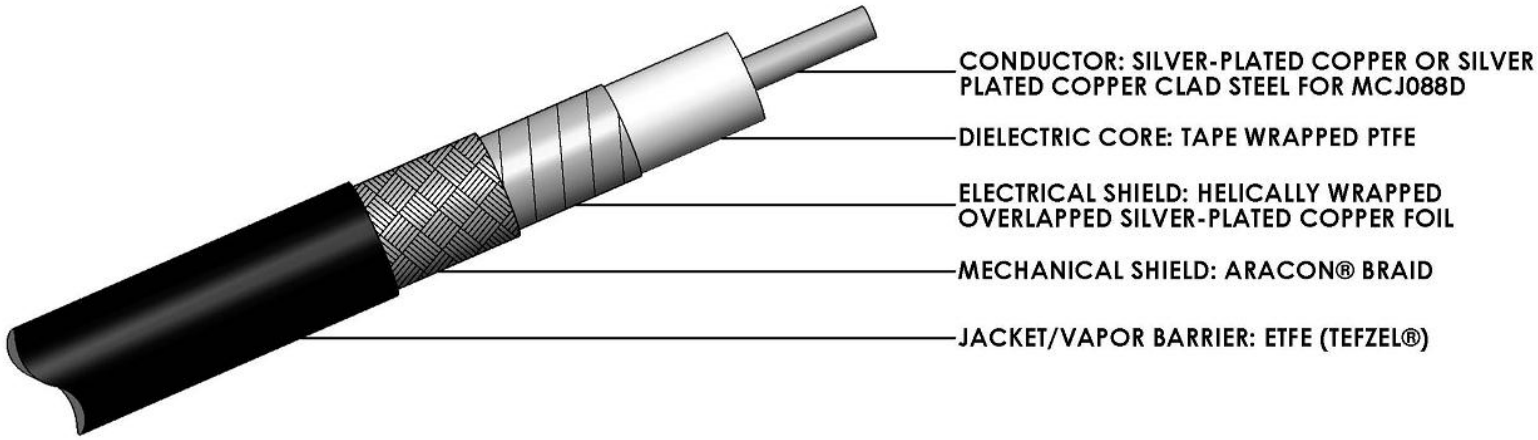


Cable Care and Handling

- The CarlisleIT MCJ cable types are unique due to their construction utilizing the ARACON® braid, which can be considered a yarn, as opposed to cables constructed with a silver plated copper braid.



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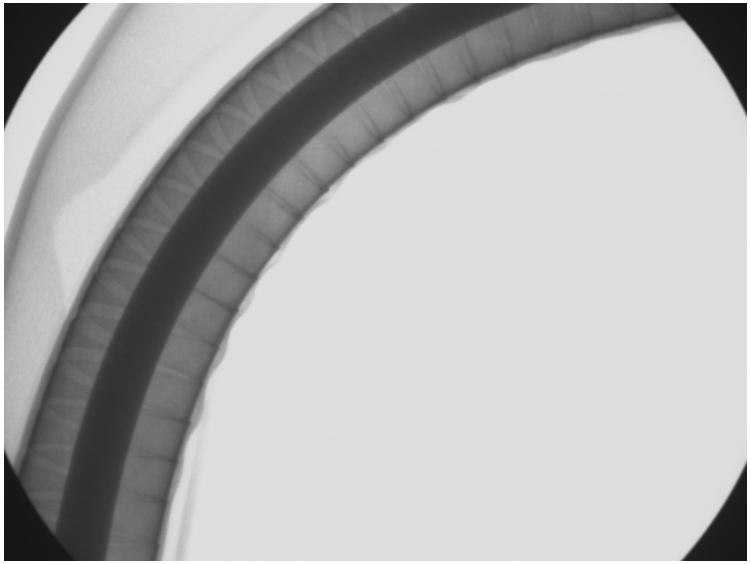
TEFZEL® is a registered trademark of DuPont

Cable Care and Handling

- Jacket rises similar to the rises along the inner radius of the heat shrink formed elbow may occur along the cable during integration and routing. With the x-ray we see the ARACON braid following the jacket rise along with the undisturbed helical beneath the ARACON. This is different from a SPC braid that could potentially impart damage to the underlying helical/outer conductor when the jacket rises. With no impairment to the outer conductor the performance of the cable will not be compromised. This is critical as this type of response between the ETFE jacket and the ARACON braid is not possible with a SPC braid.



Cable Care and Handling

- Secure the assemblies to the tie-down areas using cable-ties, “Tyraps” or equivalent, starting 8 inches minimum from the mated connectors and every 8 inches minimum thereafter. To prevent damage to the cables, wrap multiple layers of an approved fiberglass tape around the cable and underneath the cable-ties and hand-tighten to secure the cable to the tie-down areas. Stop tightening the strap when slight depressions are observed in the tape.