

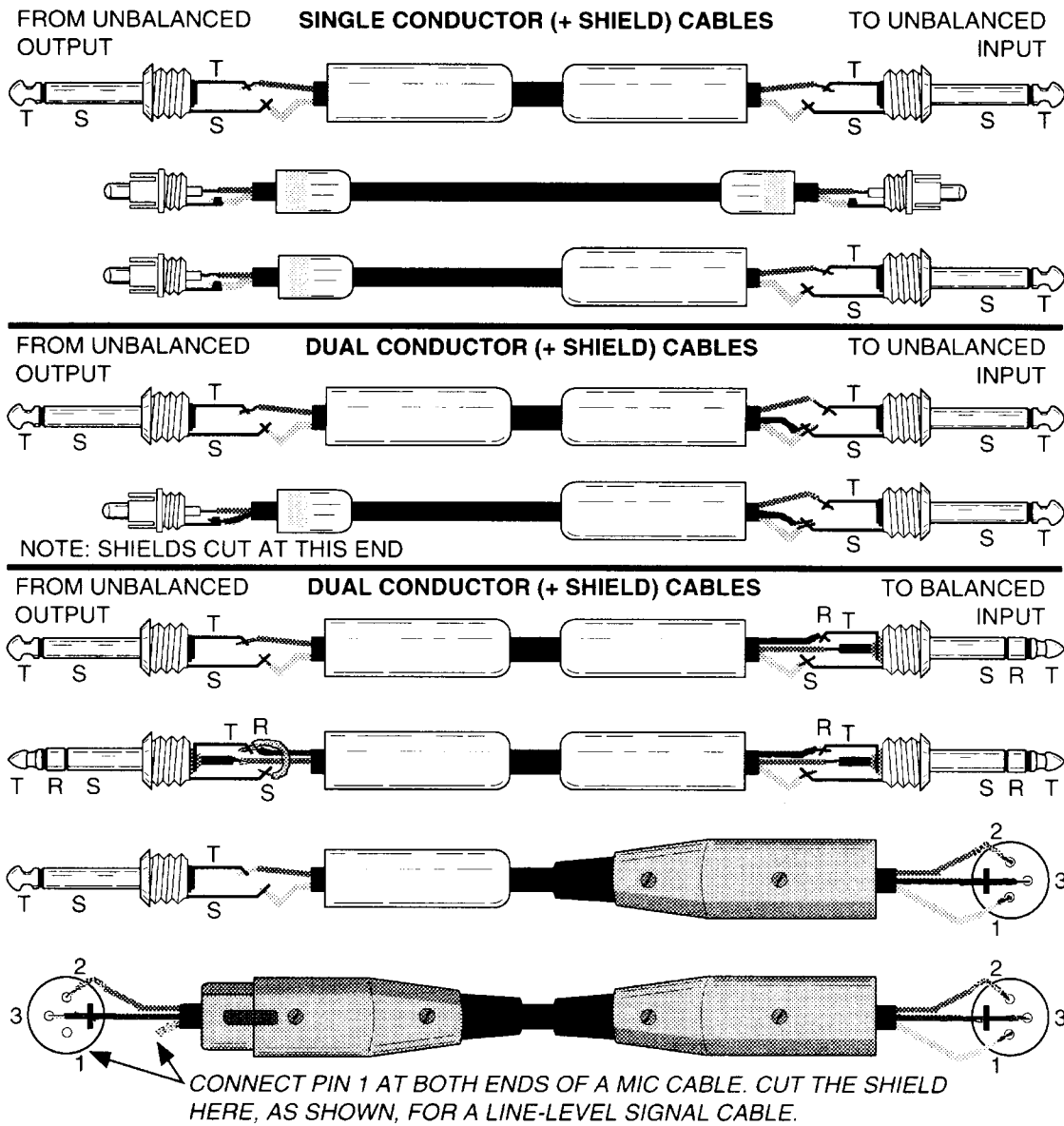
Field Operations Manual

Appendix



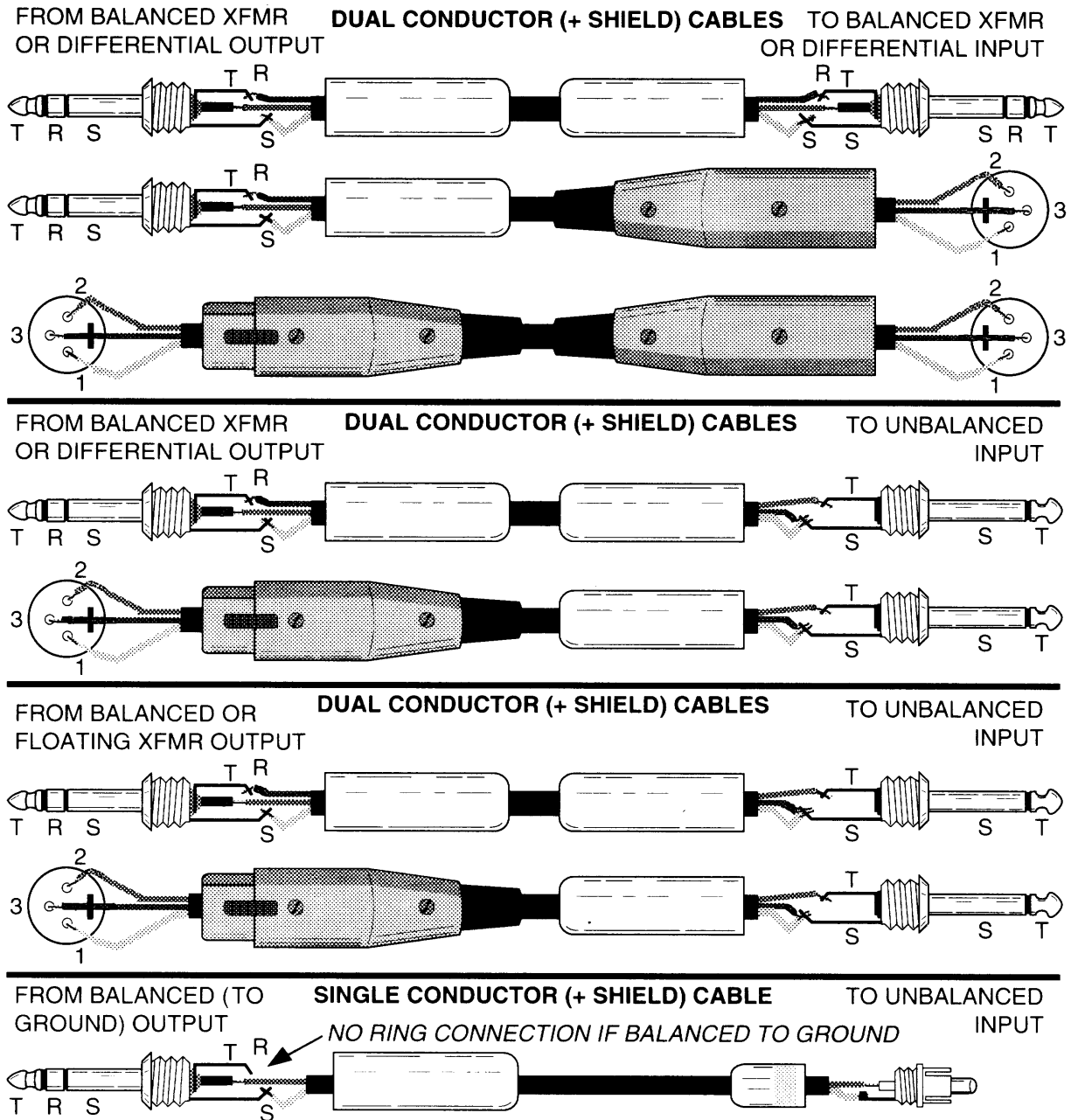
Field Standards - Appendix A

Audio Connections



Field Standards - Appendix A

Audio Connections -(continued)

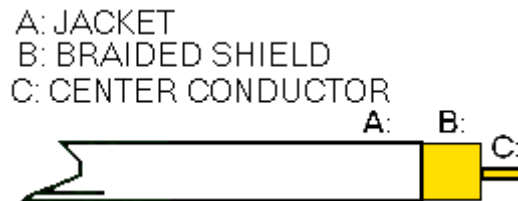


Field Standards - Appendix B

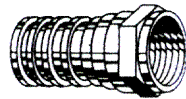
Coaxial Cable

Signal distance before degradation on coax:

- RG59 baseband (video) 600' broadband (RF) 50'
- RG6 baseband (video) 800' broadband (RF) 75'
- RG11 baseband (video) 1200' broadband (RF) 150'



RF: A two bladed rotary cutter should be used. The deepest cut 3/8" from the end of the wire should cut down to, yet not nick, the center conductor. The shallowest cut should be approximately 1/4" from the first and should cut through the jacket, yet not nick or disfigure, the foil or braid. Nicks on the braid or center conductor are not acceptable. This weakens the physical connection and is detrimental in all applications to bandwidth and shielding capabilities.

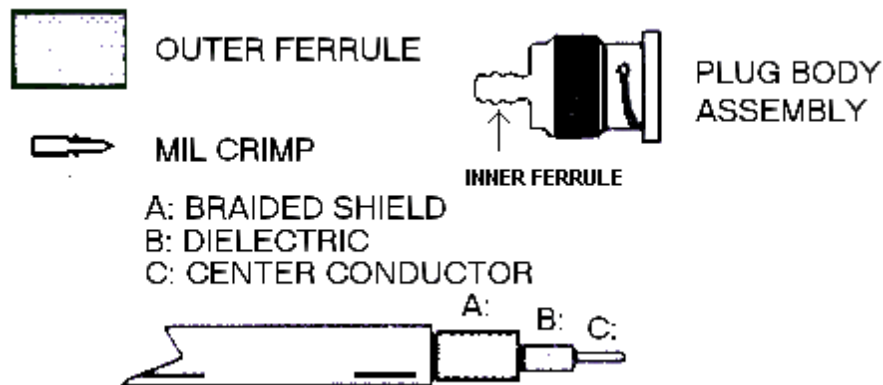


Be sure the RF connector is specifically designed for the type of cable. Hold the cable just behind the jacket cut with one hand and with the other hand grasp the dielectric. Move the dielectric in a small circular motion to flare the braid just barely off the dielectric. The RF connector should push on easily. Only the center conductor and its insulating dielectric should be slid into the center hole of the connector until the dielectric is flush with the inner base of the connector's hole. The center conductor should protrude slightly past the connector's threaded end. The shield should not be combed or un-braided as this is part of the shielding characteristics. The shield, foil and jacket should be hidden by the connector's metal casing. *A ratcheting six sided crimp tool should be used to terminate this type of connector.* A properly matched cable/connector/tool termination cannot be done by hand.

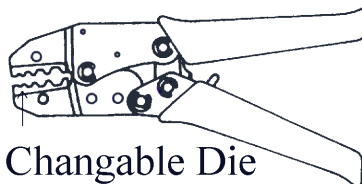
Field Standards - Appendix B

Coaxial Cable - (continued)

BNC: A three bladed rotary cutter should be used (measurements shown for this particular connector). The first cut exposing the center conductor is .15625" from the end of the wire. It should cut down to, yet not nick, the center conductor. The second cut should be approximately .25" from the end of the wire and should cut through the jacket and the shield, yet not nick or disfigure, the dielectric. The third cut is .59375" from the end of the wire. It should cut down to, yet not nick, the shield or foil. Nicks on the braid, dielectric or center conductor are not acceptable. This weakens the physical connection and is detrimental in all applications to bandwidth and shielding capabilities. The three parts of a BNC are listed below.



Slide the outer ferrule onto the cable and flair the braid as described above in the RF section. Place the mil crimp pin on the center conductor so that it butts against the dielectric. Using the appropriate crimp die for your ratcheting crimp tool (cross reference the BNC with the cable manufacturer and die manufacturer), crimp the mil crimp pin in the small 6 sided cavity in the die. Install the plug body assembly so that the inner ferrule slides over the dielectric but under the shield braid. Push the plug body onto the cable until it snaps into place. Slide the outer ferrule over the shield braid and against the plug body. Crimp the outer ferrule with the large 6 sided cavity. *Note that BNC crimping is an exact science when it comes to matching crimp die, cable, and connector.*



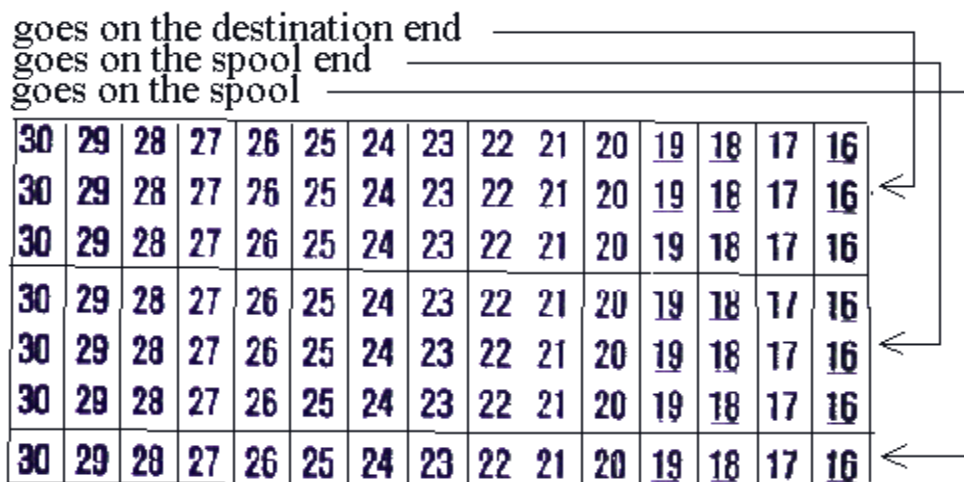
Most crimp tool manufacturers have interchangeable dies allowing one crimp tool to be used to crimp a vast array of connectors.

Field Standards - Appendix C

Cable Pulls

Leave extra wire at the starting and termination points. With long term profitability in mind, losing a few feet of wire is better than having to “extend” or “stretch” a wire run. When the run is completed and there is extra at each end, tie the wire to the structure or high on the ceiling support members every few feet. Always pull in an extra string to facilitate easy addition of wires to the same conduit.

When starting a wire pull with multiple runs, use Panduit Pan-Code wire marker books. Part number PCMB-3 or a comparable product to label the wires. These markers adhere well and usually don’t come off unless scraped against a sharp object like ceiling grid or metal studs.



One number strip will break in half. One half (three numerals) goes 18” from the end of the wire. The single numeral goes on the side of the wire reel. The other half (three numerals) goes 18” from the end of the wire after the run is complete and you are ready to cut the run from the reel. Do not use more than three numerals on a wire as this makes a higher label that will catch on sharp objects as you make the pull. Putting the wire number 18” from the end allows plenty of room to connect pulling devices (i.e., tape, jet string, wire grips and fish tapes). Run the wire in the most direct route to the destination.

Field Standards - Appendix C

Cable Pulls - (continued)

The best place to run the cable is through the roof support structure. *Do not leave the wire laying on the grid as this is not acceptable according to the NEC.* When penetrating fire walls be sure to fill the hole with approved fire stop compound or inform the G.C. that it needs to be done. Stay away from higher voltage wires and all other trades low voltage wires. Keep in mind that other trades are carrying data on their lines which can cause EMI in ours.

Stay away from other trades:

- 6" from <2KV lines
- 1' from HiV lighting
- 3' from 5KV lines
- 3.5' from transformers / motors.

RISER CLOSETS:

Riser closets are an integral part of system wiring. Connections, test points and some equipment will be housed in these small closets. The same care that is taken into making a rack look good should be used here. When pulling wire through riser closets keep signal types separated and neatly dressed. It is very important to prevent wires from tangling or interweaving within conduit between floors. All wires need to be supported on every floor as soon as that particular pull is complete. This relieves the strain on the cable and prevents cable stretching and disfiguring. If multiple pulls through the same conduit are necessary, group them separately and strain relief all pulls separately until all the wire is pulled and routed to its final destination. When all wire has been pulled, the separate bundles of like signals can be dressed together in one large neatly combed group. Ideally, all the wires on the outside of the bundle can be followed from the top closet to the bottom without weaving in and out of the bundle.

PULLING TOOLS:

When pulling wire through conduit, you can use many methods. One is to use a fish tape with a pulling grip (Hubble 6CO95, 6C107, 6D212). Twisted nylon twine (Jet Line) is rated at 165lbs. tensile strength and is sucked or blown through conduit with a shop vac and a conduit piston (Greenlee 608 1/2" to 613 2"). Pulling lubricant Greenlee Gel-q 5C647) makes pulls much easier. Wires have pulling tensions per cable that cannot be exceeded. These tensions also apply to wire installed vertically in riser closets.

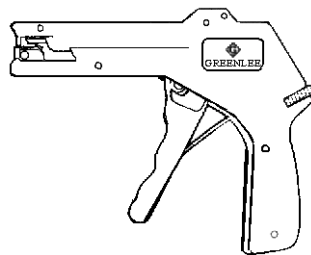
24awg	:4lbs.	20awg	:12lbs.	16awg	:30lbs.
22awg	:7lbs.	18awg	:19lbs.	14awg	:48lbs.
				12awg	:77lbs.

Field Standards - Appendix C

Cable Pulls - (continued)

CABLE DRESSING:

- Do not tie AC cables from equipment together. Tie each cable separately with just enough length to reach its outlet.
- Tie cable bundles with wire ties in 6" intervals.
- *Do not tie cables extremely tight.*
- If the wire tie deforms or squeezes the bundle, it will affect the shielding characteristics and can cause bleed through (EMI). *This is very important on all bundles and critical on video and RF signals.*
- A wire tie gun is the only appropriate way to get the correct amount of tension on a wire tie.
- When dressing coaxial cable, a bend radius of 8" should be observed.
- When dressing audio and control cable, a 90 degree bend should have a radius no less than 1/2".
- The cable should be tied within 6" of its final termination point.

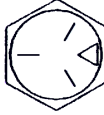


The tension settings are:

Video, RF	:4
Audio, Mic and Line	:2
Speaker, 70V and 8ohm	:3
Control and Timecode	:2
Fiber Optic	:1 or less

Field Standards - Appendix D Mounting Hardware

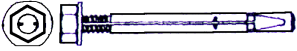
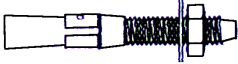
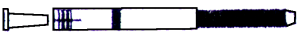
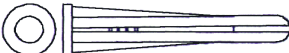
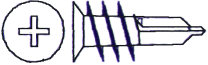
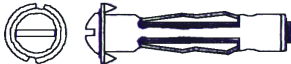
Use This Bolt reference chart when choosing hardware.

Identification Grade Mark	Specification	Material	Nominal Size Range (in.)	Proof Load (psi.)	Yield Strength Min. (psi.)	Tensile Strength Min. (psi.)
	SAE J429 Grade 1	Low or Medium Carbon Steel	1/4" thru 1 1/2"	33,000	36,000	60,000
	ASTM A 307 Grades A&B	Low Carbon Steel	1/4" thru 4"	—	—	
	SAE J429 Grade 2	Low or Medium Carbon Steel	1/4" thru 3/4" Over 3/4" thru 1 1/2"	55,000 33,000	57,000 36,000	74,000 60,000
	SAE J429 Grade 5 ASTM A 449	Medium Carbon Steel, Quenched & Tempered	1/4" thru 1" Over 1" thru 1 1/2" Over 1 1/2" thru 3"	85,000 74,000 55,000	92,000 81,000 58,000	120,000 105,000 90,000
	ASTM A 325 Type 1	Quenched & Tempered	1/2" thru 1" 1 1/8" thru 1 1/2"	85,000 74,000	92,000 81,000	120,000 105,000
	SAE J429 Grade 8	Medium Carbon Alloy Steel, Quenched & Tempered	1/4" thru 1 1/2"	120,000	130,000	150,000
	ASTM A354 Grade BD	Alloy Steel, Quenched & Tempered				
	L9	Alloy Steel, Quenched & Tempered	1/4" thru 1 1/2"	145,000	155,000	180,000
	ISO R898 CLASS 8.8	Medium Carbon Steel, Quenched & Tempered	4mm thru 24mm	85,000	92,000	120,000
	ISO R898 CLASS 10.9	Alloy Steel, Quenched & Tempered		120,000	130,000	150,000

Field Standards - Appendix E

Anchor Chart

Use this chart when choosing anchors.

Anchor	Type	Size Range	Use In
	Wej - It Anchors	1/4" x 1 3/4" to 1" x 12"	Concrete, Stone & Block
	Wedge Anchors	1/4" x 1 3/4" to 1 1/4" x 12"	Concrete or Stone
	Sleeve Anchors	1/4" x 1 1/8" to 3/4" x 6 1/4"	Concrete, Stone & Brick
	Stud Anchors	1/4" x 1 3/4" to 3/4" x 8 1/2"	Concrete, Stone & Brick
	Machine Screw Anchors	6/32" to 1/2" - 13"	Concrete, Stone & Brick
	Toggle Bolts	1/8 x 2" to 1/2 x 6"	Hollow block, Wallboard & Plaster
	Plastic Anchor Kits	Plastic Jars or Boxes	Concrete, Brick, Block & Wallboard
	Plastic Screw Anchors	4- 6- 8 x 1" to 14- 16 x 1 1/2"	Concrete, Brick, Block & Wallboard
	Plastic Anchors	1 - 2 - 3 x 1 to 13 - 14 - 15 x 2	Concrete, Brick, Block & Stone
	One Step Wallboard Anchors	6 - 8 - 10 Zinc & Nylon	Wallboard
	E -Z Toggle Anchor	# 8 Dia. x 2"	Wallboard
	Polly Toggle Anchor	3/8" to 5/8"	Wallboard or Solid Masonry
	Hollow Wall Anchor	1/8" to 1/4"	Wallboard, Hollow Plaster & Tile Block

Field Standards - Appendix E

Anchor Chart - (continued)

Use this chart to determine the size of the hole to drill for the anchor you choose.

DESCRIPTION	DIAMETER OF ANCHOR	DRILL HOLE SIZE	DIAMETER OF ANCHOR	DRILL HOLE SIZE
Drop in Anchors	1/4	3/8	5/8	7/8
	3/8	1/2	3/4	1
	1/2	5/6		
Lag Shields	1/4	1/2	1/2	3/4
	5/16	1/2	5/8	7/8
	3/8	5/8	3/4	1
Lead Wood Screw Anchors	#8	1/4	#16	3/8
	#10	5/16		
Lead Machine Screw Anchors, Single Expansion Shields & Double Expansion Shields	6/32	5/16	3/8	3/4
	8/32	5/16	1/2	7/8
	10/24	3/8	5/8	1-1/8
	1/4	1/2	3/4	1-1/4
	5/16	5/8		
Plastic Conical Anchors	6-8	3/16	10-12	1/4
	8-10	3/16	10-12	5/16
Toggle Bolts	1/8	3/8	5/16	7/8
	3/16	1/2	3/8	1
	1/4	5/8	1/2	1-1/4
Hollow Wall Anchors	1/8 - All Sizes	5/16	1/4 - S	7/16
	3/16 - S	3/8	1/4 - L	7/16
	3/16 - L	3/8	1/4 - XL	1/2
	3/16 - XL	7/16		
Plastic Toggles	1/8 - All Sizes	5/16		



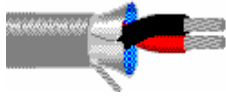
Appendix F - Core Cable

Speaker Cable (Unshielded Twisted Pair)



	PVC Jacket	Plenum Rated Jacket
awg	Belden #	Belden #
18	5300UE	6300UE
16	5200UE	6200UE
14	5100UE	6100UE
12	5000UE	6000UE

Microphone Cable (Single Twisted Pair, Foil Shield)



	PVC Jacket	Plenum Rated Jacket
awg	Belden #	Belden #
22	5500FE	6500FE
20	5400FE	6400FE
18	5300FE	6300FE

Microphone Cable w/unshielded switch pair



	PVC Jacket	Plenum Rated Jacket
awg	Belden #	Belden #
22	5502GE	6502GE

Flexible Interconnect Cable (Single Twisted Pair, Braided Shield)



	PVC Jacket	Plenum Rated Jacket
awg	Belden #	Belden #
24	1901A	N/A

Drive Thru (3 Bonded Pairs)

	PVC Jacket	Plenum Rated Jacket
Description	Belden #	Belden #
5300FE, 5500 FE, 18 awg unshielded 12 twists/ft	YM48782	N/A

Miscellaneous Control Cables

	PVC Jacket	Plenum Rated Jacket
Description	Belden #	Belden #
CAT-5e (24awg solid/4 pair)	1583A	1585A
22 awg/4 cond, overall foil shield	5502FE	6502FE
22 awg/8 cond, overall foil shield	5506FE	6506FE

Appendix F - Core Cable (continued)

RF/DBS (5MHz - 2.2GHz) Coax (75 ohm)



	awg	Belden #
Non-Plenum	RG-6	1829AC
	RG-11	7731A
Plenum	RG-6	633938
	RG-6	YR48403 (black)
	RG-11	7732A

Antenna Coax (50 Ohm)



	awg	Belden #
Non-Plenum	RG-58	8240
Plenum	RG-58	82240

Composite Video Coax (75 ohm)



	awg	Belden #
Non-Plenum	RG-6	1694A
	RG-59	1505A
Plenum	RG-6	1695A
	RG-59	1506A

RGB Video (Mini High Resolution, 75 Ohm)



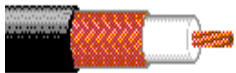
	awg	Belden #
Non-Plenum	26	1164B
Plenum	25	1277P

RGBHV Video (Mini High Resolution, 75 Ohm)



	awg	Belden #
Non-Plenum	26	1418B
Plenum	25	1279P

Flexible Interconnect Coax (75 Ohm)



	awg	Belden #
Non-Plenum	RG-59	8241F

Video over NanoSkew UTP (4 pair solid)



	awg	Belden #
Non-Plenum	24	7987R
Plenum	24	7987P
Plenum	24	7987P (Black)