

Electrical Infrastructure Research Team

Cable and Connector Requirements

October 22, 2013

1) Sections

- Areas of Focus
- Team Members for Feedback
- Electrical Characteristics
- Cable Jacket and Connector Molding Materials
- Connector Style Options
- Other Components to the System for Consideration
- Testing and Approval Requirements
- Timeline

2) Areas of Focus

- Circuits to Consider – All LED Lighting
- Primary Focus – Phase 1
 - Taxiway Edge
 - Taxiway Centerline
 - MIRLs and HIRLs
 - Runway Centerline
 - TDZs
- Secondary Focus – Phase 2
 - Threshold
 - Signs
 - REILs
 - Others?

2) Areas of Focus

- Circuits to Consider – All LED Lighting

Phase 3

- PAPIs
- MALS and ALCEF
- ODALs and others

3) Team Members for Feedback

- Gene Gottlieb (ORD)– Confirmed
- Frank Barczak / Jeff Pace (MCO)- Confirmed
- Rick Meyers (SLC) – Confirmed
- Dave Reeves (MEM) – Confirmed
- Chris Davis (ATL)
- Jim Evans (CLT)
- Dave Pracht / Heather McKee (DIA)
- Mark Borrough (SEA)
- Dave Garrett (DTW)
- Mike Bowman / Frank Slusher (IAD)
- Jay Dupont (PHX) - Confirmed

3) Team Members for Feedback

- How to use Team:
 - Feedback early on for chemical interaction in the field
 - Comments on what they want with ideal cable and connectors and why
 - Sample testing in the field of A, B and C options
 - Feedback in setting up testing requirements
- New members for consideration
 - Adam Zandan – Prysmian / Draka Cable
 - Ben Goebel – Atkins Engineer
 - Carl Johnson - Avcon
 - Why them / Other suggestions?
- Why this is important
 - Input from experts who handle product daily
 - Working with people who truly care about the betterment of industry

4) Electrical Characteristics

- Legacy Mode Option
 - Ability to go back to legacy mode
 - 6.6A at 5KV on primary, 6.6A at 600V on secondary
- Future Only Options
 - Get VA for each manufacturers LED lights (see matrix) - Confirm
 - Get layout detail – how many lights are typical for each area.
 - Calculate estimated losses
 - Excel spreadsheet for VA requirements
 - Resistance, Efficiency other considerations factored in
 - Find max requirement – spec cable and connector ratings to meet max requirements – create buffer (load calc target at 75%)

Manufacturer	Part # (Depends on color, power, height, arctic option, etc.)	Description	Arctic Option	Amps	VA
ADB	L861T (L): ETES-XXXX	Elevated Taxiway Edge Light	W/O Heater (or Heater off)	6.6	12
			W/ Heater	6.6	25
	L850A (L): IRCL-XXXXXX	LED Runway Centerline			
			Unidirectional	W/O Heater	15
			Bidirectional- One Cord Set	W/O Heater	29
			Unidirectional	W/ Heater	30
			Bidirectional- One Cord Set	W/ Heater	59
	L850B (L): TDZL-XXXXX	Style 3 LED Touchdown Zone Light	W/O Heater		15
			W/ Heater		30
	L850C (L) and L850D (L): IREL-XXX0XXX	Style 2 LED Runway Edge and Runway Threshold and Runway EndLight			
			Unidirectional	W/O Heater	21
			Bidirectional-One Cord Set	W/O Heater	36
			Unidirectional	W/ Heater	49
			Bidirectional-One Cord Set	W/ Heater	64
	L852A/B/C/D (L) and L852J/K (L): ITCF-XX0XXX	F-Range LED Taxiway Centerline Light			
			L852D (L), L852K (L)		
			Unidirectional	W/O Heater	21
			Bidirectional-One Cord Set	W/O Heater	27
	L852T (L): ITL-XXXX	Style 3 LED Taxiway Edge Light	Unidirectional	W/ Heater	56
			Bidirectional-One Cord Set	W/ Heater	58
			W/ Heater	6.6	44
			W/O Heater	6.6	19.5
	L862 (L) and L862E (L): EREX-XXXX-XXX-0000	LED Runway Edge High Intensity Bidirectional Elevated Light	N/A	2.8-6.6	32



CHALP	TEL- L861 (L): 8 6 1 5 – T 5 – B – 0 6 6	Omnidirectional Taxiway Edge Light- LED	W/O Heater	6.6	11.2
			W/ Heater	6.6	30
Pro V RCL/TDZ-LED, L850(L): 850X-5-XX-F1-XXX-XX-X		Runway Centerline Light			
		Unidirectional White	W/O Heater	6.6	21
		Unidirectional Red	W/O Heater	6.6	11
		Bidirectional White/White	W/O Heater	6.6	42
		Bidirectional White/Red	W/O Heater	6.6	33
		Unidirectional White	W/ Heater	6.6	35
		Unidirectional Red	W/ Heater	6.6	25
		Bidirectional White/White	W/ Heater	6.6	70
		Bidirectional White/Red	W/ Heater	6.6	61
Pro V TCL-LED, L852(L): 852X-5-XX-F1-XXX-XX-X		Taxiway Centerline Light			
		Unidirectional C and K	W/O Heater	6.6	12
		Bidirectional C and K	W/O Heater	6.6	24
		Unidirectional D	W/O Heater	6.6	13
		Bidirectional D	W/O Heater	6.6	26
		Unidirectional C and K	W/ Heater	6.6	26

4) Electrical Characteristics

- What needs to get done
 - Complete research
 - Meet with team to discuss layout
 - Present data for comments
- Concerns
 - **Timing – don't want to get ahead of ourselves**
 - **Need to coordinate with final infrastructure decisions**
 - **Can do some, but we just don't know enough to complete, can charge ahead in some areas – have to wait in others**

5) Jacket and Molding Materials

- Have list of about 10 chemicals and elements to consider
- (See Attached) Need to Finalize List
- Get MSDS for each chemical / element
- Visit 2 or more chemists for compounding and / or cable processing companies
- Open up project to find right cable jacket material
- Open up project to find right connector molding material

5) Jacket and Molding Materials

Primary

- Water
- Salt
- Dielectric Grease
- Potassium Acetate
- Jet Fuel
- Glycol
- Urea – Diesel Exhaust
- P605 and P606 Sealant
- Asphalt Rejuvenator
- Grass Fertilizer
- -50F to 200F

Secondary

- Fire Ant Powder and Spray
- Hot Sand / Grit
- Rodents – chew / pee
- Weed Killer

6) Cable Performance

- **Tolerance – most important (one size with tight OD tolerance – will be important for connector sizing)**
- Temp rating
- Jacket thickness minimum (needs to fit 1" ID conduit)
- Bend Radius
- Durometer
- Insulation Resistance
- Abrasion Resistant?
- Self Extinguishing?
- Need to understand cost impact
 - Life Cycle cost savings study
 - Need maintenance estimates

7) Communication

- Shielding
 - Twisted pair
 - PLC requirements
 - Other Communications and Noise concerns
-
- Need input from team when system architecture is identified

8) Connector Options

- Brass Contacts
 - Amphenol Rad Sock is perfect
 - Ballpark price quote is not excessive
 - Would only need for female, no IP on male
 - Patented – concerns (needs to be competitive)
 - The best I've seen for positive contact at 100% of brass connection
 - Camlock Style with Dinse locking tooth (no pull out with strain)
 - Military Bayonet style – thoughts?
 - Recommend same plating and chemical treatment for corrosion resistance and 20psi or more water seal

9) Connector Options

- Housing Design – Primary
 - Connector with ribs and ridges for excellent handling while assembling
 - Connector locks into place when assembled correctly, positive cue (better design than current anchor system)
 - Possibility to design with flat – one way in, one way out
 - Standard Tool used to guarantee strip lengths are accurate
 - Develop new installation process(es)
- Prevent Water Ingress
 - Mating design will continue to be 20 psi or more
 - Pull test for mating no longer an issue
 - Better control of water ingress on back side
 - Tighter cable tolerance
 - Better Control on assembly
 - Utilize superior design characteristics

10) Other Components

- Secondary Connectors and Cables
 - Secondary Focus after primary connectors are completed
- Isolation Device
 - Lots of information needed to be gathered
 - Lots of improvement opportunities for isolation and energy transformation improvement
 - Isolation and Transformer in one component or separate – like cut out for isolation and transform in light?
 - Research has indicated that there is a need to protect key operating components in best protected area

11) Testing and Approvals

- Time to address NEC Requirements
 - Not saying we conform, but we need to address differences and get written guidance for sign off; has been an issue
- IP68 – Waterproof in 1 meter (add this test)
- Start with L824, adjust as necessary
- Adopt appropriate ICEA, NEMA, ANSI and UL standards, where pertinent
- **Components are tested individually, we need a way to test for circuit impact**

12) Timeline

- Finalize Research Team 9/30
- Meet at IESALC to discuss this presentation 10/31
- Meet with EIRT Team to understand Electrical Characteristics for each option 11/15
- Get chemicals and elements list 11/15
- Get MSDS sheets 11/30
- Sign on 2 or more companies for projects 12/31
- Identify jacket and connector molding material 2/28
- Present options with pros, cons, costs 3/15
- Decide on top three options 3/15
- Identify Electrical Characteristics 3/15

12) Timeline (continued)

- Identify other cable characteristics 3/15
- Present cost benefit statements 3/31
- Identify Contact options – 3 or more 11/30
- Get prototypes of contacts 12/15
- Identify connector profile 1/31
- Get prototypes 2/28
- Present options to group 3/15
- Send prototypes to field for testing 3/31
- Send prototypes to independent test labs 3/31
- Analyze, Adjust and Decide 6/30

12) And in the Words Of:

- Jim Morrison
 - “This is the end.”
 - “The future’s uncertain and the end is always near.”
- Paul McCartney
 - “And in the end, the love you take is equal to the love you make.”

Hope you got the point.

Open Discussion Time