September 15, 2016

Flexible Metal Conduit, (FMC) Power Cables
vs.
Metal Clad Cable, (Type MC) Power Cables

- **Tensile Strength of FMC: 2X That of Type MC Cable**

  By requirement of UL 1, Standard for Safety for Flexible Metal Conduit, ". . . flexible steel conduit shall be capable of withstanding, without opening up at any point, an axial tension of 300 lbf (1334 N)."

  By contrast, UL 1569, Standard for Safety for Metal Clad Cables, (Type MC Cables) - the interlocked armor of MC Cable need only be capable of withstanding, without opening up at any point, an axial tension of 150 lbf (667 N), ,just half that of Flexible Metal Conduit.

- **CII FMC Home Run Cables: 3X the Flexibility of Type MC Cables**

  While Flexible Metal Conduit is twice as strong as Type MC Cable, it is at the same time nearly 3 times as flexible. The UL standard for the minimum bend radius of MC Cable is *14 x* the size or diameter of the cable. The table below shows the UL requirements for the minimum bend radius of the sizes of Flexible Metal Conduit used in the manufacture if CII's Home Run Cables, compared to an equivalent sized Type MC Cable. One inch trade size FMC, for example, has a 5" minimum bend radius as opposed to a 14" minimum bend radius for 1" Type MC Cable. **For all sizes of Flexible Metal Conduit used in CII Home Run Power Cables, from 1" to 2", the FMC has a smaller bend radius by a factor of 2.8, and a factor of 2.6 for ¾" conduit.** Type MC cable can be bent to a smaller radius than those given in the table below, however doing so will, in all likelihood, cause the metallic bands of the cable's armor to separate creating a serious safety hazard.

Minimum Bend Radii of FMC Used in CII Home Run Cables vs. Type MC Cable

Trade Size	FMC Min. Bend Radius Inches	Equivalent MC Cable Min. Bend Radius Inches
¾	4	10½
1	5	14
1¼	6¼	17½
1½	7½	21
2	10	28

Communications Integrators Inc 2625 South Wilson Street – Suite 105 Tempe, Arizona 85282
Toll Free: 800.679.9711 Tel: 480.464.8101 Fax: 480.668.8938 http://www.ciinet.com

- **CII S-FMC Jumper Cables: 5X the Flexibility of Type MC Cables**

  While it is clear the CII Home Run Cables outperform Type MC Cable in product flexibility, and therefore ease of installation by a margin of nearly 3:1, the margin of performance superiority is even greater when considering CII Jumper cables. The minimum bend radius of the appliance grade, "Super Flex" FMC used in the manufacture of CII Jumper Whips is as low as 1¼", compared to 7" for comparably sized Type MC Cable.

Minimum Bend Radii of Super FMC Used in CII Jumper Cables vs. Type MC Cable

Jumper Whip Size Inches	S-FMC Min. Bend Radius Inches	Equivalent MC Cable Min. Bend Radius Inches
½	1¼	7
9/16	1½	7⅞
¾	1¾	10½

Because of its superior strength and flexibility the CII power cable can be twisted, turned and stretched without causing any harm to its protective FMC sheathing. Introducing a sharp or precise bend or twist onto an MC Cable on the other hand, whether intentionally or accidentally during installation will, owing to its poor bend radius performance, often cause the interlocked metallic strips encasing the electrical conductors of the cable to separate, exposing the conductors to the sharp metallic edges of the now compromised MC Cable. Chaffing of the wire insulation against the exposed sharp edges of these metal strips could very well result in electrifying the MC Cable's outer metallic sheath, creating a significant safety hazard.

- **FMC Has Proven Resistance to Crushing Forces, Type MC Does Not**

  Because of a lack of testing during the certification process of Type MC Cable, there is no real apples-to-apples test data to compare FMC's ability to withstand an impact force to that of Type MC Cable. However, the table below shows the minimum forces that listed FMC must withstand without sustaining any significant deformation.

FMC Resistance to Impact Force

Trade Size	Force	
	ft-lbf	(J)
¾	40	54
1	70	95
1¼	90	122
1½	125	170
2	150	203

- **Stranded Conductors vs. Solid**

  In addition to the inherently superior strength and flexibility of the FMC used in the manufacture of CII power cables, the combination of the Flexible Metal Conduit in conjunction with the multi-strand copper conductors used to

produce the CII power cables provides even greater degree of flexibility that is just not possible with Type MC Cable, all of which are made using the far more rigid solid conductors. Because of the high flexibility of the multi-strand conductors used in the manufacture of CII's power cables they are able to maintain the incredibly low minimum bend radii of the FMC used in their manufacture. The rigid structure of the solid conductors used in the production of all Type MC Cable contributes to its inherently large, and largely unwieldly minimum bend radii.

- **Coil Retention Memory**

  The native rigidity of the solid conductors of Type MC Cable give it a Coil Retention Memory that is not found in the far more flexible stranded conductor based CII power cables. Coil Retention Memory is the nemesis of efficient cable installation.

  All power cables are delivered to the job site coiled either on a pallet or a large cable spool. If these cables are solid conductor based Type MC, even after they are uncoiled and stretched out end-to-end, they are naturally going to retain the coil they had while on the pallet or spool. This applies to both the relatively small Jumper Cables as well as the much larger Home Run Cables, which can be one or two hundred feet long, or more, weighing several hundred pounds. Many man hours are spent by installers muscling these cables into place, fighting to get them to lay as flat on the subfloor surface as they can. This is never an issue with the highly flexible FMC/Stranded Conductor based CII power cables. Multi-strand conductors are not susceptible to Coil Memory Retention, neither are the CII Home Run nor Jumper Whip cables.

- **In Conclusion**

  The interlocked metallic strips encasing the MC Cable's solid conductors are not nearly as flexible as is FMC, which is specifically designed for maximum flexibility. Coupled with the far more flexible multi-strand conductors used in the production of CII cables produces power cables that are far more flexible than any Type MC Cable could ever hope to be. The more flexible CII FMC/Multi-strand cables install easier, lay flatter on the concrete slab within the limited spaces beneath a raised access floor, are capable tighter bends in confined spaces, and are much easier to relocate than are the much more rigid Type MC Cables.