PSCC Subcommittee WebEx Virtual Meeting Minutes - DRAFT

Designation: PSCCC-F0	Name: IEEE Fiber Optics Subcommittee			
Meeting Location: Online Teams Meeting	Meeting Times 9 AM – 12:45 PM – EDT	Meeting Date: 2023/12/12	Minutes Revised: 2023/12/20	Minutes Approved:
Presiding Officer: Chair: Delavar Khomarlou, Vice Chair: Jack Roughan Secretary: John Jones		Recorded by: J. Jones, J. Roughan, D. Khomarlou,		

Attendance: Total attendees = 19 members + 2 Guests (M: Member, CM: Corresponding Member, G: Guest, I: IEEE)

	Affiliation	Attending via Phone (P) / Web (W) or Local (L)/ Absent (A)	M/CM/ G/I
Marie Henshaw	AFL	A	M
Peyton Campbell	AFL	A	M
Robert (Bob) Kluge	ATC – Retired	W	M
Corrine Dimnik	TBD	A	M
John Jones	PLP	W	M
Josep Martin Regalado	Prysmian	W	M
Felix Chen	ZTT China	W	M
Jack Roughan	ZTT China	W	M
Gabriel Okafor	HPS	A	M
Tewfik Schehade	Independent Consultant	A	M
Delavar Khomarlou	Hydro One Networks	W	M
Brett Boles	Southern Company	W	M
Mike Riddle	Incab America LLC	W	M
Monty Tuominen	MWT Consulting LLC –BP (Retired)	W	M
Tom Thompson	IEEE (liaison)	A	I
Emma Fulina	Shanghai Electric Cable Research Institute (SECRI)	W	M
Austin Farmer	AFL	W	M
Jaclyn Whitehead	AFL	A	M
Mark Naylor	AFL	W	M
Mike Warntjes	ATC (?)	A	M
Jacob Palmer	PLP	W	M
Paul Baird	Prysmian	A	M
Linda Cai	ZTT China	W	M
Lemon Lu	ZTT China	W	M
Greg Bennett	Southern Company	A	M
Christopher E. Royer	AEP	A	M
Yi Guo	GTTC Testing Technology (Shanghai)	W	M
Jared Smith	AEP	A	M
Ernest Gallo	Ericson	W	M

Dimitry Gilbert	Incab America LLC	W	M
Nathanael Winslow	AFL	W	M
Guests (New and Old)			
Jeff Pack		A	
Christian Riddle	Incab America LLC	?	G / M
Andrew Cresswell	Hubbell	A	G
ShenYiChun	ZTT	A	G
Jay Herman	EPRI	W	G
Jeff Wang	ZTT	A	G
Donna Pericolosi	ATC	A	G
Dan Baggett	AFL	A	G
Berjin Britto	??	A	G

Note:
G→M : Guest is eligible to become member if requested.

Item no.	Notes	Action by
CALL TO ORDER	December 12, 2023 09:00 AM	D. Khomarlou
INTRODUCTIONS, QUORUM	Quorum With 20/30 members and 2 guests in Online Teams meeting, no IEEE representative in this meeting. Copyright and Patent slides presented.	
Working Group F4: **9:10 –9:35 EDT**	Time was set aside to have F4 meeting in the first half hour of the main F0 meeting. F4: Jack Roughan, ZTT Cable, Chair; Josep Martin Regalado (Prysmian), Vice-chair. WG membership is TBD. Jack Roughan called to order meeting of working group F4. Discussed the revision to IEEE 1591.4 standard and comment resolution following balloting. Re-circulation will start in early 2024. PAR extension for IEEE 1591.4 to Dec. 30, 2025 approved in December REVCOM meeting. Working Group F4 will issue its own minutes independently .	J. Roughan
F0 AGENDA APPROVAL	Agenda for the December 12, 2023 virtual meeting was sent to all members prior to the call. The agenda was approved in this meeting. Agenda Approved –John Jones, second: Jack Roughan	D. Khomarlou
F0 APPROVAL OF PREVIOUS MINUTES	Draft Minutes of September 20-21, 2023 hybrid meeting has been placed in iMeetCentral and sent to members. Minutes were approved in this meeting. Meeting minutes approved Jack Roughan , Second: Erenst Gallo. These minutes will be posted in the IEEE PSCCC website as **Final** for public access.	D. Khomarlou
F0 CHAIR'S REMARKS	Chair presentation is attached. Didn't get a chance to discuss Awards committee activities where Marie Henshaw – AFL is F0 representative to PSCCC awards working group. Per A0 instructions, we must re-organize back to Working Groups (WG). F1: IEEE 1222 All Dielectric Self-Supporting Cable (responsible for 1222 ADSS cable) and IEEE 1591.2: ADSS Attachment Hardware, Chair: Paul Baird, Prysmian, Vice-Chair: John Jones, PLP) F2: IEEE 1138 Optical Ground Wire (responsible for 1138 OPGW cable) and IEEE 1591.1: OPGW Attachment Hardware, Chair: Mike Riddle, Incab, Vice-Chair: Brett Boles, Southern Company F3: IEEE 1594 Helically Applied (Wrapped) Fiber Optic Cable (1594 cable and 1591.3 attachment hardware): Chair: Mark Naylor, AFL, Vice-Chair: TBD (Mark to advise) F4: IEEE 1595 OPPC (1595 cable and 1591.4 attachment hardware), Chair: Jack Roughan, ZTT or Josep Martin Regalado (Prysmian). Each WG is to have their own meetings and generate own minutes. For now, appropriate WG meetings are tagged to the beginning and end of main SC meetings. Due to our new work in Fiber End of Life, we need expertise in Fiber (at strand level) and could benefit from having an expert from Corning or OFS or any other of our current manufacturers who draw their own fiber. If anyone knows or wants to reach out to these experts within the companies, please do. PSCCC main group requiring our physical attendance at Joint Technical Committee Meetings (JTCM). One face to face (hybrid meeting) will be proposed and is currently scheduled for JTCM in September 2024. Members must pay to register. January 7-11, 2024 JTCM meetings has working groups and subcommittees from PSCCC/PSRC as well as T&D overhead lines all meeting in New Orleans. Jack Roughan will provide a full list of groups for reference.	D. Khomarlou
IEEE 1138 News	No New Discussion Please see section on lightning test	D. Khomarlou

Item no.	Notes	Action by
IEEE 1591.3 and 1594 Wrap Cable	Mark Naylor, AFL representative for 1591.3 and 1594 helically-applied cable was at the meeting and contributed greatly. Mark's role within AFL is changing. He is currently chosen as the chair of Working Group: F3: 1594/1591.3 Mark has nominated Dimitrij Siskin, AFL as vice-chair. Mark Naylor will do a presentation on Helically applied (Wrapped) cable and its characteristics in the next meeting.	M. Naylor
IEEE 1595 Standard – 1595D6 OPPC –>Publication	No new information Published on April 11, 2023 per IEEE.	Jack Roughan
1591.1 OPGW hardware	1591.1 – J. Jones. Was sent for publication. Editor sent a new version on Dec 10,2023 with some comments. Hope to have comments resolved before end of December so that it can be published. Once published, we will provide a link for complementary standard download. Congratulations to subcommittee and John Jones who led the effort.	J. Jones/ B. Kluge
OPPC Hardware 1591.4	Please see Working Group F4 meeting notes. A revised copy of 1591.4 – the copy which will go to re-circulation - will be provided.	L. Cai/ J. Roughan

IEEE 524 liaison

Jack Roughan to discuss info from 524 and T&D committee. Latest meting cconcentrated on safety factors for wire / ropes pulling.
Likely retain the existing safety factors.

Use of edge come-alongs on OPGW was discussed. They shouldn't be used but at the moment the statement in 524 is not considered adequate . A statement to not use this type of clamp may be appropriate for IEEE 524.

The time for OPGW to stay in blocks is a subject to interpretation. Some manufacturers don't warranty beyond 48 hours. Some beyond 72 hours.

For stringing blocks – 72 hours is arbitrary, but it is a practical allowance for crews to leave in blocks over a weekend as long as weather conditions are mild.
It was suggested that the clock starts after stringing is completed or after sagging is completed (for the 72 hours). Also, the conditions at the installation time are important. Wind causing aeolian vibration could result in damage as cable is not secured.

The sections covering installation of OPGW and ADSS (as well as future OPPC and Helically applied) in IEEE 524 are very brief at the moment. Would 524 consider contribution from F0 in adding to these sections prior to their 2025 publication date? Jack Roughan to investigate in JTCM meeting in Jan. 2024.

Background information from previous meetings.
Stringing tension for fibre cables was discussed
Noted that the 15% value is currently in IEEE524 and we agreed to use this value at our previous meeting .
Some discussion was had for whether this could be increased to 20% or even higher. The value of 20% is already mentioned in the paragraph of 524 noting that stringing should be limited to 20%. All manufacturers present noted that they were happy with this.

It was noted that our current table shows two rows for OPGW and OPPC, with one row for ≤ 0.9" and ≥ 0.9". As no OPGW designs are greater than 0.9" it was agreed that the second row should just show OPPC ≥ 0.9"

The revised table is now:

Cable Type	Spatial Angle**	Spans	Pulling/Stringing Tension *	Minimum Sheave Size(BOG)***
ADSS	≤ 10˚	≤ 91.4 M (300 ft)	≤ 2.7 kN (600 lb)	Greater of either 254 mm (10") or Cable OD x 20
	≤ 20˚	≤ 91.4 M (300 ft)	≤ 2.7 kN (600 lb)	Cable OD x 30
	≥ 20˚	Any span	≤ 2.7 kN (600 lb)	Cable OD x40
OPGW & OPPC OD ≤ 0.9"	≤ 90˚	Any span	≤ 20% of RTS****	Greater of either 609 mm (24") or Cable OD x 40
OPPC OD >0.9"	≤ 20˚	Any span	≤ 20% of RTS	Greater of either 609 mm (24") or Cable OD x 40
	> 20˚ - ≤ 60˚			Cable OD x 50
	> 60˚ - ≤			Cable OD x 60

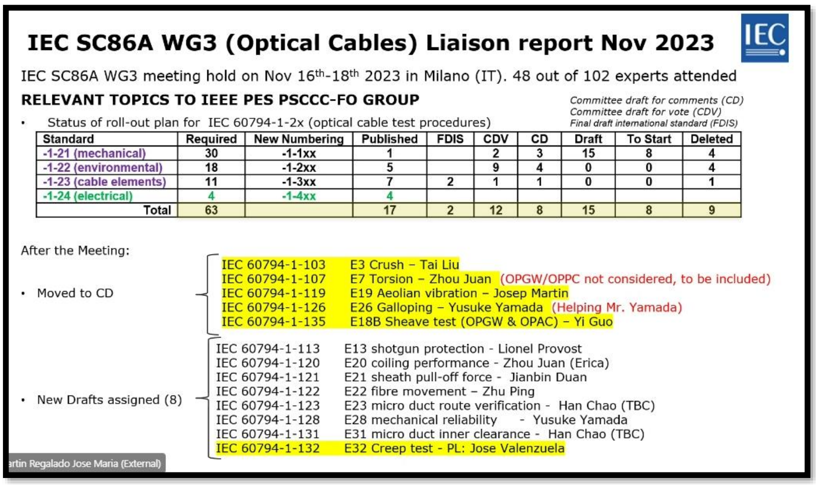
NA

Item no.	Notes	Action by
	90°	
IEEE 1591.x Task Force Group	No new Info to report. Committee will meet when revisions to the 1591.x standards are next due for revision. Background information from previous meetings. Current membership is 13: Jack Roughan, Linda Cai, Lemon Lu, Josep Martin Regalado, Tewfik Schehade, John Jones, Mark Naylor, Del Khomarlou, Dan Baggett, Peyton Campbell, Gabriel Okafor.	J. Roughan
IEEE 525 and PSCCC E0 Liaison **And** **EPRI Work**	IEEE 525- DKH - Cables within substation - Reference IEEE 1138 and 1222. - Grounding in substations. - Utility members are good candidates to become Liaison. New revision of 525 was issued in October 2023 and F0 (D. Khomarlou) provided new comments on section 6: Fiber Optics cables and Annex Q. Chair attends substation committee meetings. PSCCC-E0 Wireline subcommittee (D. Khomarlou liaison). Ernest Gallo provided update: • E0 work has been streamlined due to leadership stepping down. • Work on IEEE 367 (GPR) was in process but will be on-hold. • Work on IEEE 1692 - 2011 (IEEE Guide for the Protection of Communication Installations from Lightning Effects) will progress. • Limited members and dealing with relatively obsolete technology. Also, Ernest Gallo is retiring from Ericson, but will maintain his IEEE work on NESC, IEEE 1692 as well as standard on surge protective devices, IEEE C.62.41.3-2020: IEEE Guide for Interactions between Power System Disturbances and Surge Protective Devices. Ernest Gallo is also the recipient of IEEE life time achievement award. Many congratulations.	D. Khomarlou
IEC Liaison **ITU Liaison**	IEC standard chart (placed in the document) IEC meeting was in November 2023. When a standard is considered stable, then it won't be changed. May modify the ADSS Creep to another name. IEC – uses a controlled process – shared among all the international members. More steps are taken during the review process before publishing.	Josep Martin Regalado

Item no.	Notes	Action by
IEEE 1222	No New item for IEEE 1222 A Corrigendum must be issued to cover the issue of error in Aeolian Vibration Testing (AVL). For AVT, the number of cycles is only 1 million (but it was 100 million in 2011 revision). Since F2 WG chair, Paul Baird was not present, chair asked the F2 vice-chair, John Jones, to collaborate with Paul and identify if there are any other items that need modification/correction in 1222, so that they are all covered in one corrigendum, to be sent to REVCOM in Jan 2024. We had the following from a previous meeting: Pass criteria for AVT and Galloping is 0.2 dB/km. Looks a large value. (should this also be included in Corrigendum?) Pass criteria for Sheave test in 1222 and 1138 is 1.0 dB/km. Looks a huge value – (should this also be included in Corrigendum?) Fiber Proof Test was discussed. As cable is tensioned to MRCL, fiber strain must be less than 20% of proof strain. This corresponds to 20 % for most fiber (100kpsi proof test = 1% strain). (should this also be included in Corrigendum?) Tensile test (should this also be included in Corrigendum?) ADSS – dB vs OPGW – dB/km	
dB vs dB / km Discussion	No discussion in this meeting. All reference information is in September 20-21 meeting minutes.	
Preforming Concern – OPGW, OPPC	This item was not discussed and is placed here only for reference. All reference information is in September 20-21 meeting minutes.	
Presentation(s)	None in this meeting.	
Lightning (OPGW)	The only discussion was with respect to Coherent high speed (40+ Gb/s) communication over OPGW fibers and the effect of lightning. It has been reported that at 100 Gb/s communications, coherent receivers can unlock due to very fast state-of-polarization (SOP) transient events which happen on aerial fiber optic cables (notably OPGW) due to exposure to lightning. These systems are polarization-multiplexed to achieve 100-Gbps transmission. As reported, “These transients can be hundreds of thousands of radians per second, even over 1 million radians per second, within tens of microseconds, followed by a slower relaxation in a few milliseconds” [Lightning Affects Coherent Optical Transmission in Aerial Fiber | Lightwave (lightwaveonline.com)]. All other reference information for lightning tests All reference information is in September 20-21 meeting minutes.	

Item no.	Notes	Action by
New /Other Business	**OPPC/OPGW/ADSS/Helical End of Life Determination Study and Scope** Discussion on fiber ageing mechanisms and ways to detect it. As there were many points raised in this discussion, a separate section has been created in order to document these discussions. This material will be compiled for new technical guide which describes any new type test, factory or field testing for aerial cables (all fiber cables or perhaps only aerial cables) to determine End-of-Life(EOL) criteria for F0 cables. **Study group for Sensing applications (Brillouin, Raman,..) using aerial fiber optic cable**. Limited open Discussion on this topic. Captured in the section on Fiber EOL further down in this document. The material associated with this work and discussion will be placed in iMeetCentral. Other Work: Did not consider these work in detail in this meeting. These are from previous meeting: Tewfik – asked about standards for other fiber cables. Mike Riddle suggested blown in fiber and FTTH application. (Mentioned 2 companies turn-key. – cable TV is one).	
ITEMS REPORTED OUT OF EXECUTIVE SESSION	NA	
OTHER ITEMS	NA	
CLOSING	Please let chair / vice-chair know if you don't have access to iMeetCentral.	
NEXT MEETINGS	The next Meeting will be a Hybrid (face-to-face and Teams) meeting on Wednesday - Thursday April 17-18, 2023 Time: 10 AM – 5 PM Central Time – First Day 9 or 10 AM – 2 or 3 PM Central Time – Second Day Location: Incab America LLC offices: 900 Nolen Drive, Grapevine, TX	
Meeting Adjournment	Motion to Adjourn – Jack Roughan. Meeting adjourned at 12:45 PM (EDT) on Dec 12, 2023.	
MATERIAL TO BE PLACED IN iMeetCentral or Attached	1. IEEE Copyright statement (included in this document) 2. IEEE Patent and duty to inform clause (included in this document) 3. Chair Presentation - Dec 2023 (to be attached to email) 4. Lightwave magazine Article on OPGW fiber ageing (https://www.corning.com/media/worldwide/coc/documents/Fiber/articles/r1082.pdf)	

IEC LIAISON – JOSEP MARTIN REGALADO - Update of IEC meeting in Nov 2023:



IEC SC86A WG3 (Optical Cables) Liaison report Nov 2023

IEC SC86A WG3 meeting hold on Nov 16th-18th 2023 in Milano (IT). 48 out of 102 experts attended

RELEVANT TOPICS TO IEEE PES PSCCC-FO GROUP

Committee draft for comments (CD)
Committee draft for vote (CDV)
Final draft international standard (FDIS)

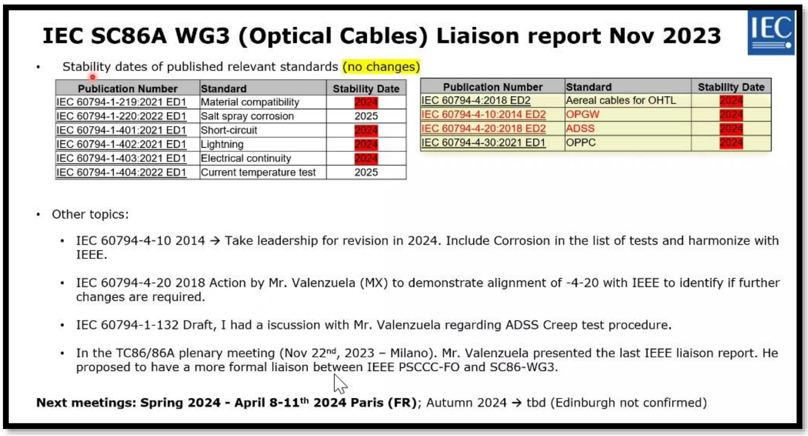
- Status of roll-out plan for IEC 60794-1-2x (optical cable test procedures)

Standard	Required	New Numbering	Published	FDIS	CDV	CD	Draft	To Start	Deleted
-1-21 (mechanical)	30	-1-1xx	1		2	3	15	8	4
-1-22 (environmental)	18	-1-2xx	5		9	4	0	0	4
-1-23 (cable elements)	11	-1-3xx	7	2	1	1	0	0	1
-1-24 (electrical)	4	-1-4xx	4						
Total	63		17	2	12	8	15	8	9

After the Meeting:

- Moved to CD
  - IEC 60794-1-103 E3 Crush – Tai Liu
  - IEC 60794-1-107 E7 Torsion – Zhou Juan (OPGW/OPPC not considered, to be included)
  - IEC 60794-1-119 E19 Aeolian vibration – Josep Martin
  - IEC 60794-1-126 E26 Galloping – Yusuke Yamada (Helping Mr. Yamada)
  - IEC 60794-1-135 E18B Sheave test (OPGW & OPAC) – Yi Guo
- New Drafts assigned (8)
  - IEC 60794-1-113 E13 shotgun protection - Lionel Provost
  - IEC 60794-1-120 E20 coiling performance - Zhou Juan (Erica)
  - IEC 60794-1-121 E21 sheath pull-off force - Jianbin Duan
  - IEC 60794-1-122 E22 fibre movement – Zhu Ping
  - IEC 60794-1-123 E23 micro duct route verification - Han Chao (TBC)
  - IEC 60794-1-128 E28 mechanical reliability - Yusuke Yamada
  - IEC 60794-1-131 E31 micro duct inner clearance - Han Chao (TBC)
  - IEC 60794-1-132 E32 Creep test - PL: Jose Valenzuela

artin Regalado Jose Maria (External)



IEC SC86A WG3 (Optical Cables) Liaison report Nov 2023

- Stability dates of published relevant standards (no changes)

Publication Number	Standard	Stability Date
IEC 60794-1-219:2021 ED1	Material compatibility	2024
IEC 60794-1-220:2022 ED1	Salt spray corrosion	2025
IEC 60794-1-401:2021 ED1	Short-circuit	2024
IEC 60794-1-402:2021 ED1	Lightning	2024
IEC 60794-1-403:2021 ED1	Electrical continuity	2024
IEC 60794-1-404:2022 ED1	Current temperature test	2025

Publication Number	Standard	Stability Date
IEC 60794-4:2018 ED2	Aereal cables for OHTL	2024
IEC 60794-4-10:2014 ED2	OPGW	2024
IEC 60794-4-20:2018 ED2	ADSS	2024
IEC 60794-4-30:2021 ED1	OPPC	2024

- Other topics:
  - IEC 60794-4-10 2014 → Take leadership for revision in 2024. Include Corrosion in the list of tests and harmonize with IEEE.
  - IEC 60794-4-20 2018 Action by Mr. Valenzuela (MX) to demonstrate alignment of -4-20 with IEEE to identify if further changes are required.
  - IEC 60794-1-132 Draft, I had a iscussion with Mr. Valenzuela regarding ADSS Creep test procedure.
  - In the TC86/86A plenary meeting (Nov 22nd, 2023 – Milano). Mr. Valenzuela presented the last IEEE liaison report. He proposed to have a more formal liaison between IEEE PSCCC-FO and SC86-WG3.

Next meetings: Spring 2024 - April 8-11th 2024 Paris (FR); Autumn 2024 → tbd (Edinburgh not confirmed)

IEC CABLE STANDARD REFERENCE - From Josep
Indoor Cables
60794-2 Ed4 2017; Optical fibre cables - Part 2: Indoor cables - Sectional specification; stability date 2024
60794-2-10 Ed2 2011; Optical fibre cables - Part 2-10: Indoor optical fibre cables - Family specification for simplex and duplex cable; stability date 2023
60794-2-11 Ed3 2019; Optical fibre cables - Part 2-11: Indoor cables - Detailed specification for simplex and duplex cables for use in premises cabling; stability date 2025
60794-2-12 Draft - In house cabling (not approved)
60794-2-20 Ed3 2013; Optical fibre cables - Part 2-20: Indoor cables - Family specification for multi-fibre optical cables; stability date 2024 (family spec)
60794-2-21 Ed3 2019; Optical fibre cables - Part 2-21: Indoor cables - Detailed specification for multi-fibre optical distribution cables for use in premises cabling; stability date 2025
60794-2-22 Ed1 2016; Optical fibre cables - Part 2-22: Indoor cables - Detail specification for multi-simplex breakout optical cables for use in terminated breakout cable assemblies; stability date 2024

60794-2-23 CDV Optical fibre cables - Part 2-23: Indoor cables – Detail specification for multi-fibre cables for use in MPO connector terminated cable assemblies (Next step FDIS)
60794-2-24 CDV Optical fibre cables - Part 2-24: Indoor cables – Detailed specification for multiple multi-fibre unit cables for use in MPO connector terminated breakout cable assemblies (Next step FDIS)
60794-2-30 Ed3 2019; Optical fibre cables - Part 2-30: Indoor cables - Family specification for optical fibre ribbon cables for use in terminated cable assemblies; stability date 2024
60794-2-31 Ed3 2019; Optical fibre cables - Part 2-31: Indoor cables - Detailed specification for optical fibre ribbon cables for use in premises cabling; stability date 2025
60794-2-40 Ed2 2008; Optical fibre cables - Part 2-40: Indoor optical fibre cables - Family specification for A4 fibre cables; stability date 2024
60794-2-41 Ed1 2008; Optical fibre cables - Part 2-41: Indoor cables - Product specification for simplex and duplex buffered A4 fibres; stability date 2024
60794-2-42 Ed1 2008; Optical fibre cables - Part 2-42: Indoor cables - Product specification for simplex and duplex cables with A4 fibres; stability date 2024
60794-2-50 Ed2 2020; Optical fibre cables - Part 2-50: Indoor cables - Family specification for simplex and duplex cables for use in terminated cable assemblies; stability date 2024
60794-2-51 Document withdrawn.

Outdoor Cables
60794-3 Ed4 2014; Optical fibre cables - Part 3: Outdoor cables - Sectional specification; stability date 2025
60794-3-10 Ed3 2015; Optical fibre cables - Part 3-10: Outdoor cables - Family specification for duct, directly buried and lashed aerial optical telecommunication cables; stability date 2024
60794-3-11 Ed2 2010; Optical fibre cables - Part 3-11: Outdoor cables - Product specification for duct, directly buried, and lashed aerial single-mode optical fibre telecommunication cables; stability date 2024
60794-3-12 Ed2 2021; Optical fibre cables - Part 3-12: Outdoor cables - Detailed specification for duct and directly buried optical telecommunication cables for use in premises cabling; stability date 2024
60794-3-20 Ed3 2016; Optical fibre cables - Part 3-20: Outdoor cables - Family specification for self-supporting aerial telecommunication cables; stability date 2024
60794-3-21 Ed2 2015; Optical fibre cables - Part 3-21: Outdoor cables - Product specification for optical self-supporting aerial telecommunication cables for use in premises cabling; stability date 2024
60794-3-30 Ed2 2008; Optical fibre cables - Part 3-30: Outdoor cables - Family specification for optical telecommunication cables for lakes, river crossings and coastal application; stability date 2024
60794-3-40 Ed2 2022; Optical fibre cables - Part 3-40: Outdoor cables - Family specification for cables for storm and sanitary sewers; stability date 2027
60794-3-50 Document withdrawn
60794-3-60 Document withdrawn
60794-3-70 Ed1 2021; Optical fibre cables - Part 3-70: Outdoor cables - Family specification for outdoor optical fibre cables for rapid/multiple deployment; stability date 2025

Aerial cables along electrical power lines
60794-4 Ed2 2018; Optical fibre cables - Part 4: Sectional specification - Aerial optical cables along electrical power line; stability date 2024
60794-4-10 Ed2 2014; Optical fibre cables - Part 4-10: Family specification - Optical ground wires (OPGW) along electrical power lines; stability date 2024
60794-4-20 Ed 2 2018; Optical fibre cables - Part 4-20: Sectional specification - Aerial optical cables along electrical power lines - Family specification for ADSS (all dielectric self-supported) optical cables; stability date 2024
60794-4-30 Ed1 2021; Optical fibre cables - Part 4-30: Aerial optical cables along electrical power lines - Family specification for optical phase conductor (OPPC) optical cables; stability date 2024 (OPPC)

Microduct cabling for installation by blowing
60794-5 Ed2 2014; Optical fibre cables - Part 5: Sectional specification - Microduct cabling for installation by blowing; stability date 2024
60794-5-10 Ed1 2014; Optical fibre cables - Part 5-10: Family specification - Outdoor microduct optical fibre cables, microducts and protected microducts for installation by blowing; stability date 2024
60794-5-20 Ed1 2014; Optical fibre cables - Part 5-20: Family specification - Outdoor microduct fibre units, microducts and protected microducts for installation by blowing; stability date 2024

Indoor-Outdoor Cables
60794-6 Ed1 2020; Optical fibre cables - Part 6: Indoor-outdoor cables - Sectional specification for indoor-outdoor cables; stability date 2025
60794-6-10 Ed1 2020; Optical fibre cables - Part 6-10: Indoor-outdoor cables - Family specification for universal indoor-outdoor cables; stability date 2025
60794-6-20 Ed1 2020; Optical fibre cables - Part 6-20: Indoor-outdoor cables - Family specification for flame retardant outdoor cables; stability date 2025
60794-6-30 Ed1 2020; Optical fibre cables - Part 6-30: Indoor-outdoor cables - Family specification for weatherised indoor cables; stability date 2025

Fire resistant optical fibre data communication cables
60794-7 (under development, draft)

Automotive
60794-8 (under development, draft)

Technical Report Document set
TR 62222 Ed3 2021; Fire performance of communication cables installed in buildings; stability date 2025
TR 62362 Ed2 2020; Selection of optical fibre cable specifications relative to mechanical, ingress, climatic or electromagnetic characteristics – Guidance; stability date 2024
TR 62470 Ed1 2011; Guidance on techniques for the measurement of the coefficient of friction (COF) between cables and ducts; stability date 2024
TR 62690, Ed1 2014; Hydrogen effects in optical fibre cables – Guidelines; stability date 2032
TR 62691, Ed2 2016; Guidelines to the installation of optical fibre cables; stability date 2024
TR 62901, Ed1 2016; Guide for the selection of drop cables; stability date 2024
TR 62959, Ed1 2021; Shrinkage effects on cable and cable element end termination – Guidance; stability date 2025
TR 63194, Ed1 2019; Guidance on colour coding of optical fibre cables; stability date 2024
TR 63431, Microduct Technology (under development, CD)
TR 63442, Rodent (under development, CD)
TR 63484, Fungus (under development, draft)

Chair Presentation:

To be Attached to Minutes.

OPPC/OPGW/ADSS/Helical End of Life Determination Study and Scope

Any study of the aerial cable end of life must separate failures due to installation errors and/or issues due to poor utility practices. An example would be failure due to lightning strike caused by poor tower grounding.

The aim of this study is to develop methods/tests which allow a utility to characterize the overhead fiber cable and determine its remaining life.

Periodic or continuous monitoring of the fiber inside the cable using OTDR is a valuable tool. OTDR measurements must be done at different time and temperatures in order to have statistically significant data. Fiber manufacturers allow for variations in attenuation (see below) due to temperature, temperature humidity cycling, water immersion, heat aging, damp heat.

OTDR results must be compared against the baseline OTDR traces made at the time of cable manufacturer or installation.

If the OTDR results find the attenuation values (dB/km) outside the allowed range, then the remaining life of the cable can be extrapolated. Note that this method does not identify the mechanism responsible for additional loss (dB/km), rather looks at the overall effect from several factors. A linear relationship vs. other factors that may show accelerated rate of deterioration. From a business perspective, a linear relationship may be a reasonable approach to determine a rough timeline. Thereafter periodic checks can be done to modify the timeline.

A separate and more focused OTDR wavelengths for OH-: 1383 nm and H2: 1240 nm can identify whether this effect is due to water ingress and hydrogen / OH absorption. If the deterioration mechanism is determined through these tests, the extrapolation for remaining life may have a different slope and may point to micro-cracks in optical tube. [A test equipment manufacturer claims they can detect these micro-cracks using Distributed Acoustic Sensing (DAS)].

Dimensional Specifications

Glass Geometry	
Fiber Curl	≥ 4.0 m radius of curvature
Cladding Diameter	125.0 ± 0.7 µm
Core-Clad Concentricity	≤ 0.5 µm
Cladding Non-Circularity	≤ 0.7%

Coating Geometry	
Coating Diameter	242 ± 5 µm
Coating-Cladding Concentricity	< 12 µm

Environmental Specifications

Environmental Test	Test Condition	Induced Attenuation 1310 nm, 1550 nm, and 1625 nm (dB/km)
Temperature Dependence	-60°C to +85°C*	≤ 0.05
Temperature Humidity Cycling	-10°C to +85°C up to 98% RH	≤ 0.05
Water Immersion	23°C ± 2°C	≤ 0.05
Heat Aging	85°C ± 2°C	≤ 0.05
Damp Heat	85°C at 85% RH	≤ 0.05

*Reference temperature = +23°C
Operating Temperature Range: -60°C to +85°C

Mechanical Specifications

Proof Test
The entire fiber length is subjected to a tensile stress ≥ 100 kpsi (0.69 GPa).*
*Higher proof test levels available.

Length
Fiber lengths available up to 63.0 km/spool.

Performance Characterizations

Determination of strain on fiber with good spatial resolution using a DSS or DSTS system (especially if cable is tight-buffered) and development of a strain (strain budget) vs time figure can also be another way to characterize the cable. **Please see an excellent reference contribution from Josep Martin Regalado on this topic placed in this document.**

The strain map idea should be developed further as it can be considered cumulative; it can include penalties to max strain allowed due to exposure to significant events such as:

- Ice-storm,
- Extreme temperature variations,
- Wildfires,
- Short circuit (OPGW/OPPC),
- Direct Lightning hits
- Tornadoes / Hurricanes

Other factors and criteria to be considered are:

- Micro-cracks on the optical tube due to environmental factors (vibration/sudden temperature changes, …)
- Issues with optical tube weld at the time of manufacture
- Other degradation mechanism that may have started on day one and during manufacturing
- Corrosion of the ACSR and steel material - LineVU or similar non-intrusive method
- UV Degradation of Jacket over Time (ADSS and wrap Cable)
- Corona effects (ADSS) - Forward Looking Infrared (FLIR) using helicopter/drone may pickup
- Electric field exposure of the jacket (ADSS) leading to tracking burn marks on the jacket
- Road salt deposit on jacket and Electric field (ADSS and possibly wrap) also leaving charred marks on jacket - FLIR may pickup
- Exposure of Jacket (ADSS and Wrap) to chemicals in industrial areas.
- Hot spots (OPPC) - Currently FLIR is used

What are other viable methods /strategies to determine an aerial cable's ageing mechanisms?

- Can Polarization Mode Dispersion (PMD) be used as an indicator of fiber health.
- Can external tests (e.g. LineVu developed by Kinectrics) be used to assess level of corrosion on ACSR wires without causing interruption?
- Pressure Testing of the Optical tube to determine cracks was discussed and doesn't seem practical. A Dry tube with water blocking tape may be better suited. Is there a Novel method to detect micro-cracks before they become problematic?
- Any new ideas using something similar to FLIR used with drone/helicopter for corrosion characterization.

Given that OPGW can't be cut to perform laboratory tests similar to shieldwire, would it make sense for utilities to install a couple of sacrificial spans parallel to existing spans for such purpose. The loop at the splice tower can also be used, but this loop is not under tension, so the study would be limited to environmental exposure factors.

Reference to the Corning White Paper.
[https://www.corning.com/media/worldwide/coc/documents/Fiber/white-paper/WP8002.pdf]

Referenced White paper by AFL/Corning [
https://www.corning.com/media/worldwide/coc/documents/Fiber/articles/r1082.pdf]

Study group for Sensing applications (Brillouin, Raman,..) using aerial fiber optic cable.

Most of the discussion was captured in the previous section.

Information on the use of various configuration of Distributed Acoustic Sensing (DAS) using Rayleigh scattering (provided by Josep Martin Regalado)

"A DAS interrogator is a device that allows measurements of very small perturbances caused by local changes of either temperature, strain and/or vibration in the optical fiber connected to it. DAS analyzes Rayleigh scattered light and what it measures is a relative change with respect to a previous state (reference) and is able to do it very fast, even thousands of times per second. There are few types of DAS interrogators in the market: intensity DAS, dual pulse DAS, Chirped pulse DAS ,etc. To my knowledge, the most sensitive and accurate one is the chirped pulse (CP-DAS) since it is able to provide a strain measurement (despite their origin, temperature change, strain change, vibration or a combination of any of the three) proportional to the perturbation and with a very high fidelity. Using CP-DAS, the fee you pay is the computational capacity which is much larger than for a dual pulse DAS.

If we connect a DAS to a fiber of an OPGW installed in the field, the OPGW is submitted to such many perturbations (temperature changes along length and time, wind, vibrations, etc) that it is not feasible to have a stable reference to get absolute strain results. However, the DAS can provide excellent information about local perturbations that occur between two measurements spaced shortly in time. The key is to design proper algorithms able to analyze this information, classify it and resolve true events from false positives. "

Bob Kluge Observations:

End of fife mechanisms for OPGW:
1) Damage done during manufacture of fiber, proof testing fiber and assembling optical fiber cable
2) Damage done during installation — grips used, bending over sheaves, time in sheaves
3) Hydrogen (moisture) damage of fibers (Causes?)
4) Strain damage of fiber (Extreme loading, temperature fluctuations — may be specific to various cable designs.)
5) damage to tube (e.g. cracks, corrosion), which could lead to moisture ingress and fiber damage
6) damage to supporting cable strands (by corrosion, vibration and Lightning...)
#3 and #6 are related. because a crack in the tube can allow water to enter.

During our meeting we talked a host of exposures during the life of an OPGW…recapping some of them...
Pep shared a paper on exposures during manufacture. I believe he was implying the degradation starts day one.
Someone mentioned Chicago (Kellum) grips during pulling, sagging. If they're used, it's a detrimental exposure.
There was discussion on fiber bending.
Del added discussions on temperature fluctuations and its effect on fiber strain for tight-fiber designs
There was discussion on tube cracks
Also corrosion of supporting cable strands and a method to detect it.
And lightning was mentioned, which could be a detrimental environmental event.

I thought we should categorize the various exposures to organize our discussions for a paper. This is only a draft list.
Many of these are addressed in existing standards to eliminate their possible occurrence or limit the damage. But they are possible events that can reduce the life of an OPGW. I'm not sure if Del intended to be this all-inclusive, because there are likely more events.

Contribution to Strain Analysis by Josep Martin Regalado (Corning Mechanical Reliability Paper – Attached - can be an asset in understanding this concept)

"The optical fiber mechanical reliability strongly depends on the elongation history of the fiber in the cable since, under stress conditions, the small flaws remaining in the fiber glass after the screening test may propagate and enlarge leading to a fiber failure in the field. Optical fibers are very sensitive to static fatigue which is related to the crack growth (stress corrosion) when fiber is under load. The effect is cumulative, so fiber failure probability depends on the static fatigue during fiber processing, cable manufacturing process as well as cable in-service during its life time.

The most relevant stress event for a fiber during manufacturing is proof testing. All optical fibers are submitted at the end of their production process to a screening test (i.e. 1% elongation during 1 second) to stress the fiber glass and force fiber failure in case of internal flaws or cracks. The fiber length sections passing the screening test does not guarantee that the fiber glass is defect free since small flaws or cracks may still be present.

During the optical cable production, the fiber is submitted to processes like fiber coloring and loose tube buffering, in which will be exposed to light fatigue stress (<0.1% elongation) during few seconds. Along cable installation, depending on the cable design, fiber can also be exposed to additional fatigue stresses (<0.2% elongation) during minutes or even hours. Along cable lifetime (>25 years), the optical cable can be exposed to extreme environmental conditions like strong winds or heavy ice loads in which the optical fibers can be exposed to large fatigue stress (i.e 0.3% elongation for weeks or even months).

The most famous and simplest model to estimate fiber reliability is Mitsunaga reliability model (*J. Appl. Phys. 57(7) pp. 4847-4853*) which allows a failure probability calculation using the following formula:

$$F = 1 - \exp\left[N_p L \times \left\{1 - \left[1 + \left(\frac{\varepsilon}{\varepsilon_p}\right)^n \frac{t}{t_p}\right]^{\frac{m}{n-2}}\right\}\right]$$

where Np is the Failure probability during proof test (typically 0.01-0.05 km^-1), e is the applied fiber strain, L is the length where the fiber is under strain (i.e. 10.0 km), e_p is the applied strain during the proof (screening) test (i.e. 1.0%), t_p is the duration of the proof test (i.e. 1 sec), t is the time period of strain application during installation or cable lifetime, n is the static fatigue parameter (typically 20); and m the static Weibull modulus (typically 2-3).

Putting some numbers, it turns out that the most limiting factor for the fiber lifetime is the extreme environmental conditions that may bring the optical fibers to static fatigue conditions during long periods of time

	Lifetime	Installation	Production
Np	0.05	0.05	0.05
L	10	100	1000
e	0.3	0.3	0.1
e_p	1	1	1
t	1.00E+08	1.72E+05	1.00E+02
t_p	1	1	0.1
m	2	3	2
n	20	20	20
F [km^-1]	**1.93E-04**	**5.00E-06**	**0.00E+00**

"

Section 11.4 of IEEE 524 Standard and john Jones Comments:

11.4 Composite overhead groundwire with optical fibers (OPGW)

OPGW was developed in order to provide large capacity telecommunication capabilities to utilities by allowing the utilization of their overhead power transmission lines. The product is one in which the central core of the overhead groundwire contains many fibers and various manufacturers have different ways of enclosing the fibers. The balance of the OPGW is generally made of aluminum clad steel wires of varying conductivities but may utilize other wire types and combinations to satisfy the strength/fault current requirements.

11.4.1 Stringing

Lined blocks are recommended for use with OPGW. The minimum sheave diameter is dependent upon the cable design. When installing OPGW, the cable manufacturer should be consulted for a recommendation on the minimum sheave and bullwheel diameters, the specific maximum pulling speeds and the maximum pulling tension.

Using the correct size sheave is very important to ensure that the optical fibers in an OPGW are not crushed during the stringing process. If specific sheave recommendations are not available from the manufacturer, a conservative sheave diameter is 40*D* (i.e., 40 × *D*; *D* = diameter of the OPGW). On line angles or pullover angles greater than 30°, larger sheave diameters may be needed. If specific bullwheel diameter recommendations are not available, a conservative bullwheel diameter for tensioners is 70*D*. For OPGW with

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left-hand lay, the bullwheel must be reeved from right to left. The opposite reeving direction is appropriate for OPGW with right-hand lay. The use of a swivel on the pulling line followed by an anti-rotation device should be used to minimize the tendency of the OPGW to twist during stringing. Some cable design and installation tension combinations of OPGW may not require an anti-rotation device.

The setup location for the cable reel, the tensioner and the puller should take into consideration the slope of the cable between the tensioner and the sheave at the first structure. This slope should never be steeper than three to one (3 horizontal and 1 vertical). If the tensioner cannot be placed at the proper distance from the first structure, the tensioner should be repositioned or the first sheave temporarily lowered during the pulling operation, then later raised for final hardware installation.

Experience has shown that pulling speed, maximum tension imposed on the line during stringing, and the number of times the line passes through stringing blocks in one section are important factors in achieving a smooth operation. Typical stringing tensions are in the range of 15% or less of the OPGW's rated breaking strength. The maximum stringing tension should generally be limited to 20% of the rated breaking strength and pulling speeds of 2 km/h to 5 km/h (1.5 mph to 3 mph) are recommended.

11.4.2 Sagging

The method used to sag OPGW is similar to that used for conductors and overhead ground wires. Certain grips used for conductor and overhead ground wire are normally not acceptable for OPGW because they could crush the fiber tube(s). Pocket book type come-alongs are available, but are typically designed for the specific OPGW cable. These special tools are machined to closely match the diameter of the OPGW so that they will not crush the cable. Formed wire grips may sometimes be used, if they are approved by the manufacturer. Sag/tension data is normally supplied by the OPGW manufacturer.

11.4.3 Splicing

There is one primary difference between OPGW and normal overhead groundwires. Conventional overhead groundwires are typically spliced midspan with a compression type connector. OPGW, on the other hand, is typically spliced at a tower. A 9 m (30 ft) to 20 m (65 ft) tail is therefore required to make up the connection, depending on the particular splice box arrangement being used.

Commented [JJ1]: Probably should match terminology of IEEE 1138. I believe the core is referred to as the optical unit

Commented [JJ2]: Aluminum clad steel and aluminum alloy

Commented [JJ3]: I'm not sure but IEEE rules may require a word instead of should

Commented [JJ4]: A general comment may be advised for the groove diameter of the stringing block - and the use of guides to keep the OPGW from drifting out of the sheave.

Commented [JJ5]: ?

Commented [JJ6]: This range may be a little on the lean side - perhaps 20 m to 30 m may be better. Or you could indicate that the length account for the height from ground level that the splice is mounted, slack storage, and cable opening for splicing.

Commented [JJ7]: Of cable slack

MAINTENANCE SCHEDULE FOR STANDARDS UNDER PSCCC-F0

PRIORITY	DUE DATE	STANDARD NUMBER PER IEEE WEBSITE	STANDARD TITLE	LAST PUBLISHED DATE	ACTION (DEV / REVISION / COMMENTS ONLY	COMMENTS
	New PAR submitted. June 2024	IEEE-1138-2021	IEEE Standard for Testing and Performance for Optical Ground Wire (OPGW) for Use on Electric Utility Power Lines	2021	Published in 2021	Published in November 2021.
	No Active PAR Published in 2020	IEEE 1222-2019	IEEE Standard for Testing and Performance for All-Dielectric Self-Supporting (ADSS) Fiber Optic Cable for Use on Electric Utility Power Lines	2020	Published 2020	Published 2020
	No Active PAR. Published in 2020	IEEE 1594-2020	IEEE Standard for Helically Applied Fiber Optic Cable Systems (Wrap Cable) for Use on Overhead Utility Lines	2020	Replaced 2008 version	Published in 2020
	No Active PAR.	IEEE 1595-2022	Draft Standard for Testing and Performance for Optical Phase Conductor (OPPC) for Use on Electrical Utility Power Lines		Published April 12, 2023	
2	Active PAR Ex. Dec. 2023	IEEE 1591.1-2012	IEEE Standard for Testing and Performance of Hardware for Optical Ground Wire (OPGW)	2012	On track for Publication in 2023	Sent to IEEE final edit and Publication
	No Active PAR Published in 2020	IEEE 1591.3-2020	IEEE Standard for Qualifying Hardware for Helically Applied Fiber Optic Cable Systems (WRAP Cable)	2020	Replaced 2011 version	Published in 2020
1	PAR Expires Dec. 2025	IEEE 1591.4-DRAFT	Standard for Testing and Performance of Hardware for Optical Fiber Composite Overhead Phase Conductor (OPPC)		D4	PAR extension to Dec 2025 approval
	NA	IEEE 1591.2-2017	IEEE Standard for Testing and Performance of Hardware for All-Dielectric Self-Supporting (ADSS) Fiber Optic Cable	2018	No new Activity	May be revised as part of 1591.x task force work.
	Published Date: Apr. 2017	IEEE 524-2016	IEEE Guide for the Installation of Overhead Transmission Line Conductors		For comment only	Liaison Report
	NA	IEEE 524-2016	IEEE PSCCC-F0 recommendation for sheave sizing			Information provided for inclusion in IEEE 524.
	NA	IEEE 525-2016	IEEE Guide for the Design and Installation of Cable Systems in Substations		For comment only	Liaison Report. Table Q updated. Comment resolution pending

* * *

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- IEEE-SA Standards Board Operations Manual (Clause 6.3) http://standards.ieee.org/develop/policies/opman/sect6.html
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