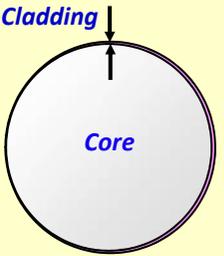
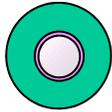


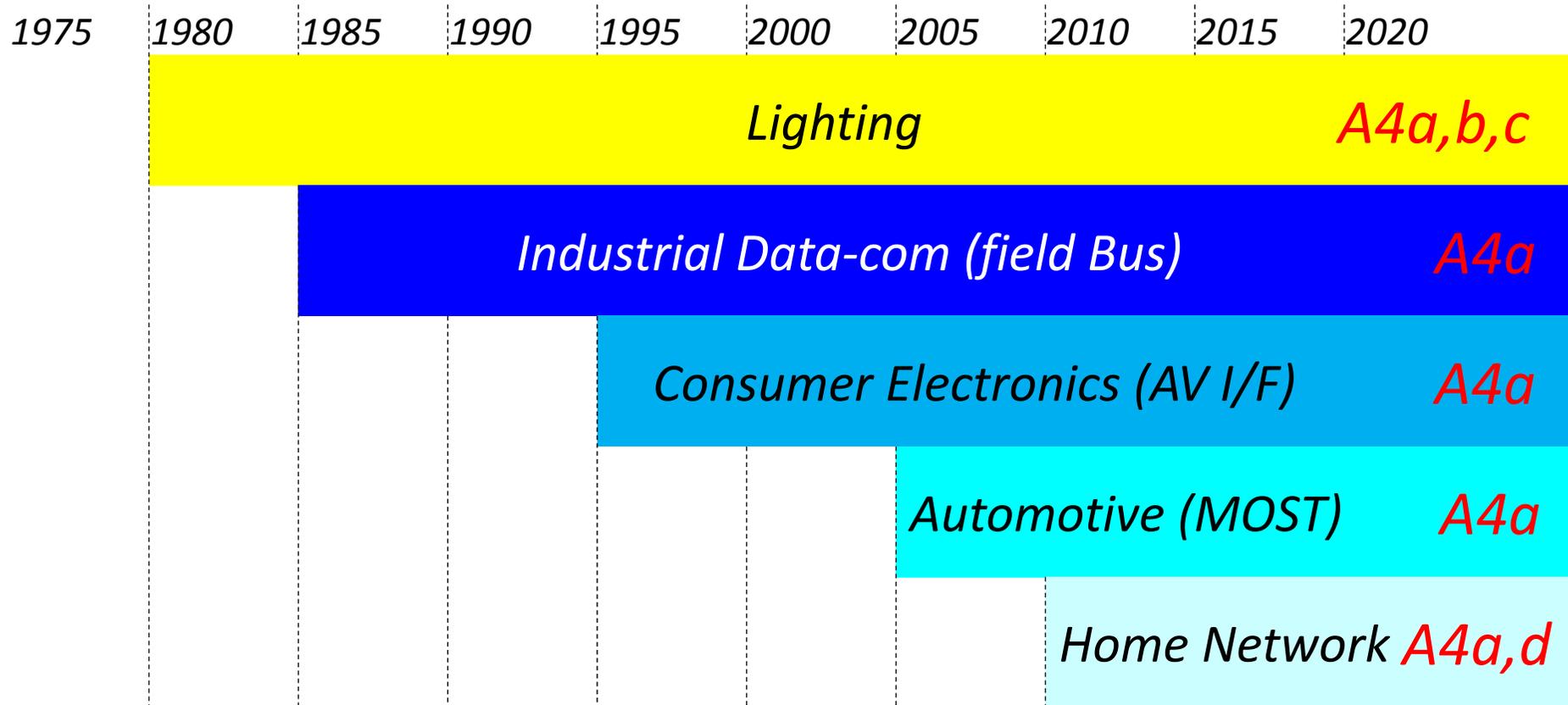
*Plastic Optical Fiber (POF) technology for
Automotive, Home network systems*

Plastic Molding Material Department,
Mitsubishi Rayon Co., Ltd.

Fiber types and Materials/Constructions

Core/Cladding	Plastic/Plastic	Plastic/Plastic	Glass/Plastic	Glass/Glass
Known as	POF(A4a.2)	GI-POF(A4g)	PCF (HCS/HPCF)	GOF
Bandwidth (MHz-km)	3	20	20	300-1500
Fiber (corer) diameter (μm)	(250)750-1000	50-500	125-600	50-100
Transmission distance	Short	Medium	Medium	Long
Attenuation (dB/km)	250	6	6	4
Numerical Aperture	0.50	0.19-0.25	0.37	0.30
Wavelength (nm) of the source	650	650, 850	650, 850	1300,1550
Cross sections, typical sizes	 <p>980/1,000 μm</p>	 <p>120/500 μm</p>	 <p>200/230 μm</p>	 <p>62.5/125 μm Multimode Singlemode</p>

Expansion of Data Applications



Plastic Optical fiber(POF)

has more than 30 years, long history

has been used in several Data-com purpose(FA, Automotive, Home)

Connector interfaces for **A4a** POF

Applications

Connectors

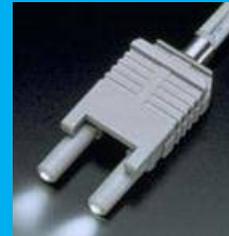
Industrial(Field Bus)

SMA 905



Consumer(AV I.F)

Versatile Link
IEC 60874-17 Type F05
IEC 61754-16 Type PN



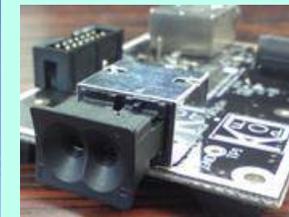
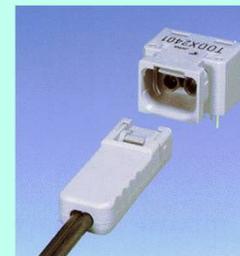
Automotive(MOST)

MOST

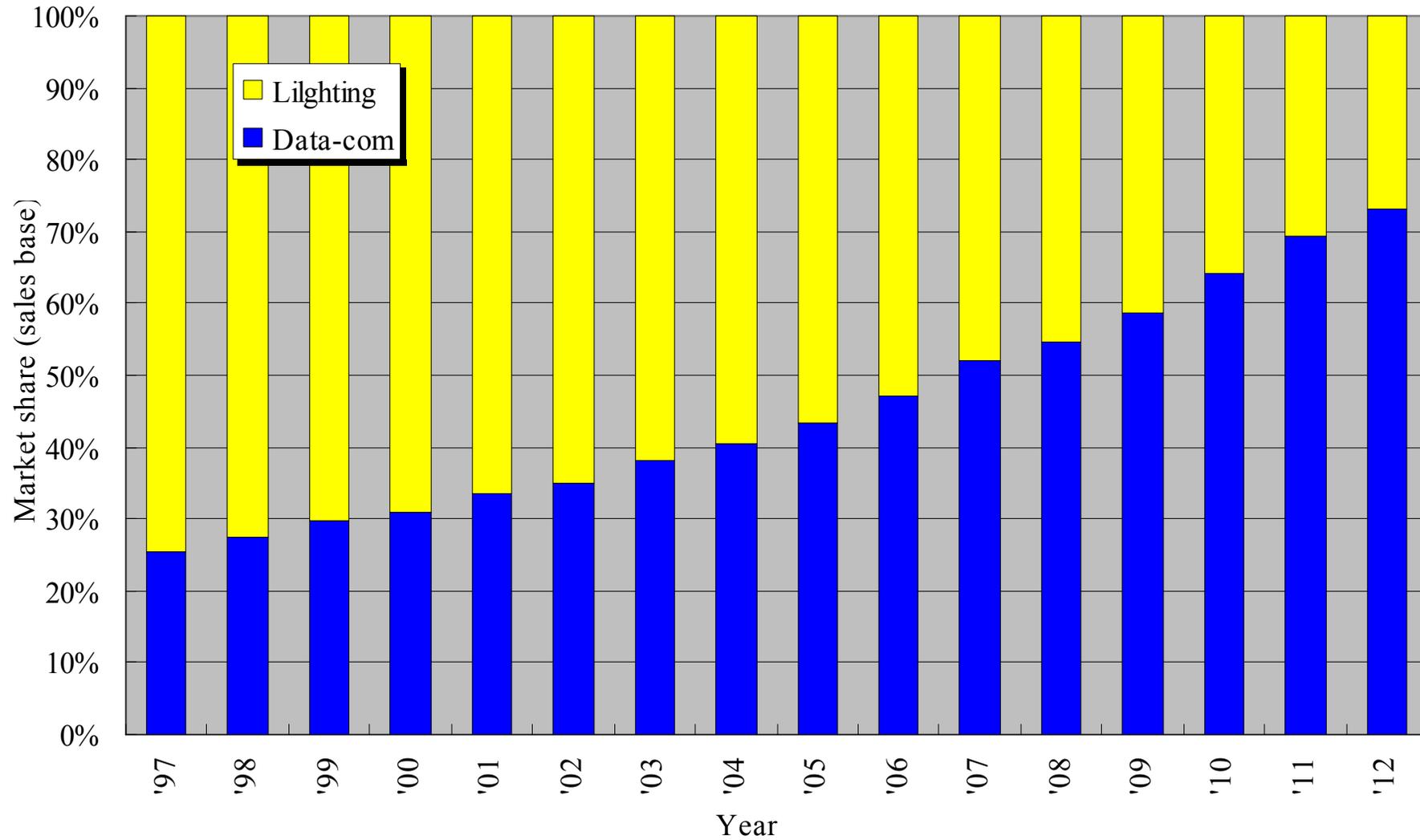


Home Network

IEC 61754-21 Type SMI
Fiber-Lock
Opto-Lock



POF Market Trend



POF Application for Automotive, Home network

150 Car models with MOST systems over POF(A4a.2) since 2001

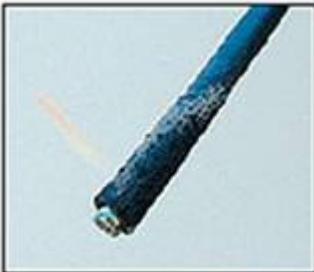
- Audi
 - A1, A3(12~)*, A5, A6, A7-sports back, A8
 - Q3, Q5, Q7
- BMW
 - 1s, 3s (12~), 5s, 6s, 7s
 - X1, X3, X5, X6, Z4
- Daimler-Chrysler
 - A(12~), B, C, CLS, E, S(14~)*, SL(12~), SLK, GL(12~), M, R, Maybach
 - Smart forfour
- VOLVO
 - C30, C70, S40, S60, S80, V40, V50, V60, V70,
 - XC60, XC70, XC90
- Land Rover
 - Range Rover, evoque, Freelander, Discovery3&4
- MINI (MINI, Coupe, Clubman, Countryman)
- Porsche:
 - Cayenne, Boxster, Cayman, 911('11), Panamera
- VW
 - Touareg
 - Golf(12~)*
- Hyundai
 - Genesis, Mohave, Equus
- Aston Martin, Bentley, Jaguar, Rolls-Royce

Note * MOST150



Source: MOST Cooperation

Fire & Toxicity Rating

Cable Type	Standard cable	Riser & Plenum	LSZH
Burning image Of three different cables			
Flammability 	HIGH Burn rapidly Non-self extinguish	LOW Burns, but will self extinguish when flame removed	MEDIUM Burns, may will self extinguish when flame removed
Toxicity / Corrosive Level 	HIGH When burned gives toxic and corrosive gasses	HIGH When burned gives off toxic and corrosive gasses	LOW No corrosive gasses, but does give off carbon monoxide when burned
Typical Application	Most computer cabling found in offices and homes	Cabling found inside walls, ceilings and air plenums of office or private building	Cabling found in enclosed areas such as ships, submarines, high computer rooms, network centers and aircraft

<http://www.ibsjapan.co.jp/>

IEEE 802.3 GEPOF SG, May 2014 Interim

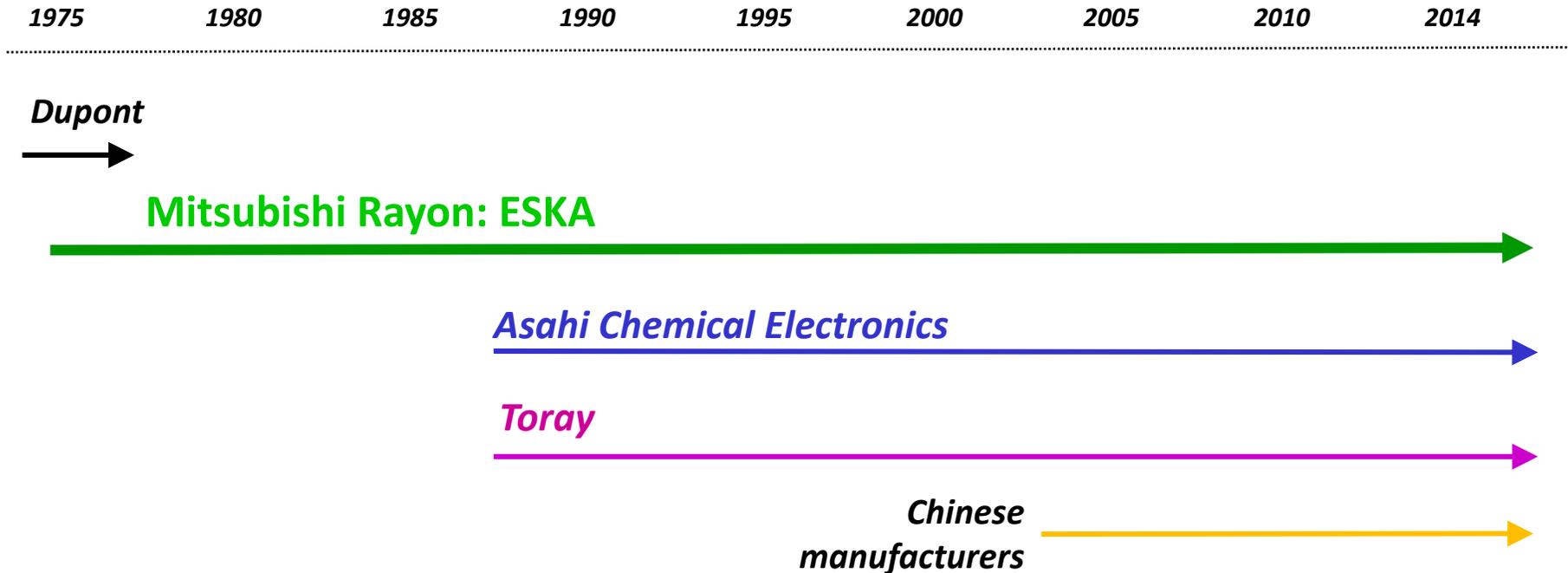
Slide 9

Related standards and status of compliance

Items (OPTOHOME); RH series, simplex or duplex					
Standard					Status
Category	Description	UL Standard		Materials	
Fire rating	Vertical specimen flame test	UL 758 UL1581	VW1	PVC, CPE	Available
				FR-PE(LSZH)	Sample distribution scheduled June '14
	Test for flame propagation height of electrical and optical-fiber cables installed vertically in shafts	UL1651 UL 1666	OFNR, Riser	PVC	Available
	Test for flame-propagation and smoke-density values for electrical and optical-fiber cables used in spaces transporting environmental air	UL1651 NFP262 (former UL910)	OFNP, Plenum	Fluorinated Polymer	Available

reference

POF suppliers in the world



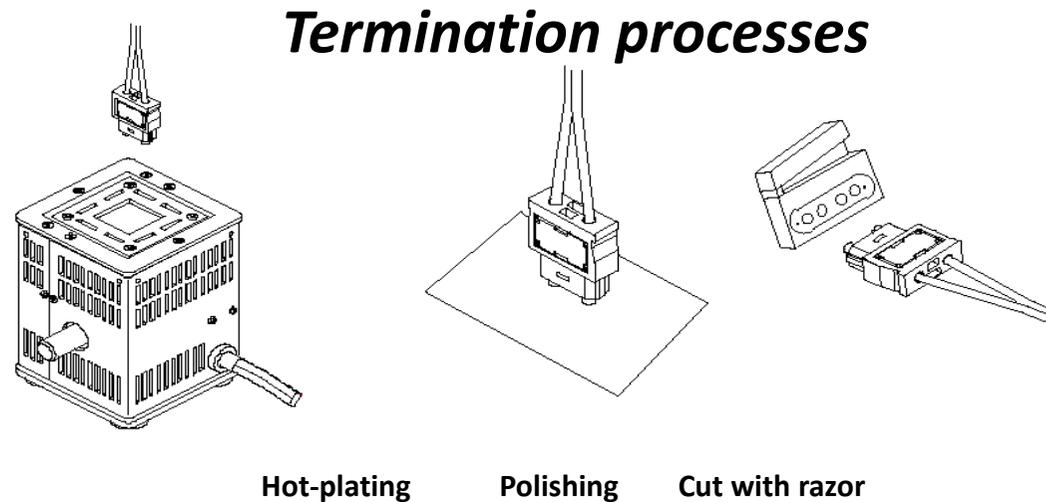
POF has

more than 30 years, long history.

has been used in several Data-com purpose(FA, Automotive, Home)

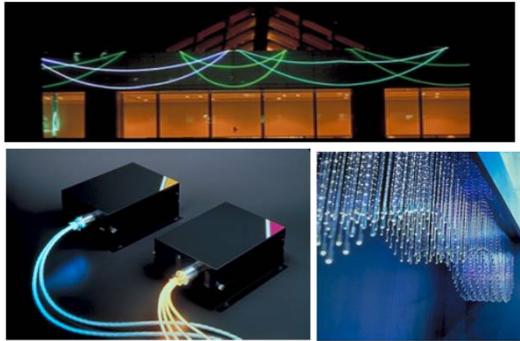
POF's Advantages

- Large core diameter allows
 - Easy handling/ termination with mechanical flexibility
 - Large tolerance shorten assembly man-hour with simple tools
 - Minimal assembly cost



- Optical media
 - Immune to EMI susceptibility and radiation along the media
 - Immune to lightning strikes
 - Will not produce sparks causing explosion and fire
 - No ground loop interference
 - Smaller cable and less weight than copper
 - Broad bandwidth over a longer distance

Expansion of applications



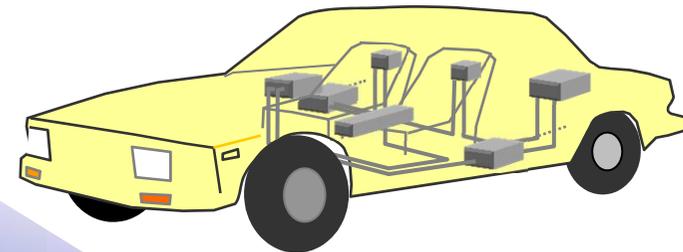
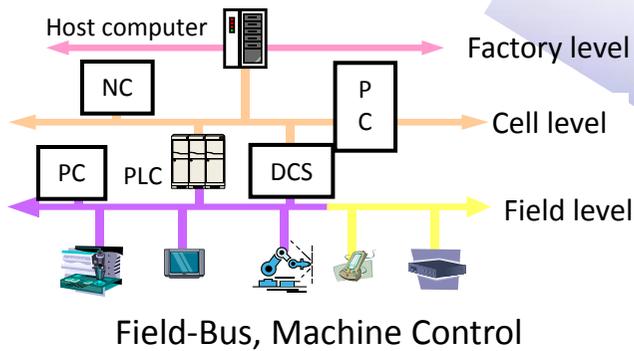
Lighting & Illumination



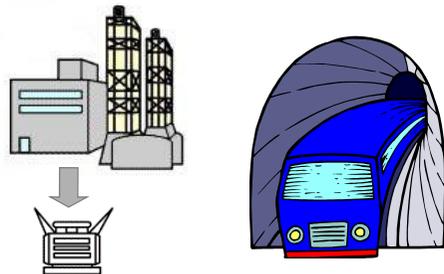
Industrial light for machine vision



Photo-electric switch



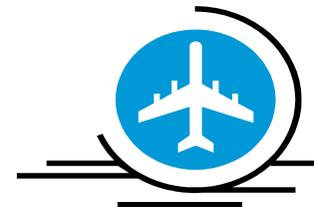
Automotive networking



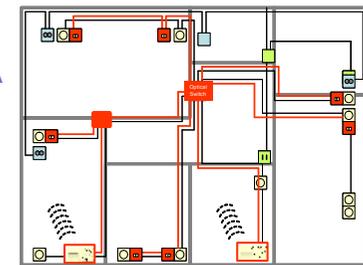
Power plant/substation, Locomotive/Train control



Digital audio

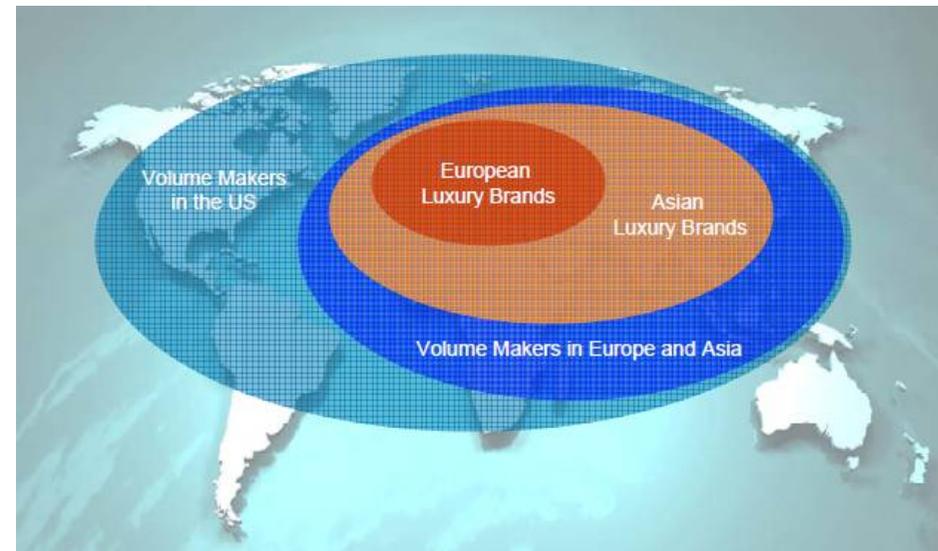
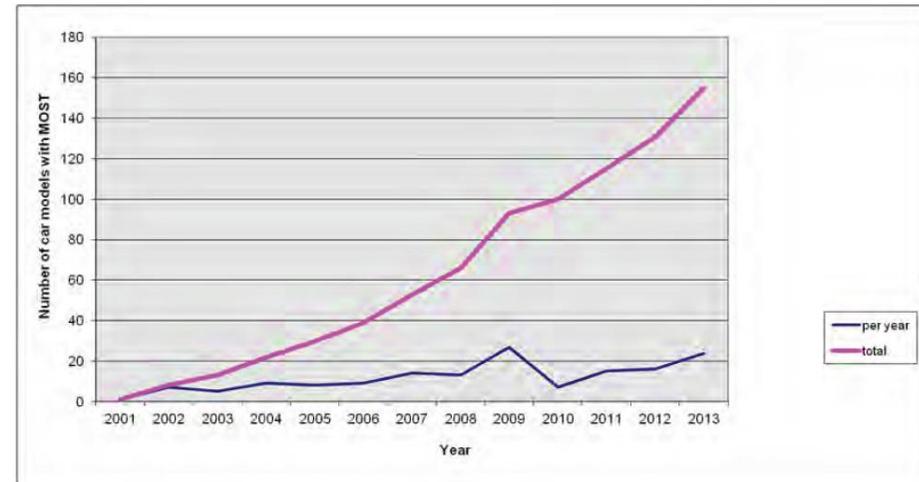
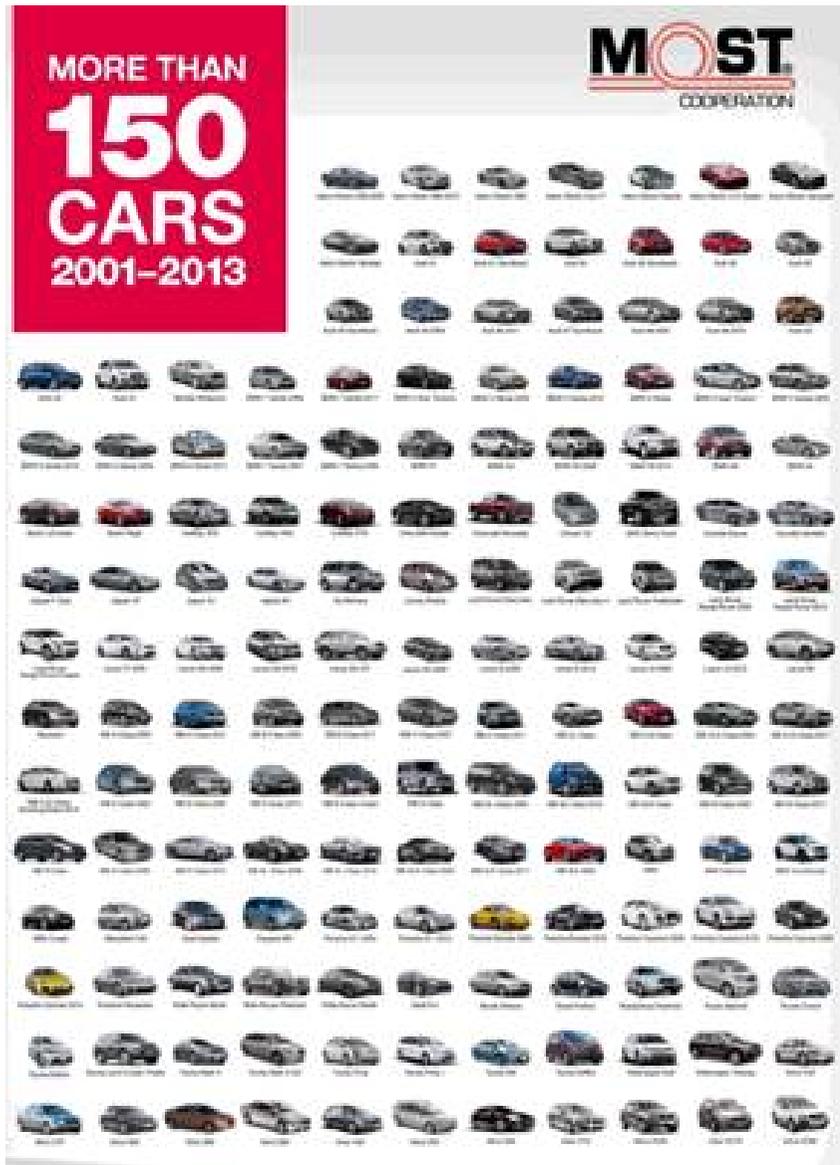


Avionics



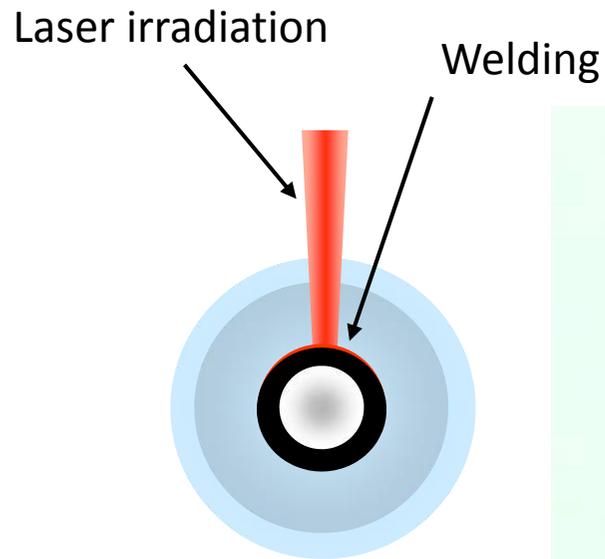
Residential data-com

Car models with MOST systems over POF since 2001



Source: MOST Cooperation(<http://www.mostnet.de/en/>)

Plastic ferrule for laser welding



Ferrule fixed with inner sheath by laser fusion

Home networking : IPTV application



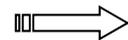
Background

IPTV: Telcos offer another option for consumers to watch digital TV services in addition to Terrestrial Broadcast, Cable, and Satellite.

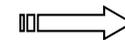
Triple-play service benefits users with...

Unified Billing, Total Costs Saving, and new video services e.c. VOD

Point to Point



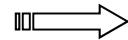
Structured Wiring



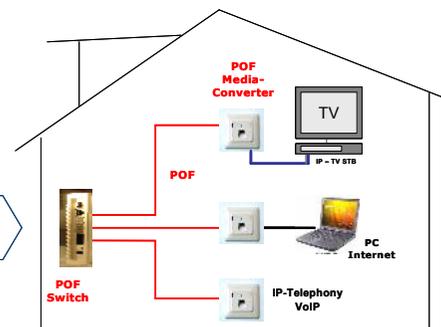
New Architecture



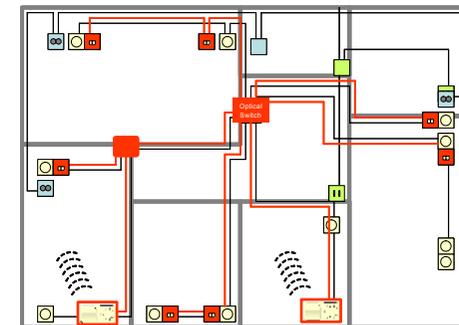
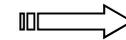
IPTV Telcos



Broadband Access Network (Gateway)

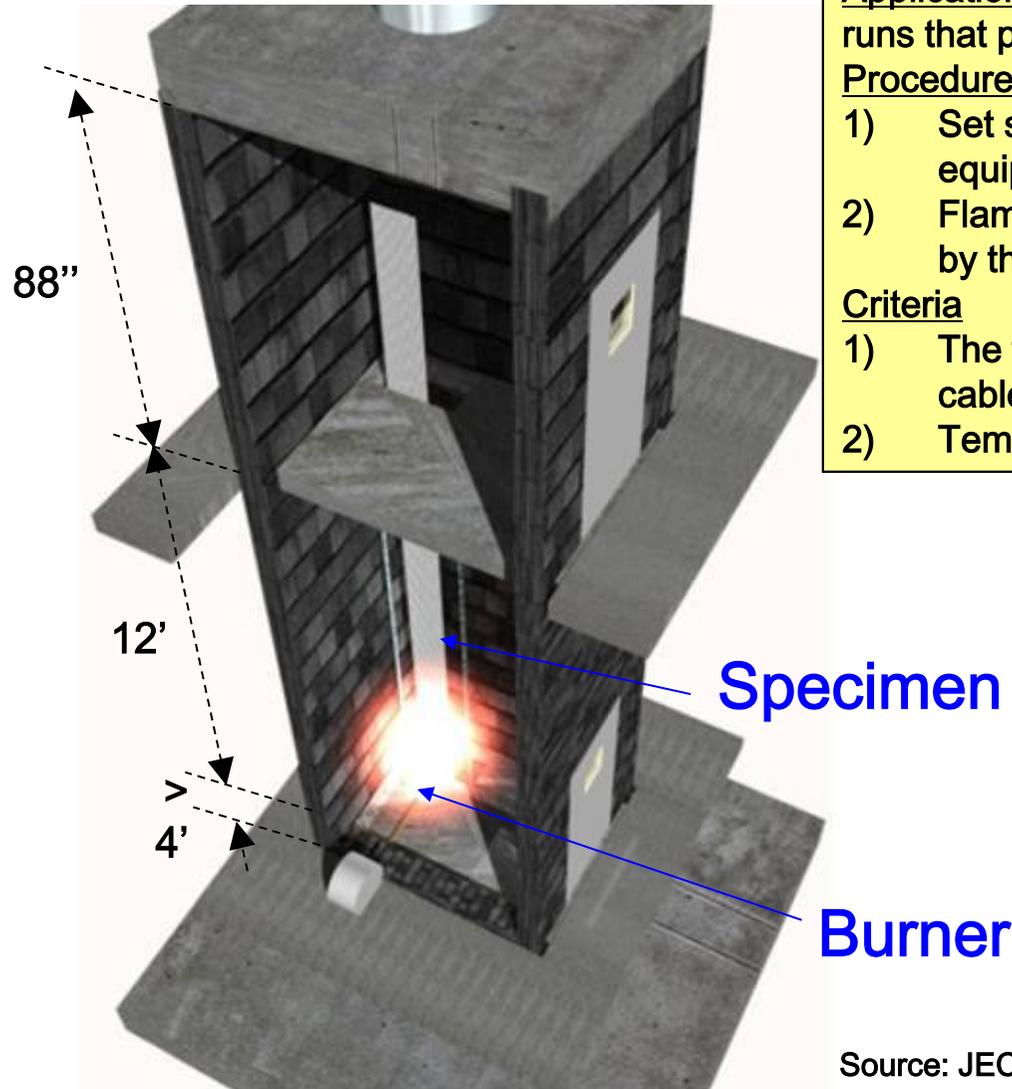


Cable Installers



System Vendors

UL1666(Riser): Vertical shaft test



Application: Installation vertically in shafts or in vertical runs that penetrate more than one floor

Procedure

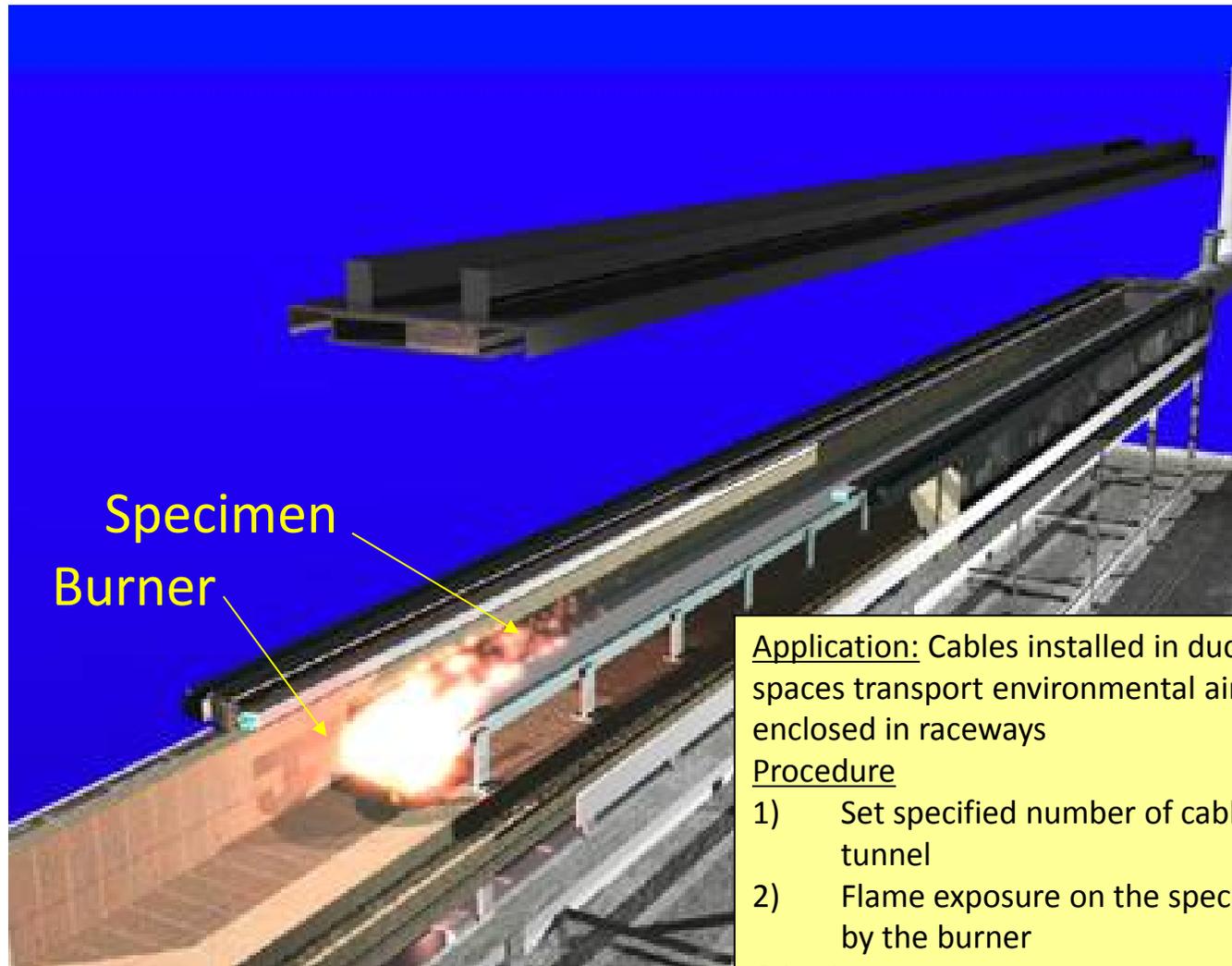
- 1) Set specified number of cable specimen in the equipment
- 2) Flame exposure on the specimen for 30 minutes by the specified burner

Criteria

- 1) The flame propagation height of each set of cable specimens shall not equal or exceed 12ft
- 2) Temperature < 850°F

Source: JECTEC (Japan Electric Cable Technology Center, Inc.)

NFP262(Plenum) : Steiner tunnel test



Application: Cables installed in ducts, plenums, spaces transport environmental air without being enclosed in raceways

Procedure

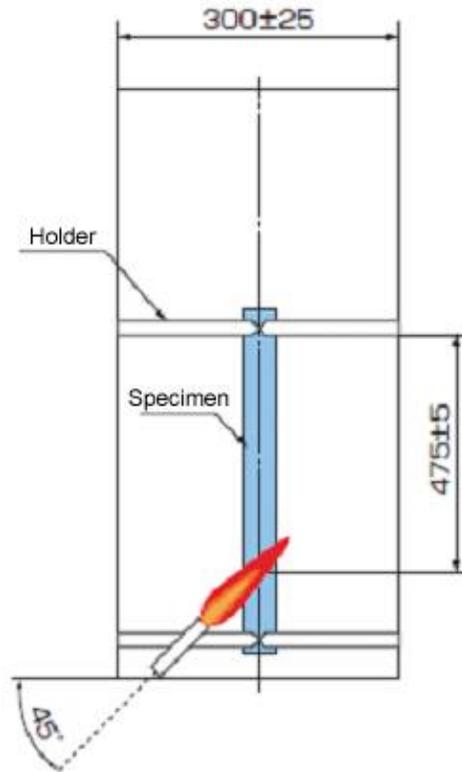
- 1) Set specified number of cable specimen in the tunnel
- 2) Flame exposure on the specimen for 20 minutes by the burner

Criteria

- 1) Optical density; Peak < 0.5, average 0.15

Source: JECTEC (Japan Electric Cable Technology Center, Inc.)

LSZH: IEC 60332-2, 60695-6, 60754



IEC 60332-1 Set-up (Unit mm)

Criteria	
Cable OD (mm)	Burning time (sec)
<25	60
25 < D < 50	120
50 < D < 75	240
75 < D	480

IEC60695

- Fire hazard testing
 - Part 6: Guidance and test methods on the assessment of obscuration hazards of vision caused by smoke opacity from electro-technical products involved in fires

IEC 60754

- Test on gases evolved during combustion of materials from cables
 - Part 1: Determination of the amount of halogen acid gas
 - Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity