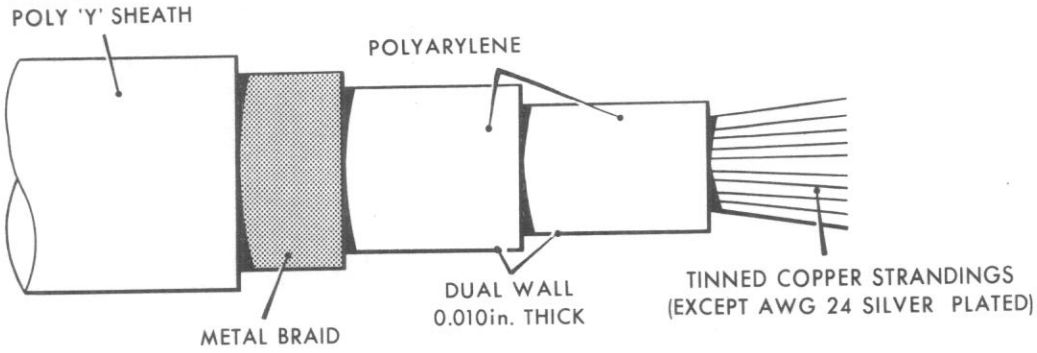
Chapter 9

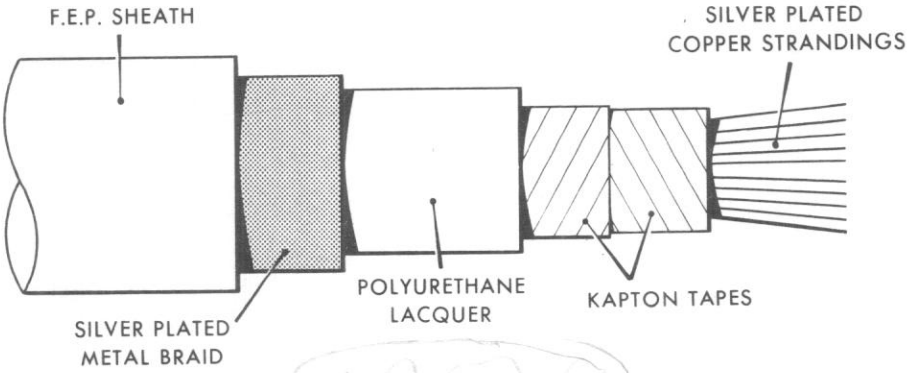
AIRCRAFT LIGHTWEIGHT CABLES

Introduction

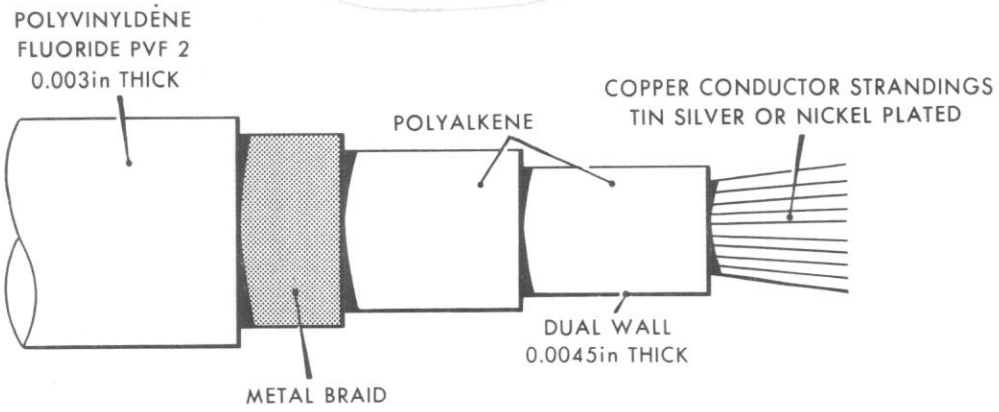
1 These are designed with single or dual wall insulations, for general purpose airframe wiring and as equipment type wire for electronic high density wiring inside of junction boxes and panels etc. They afford weight and space saving, are impervious to most common aircraft fluids, lubricants and cleaning solvents and are flame resistant and possess good resistance to mechanical damage.



Raychem specification 88B cable (stilan)



BICC KTCL Cable



Raychem specification 44A cable
(Thin wall type)

Fig.1 Aircraft lightweight cables

2 Being tough thin walled cables, sharp bends should be avoided - minimim diameter of bend should be approximately 6 times diameter of cable - but there is no danger of 'cable set'.

3 Besides single core, twisted pairs and twisted triples etc. are available, in plain or screen/sheathed versions. The metal screen of the latter is of the light foil type.

4 The cables are normally externally codified throughout their length with their suffix numbers providing the colour code arrangement. The International colour code is utilised. Types available are:-

RAYCHEM TYPE 88B (STILAN) INSULATED CABLES

5 The extruded insulation is a Polyarylene Polymer (Poly 'Y') which is applied in a single wall 0.006 in. thick for junction box and panel wiring (also screened/sheathed wires) and in dual wall 0.010 in. thick for airframe wiring.

6 Operating temperature is dependent upon the conductor plating. ie tin coated copper - 65°C to 150°C, silver coated copper -65°C to 200°C and nickel coated copper -65°C to 260°C. Voltage application is 600 volts.

7 The part number of the codified cable is prefixed 88B, followed by a 4 figure group which indicates the wire strandings, number of cores and whether screened or unscreened, and a further 2 figure group indicating the AWG wire size. Where a further suffix is added, this represents the colour code, ie. The first digit is the component wire colour and any second digit, the colour of the stripe.

Note...

BAS or ISO wire stranding can be used but AWG wise they approximate to the same cross sectional area.

CABLE CODING

88B - 8778 - 22 - 9/90/92

Cable Type

4 Figure Group
Indicates:-
a. Type of stranding
BAS or ISO
b. Number of cores
c. Screened or
unscreened cable

Colour Code (Example)
3 Cores - White
1 Plain White
1 with Black stripe
1 with Red stripe

Cable size
24 to 12 AWG

CABLE TYPE	CORES	CABLE/CORE DETAILS	USE	WALL
88B 8022-xx-9 88B 8622-xx-2/6 88B 8623-xx-2/6/4	1 2 3	White core Red and Blue cores Red, Blue and Yellow cores	Airframe General Un-screened	Dual
88B 8744-xx-9/9 88B 8745-xx-1/6/9 88B 8746-xx-2/6/4-9	1 2 3	White core, White sheath Red and Blue cores, White sheath Red, Blue and Yellow cores, White sheath	Airframe General Screened sheath	Single
88B 8022-xx-2 88B 8622-xx-2/20 88B 8623-xx-2/20/29	1 2 3	Red core Both cores Red, 1 with Black stripe All cores Red, 1 with Black stripe and 1 with White stripe	Airframe Armament Un-Screened	Dual
88B 8744-xx-9/2 88B 8745-xx-2/6/2 88B 8746-xx-2/6/4-2	1 2 3	White core with Red sheath Red and Blue cores, Red sheath Red, Blue and Yellow cores, Red sheath	Airframe Armament Screened sheathed	Single
88B 8776-xx-9 88B 8777-xx-9/90 88B 8778-xx-9/90/92	1 2 3	White core Both cores White, 1 with Black stripe All cores White, 1 with Black stripe and 1 with Red stripe	Panel Wiring General Un-screened	Single
88B 8776-xx-2 88B 8777-xx-2/20 88B 8778-xx-2/20/29	1 2 3	Red core Both cores Red, 1 with Black stripe All cores Red, 1 with Black and 1 with White stripe	Panel Wiring Armament Un-screened	Single

International Colour Code

0 - Black, 2 - Red, 3 - Orange
4 - Yellow, 5 - Green, 6 - Blue
7 - Violet, 8 - Grey, 9 - White
1 - Brown

Note...
xx in cable type will normally be replaced by the AWG cable size.

BICC TYPE KPA 150 AIRCRAFT CABLES (KTCL)

8 These light weight small size cables are designed for general purpose aircraft wiring and as equipment type wire for electronic and high density wiring. They are immune to aircraft fluids, do not support combustion and possess good resistance to mechanical damage. Operating temperature is from -65°C to 50°C and voltage application is 600 volts at 2000 Hz.

9 The insulation consists of Polyimide Tapes 1 MIL thick (Kapton 616) coated on both sides with FEP adhesive 0.1 MIL thick, which after heat treatment seals into an amber coloured laminated mass 1.2 MIL thick. Two tapes each with $66\frac{2}{3}\%$ overlap are applied in opposite directions to give 6 layers of composite insulation, with a radial thickness of 0.18 MM (7.2 MILS) and with a final outer coating of white polyurethane lacquer. The latter is a better colour finish and is easier to print on the cable and circuit details. Unless otherwise stated, the concentric conductor wires are of silver plated copper and in ISO (metric) strandings. Stripping tools are as for Raychem 88B cables.

10 Types available are unscreened, single, two core and three core - the latter are twisted singles without a final outer covering - and metal braided/sheathed types, which have a silver plated copper screen and with a final outer sheath of lacquered FEP.

Core colours:- 4 core - Red, Blue, Yellow and Green
3 core - Red, Blue and Yellow
2 core - Red and Blue
1 core - White

Approximately every 9 in: the cable is identified by a printed legend; eg KPA 150 - GBBJ - 22, which indicates:-

(KTCL) KPA 150 - Cable name and type
G - Country of origin (Great Britain)
BB - Manufacturer (BICC BURNBY)
J - Year of manufacture (1971)
22 - AWG cable size

Cable Type	Designation	Size	Remarks
1 core unscreened 2 " " 3 " "	KPA 150 KPA 150 KPA 150	24 to 12	2 or 3 cores twisted together
1 core screen/sheath 2 " " " 3 " " "	KPA 150 MS KPA 150 2 MS KPA 150 3 MS	24 to 18 24 to 20 24 to 20	M - Metal screen S - Outer sheath

Cable size	ISO Strandings in MM	Conductor Nominal dia	Single cable Nominal OD	88B Single cable Nominal OD
24	19/0.118	0.59 MM	1.07 MM	1.12 MM
22	19/0.15	0.75 MM	1.23 MM	1.27 MM
20	19/0.20	1.00 MM	1.48 MM	1.48 MM
18	19/0.25	1.25 MM	1.73 MM	1.76 MM
16	19/0.30	1.50 MM	1.98 MM	1.90 MM
15	37/0.25	1.75 MM	2.23 MM	2.42 MM
12	37/0.315	2.20 MM	2.89 MM	2.74 MM

RAYCHEM 88B AND BICC KAPTON CABLES

REF. NO.	PART NO.	REF. NO.	PART NO.
OLD ITEM	OLD ITEM	NEW ITEM	NEW ITEM
5E/640-2676	88B8009.22.9.9	5E/5607	KPA150-1MS22
5E/636-6536	88B8009.24.9.9	5E/650-7755	KPA150-1MS24
5E/5472	88B8022.12.9.9	5E/5596	KPA150-1-12
5E/640-2673	88B8022.14.9.9	5E/5597	KPA150-1-14
5E/640-2674	88B8022.16.9.9	5E/5598	KPA150-1-16
5E/640-2675	88B8022.18.9.9	5E/5594	KPA150-1-18
5E/636-6535	88B8022.20.9.9	5E/5599	KPA150-1-20
5E/636-6534	88B8022.22.9.9	5E/5595	KPA150-1-22
5E/636-6533	88A8022.24.9.9	5E/5600	KPA150-1-24
5E/	88B8010.22.2.6.9	5E/5608	KPA150-2MS22
5E/636-6537	88B801D.24.2.6.9	5E/5601	KPA150-2MS24
5E/640-7152	88B8622.22.2.6.9	5E/5605	KPA150-2-22
5E/640-5086	88B8623.24.2.6.9	5E/5603	KPA150-2-24
5E/640-3299	88B8011.24.2.4.6.9	5E/5602	KPA150-3MS24
	88B8623.12.2.4.6.9	5E/5610	KPA150-3-12
	88B8623.14.2.4.6.9	5E/5609	KPA150-3-14
	88B8623.16.2.4.6.9	5E/5611	KPA150-3-16
5E/640-5084	88B8623.20.2.4.6.9	5E/5612	KPA150-3-20
	88B8623.22.2.4.6.9	5E/5593	KPA150-3-22
5E/640-5085	88B8623.24.2.4.6.9	5E/5604	KPA150-3-24
5E/640-2671	88B8623.12.6.9		

RAYCHEM SPECIFICATION 55A CABLE

11 This utilises an extruded Ethylenetetrabluorethylene (ETFE) insulation system and is available in dual wall (0.010 in. thick) for airframe installations and in single wall (0.006 in. thick) for panel wiring.

12 It is a thin tough wall insulation system but being flexible it does not take 'reel set'. It is easily marked, stripped and terminated, using conventional tooling.

13 Tin or silver platings are used on the copper braidings and conductor wires - the latter can be in ISO or BAS strandings form.

14 Continuous operating temperature is from -65°C to 150°C and voltage applications is 600 volts (RMS). It is unaffected by all known aircraft fluids, fuels, lubricants and cleaning solvents, and to flames and soldering irons.

15 Unscreened single and dual wall types are available in single core, or various other core configurations - the individual cores are colour coded for identification.

16 Screen/sheathed single and dual wall types are available in similar configurations and colours. The final outer sheath takes up the contour of the twisted pair or twisted triple cores.

17 The International colour code is utilised and their numerical values serve as a suffix in the code number of the cable.

CABLE CODINGS

Cable Type	55A 1 Core Strandings		55A 2 Core Strandings		55A 3 Core Strandings	
	BAS	ISO	BAS	ISO	BAS	ISO
Unscreened cables	8022	8617	8622	8624	8623	8625
Cable sizes	24, 22, 20, 18 16, 14, 12		24, 22, 20, 18 16, 14, 12		24, 22, 20, 18 16, 14, 12	
Screened/ sheathed cables	8009	8618	8010	8619	8011	8620
Cable sizes	24, 22, 20, 18		24, 22, 20		24, 22, 20	

WIRE STRANDINGS

BAS Strandings in MM	19/0.12	19/0.152	19/0.193	19/0.25	37/0.20	19/0.361	37/0.32
ISO Strandings in MM	19/0.118	19/0.15	19/0.20	19/0.25	19/0.30	37/0.25	37/0.315
AWG	24	22	20	18	16	14	12

RAYCHEM 55A AIRCRAFT CABLES

CABLE TYPE	CORES	CABLE/CORE DETAILS	USE	WALL
55A 8022-xx-9	1	White core	Airframe	Dual
55A 8622-xx-2/6	2	Red and Blue cores	General	
55A 8823-xx-2/6/4	3	Red, Blue and Yellow cores	Un-screened	0.010"
55A 8744-xx-9/9	1	White core, White sheath	Airframe	
55A 8745-xx-1/6/9	2	Red and Blue cores, White sheath	General	Single
55A 8746-xx-2/6/4-9	3	Red, Blue and Yellow cores, White sheath	Screened/ sheathed	0.006"
55A 8022-xx-2	1	Red core	Airframe	
55A 8622-xx-2/20	2	Both cores Red, 1 with Black stripe	Armament	Dual
55A 8623-xx-2/20/29	3	All cores Red, 1 with Black stripe and 1 with White stripe	Un-screened	0.010"
55A 8744-xx-9/2	1	White core with Red sheath	Airframe	Single
55A 8745-xx-2/6-2	2	Red and Blue cores, Red sheath	Armament	
55A 8746-xx-2/6/4-2	3	Red, Blue and Yellow cores, Red sheath	Screened/ sheathed	0.006"
55A 8776-xx-9	1	White core	Panel wiring General	
55A 8777-xx-9/90	2	Both cores White, 1 with Black stripe		Single
55A 8778-xx-9/90/92	3	All cores White, 1 with Black stripe and 1 with Red stripe	Un-screened	0.006"

(continued)

RAYCHEM 55A AIRCRAFT CABLES (continued)

CABLE TYPE	CORES	CABLE/CORE DETAILS	USE	WALL
55A 8776-xx-2	1	Red core	Panel Wiring Armament Un-screened	Single 0.006"
55A 8777-xx-2/20	2	Both cores Red, 1 with Black stripe		
55A 8778-xx-2/20/29	3	All cores Red, 1 with Black and 1 with White stripe		

International Colour Code

0 - Black, 2 - Red, 3 - Orange
4 - Yellow, 5 - Green, 6 - Blue
7 - Violet, 8 - Grey, 9 - White
1 - Brown

Note ...

xx in cable type will normally be replaced by the AWG cable size.

RAYCHEM 44A SPECIFICATION CABLES

18 These small diameter lightweight cables have an operating temperature from -40°C to 140°C and are chemically inert to most acids, alkalis, fuels and lubricants.

19 The dual wall insulation can be either of those listed below and are designed for use in applications such as airframe wire and equipment wire.

20 Plain (primary) unscreened and screened/sheath types are available, and with single or multicore selections. Multicore cables are colour coded for identification and utilise the international colour system. The material of the metal screen is normally the same as that of the conductor wires.

Cable Coding	Class	Dual Wall Details: Inner Polyalkene	/ Outer PVF_2	Overall Thickness
44A - 01	Thin	0.0045"	0.003"	0.0075"
44A - 02	Medium	0.007"-0.016"	0.003"-0.005"	0.015" (mean)
44A - 08	Thick	0.010"-0.021"	0.004"-0.006"	0.020" (mean)

CABLE CODING

44A-X-X-X-X - AWG - X/X-X

Makers Spec: No.

Type
0 - Unscreened (primary) wire
1 - Round braid screen and sheathed.
2 - Flat braid screen and sheathed.
4 - Jacketed, no screen.

Class of Wire
1 - Thin wall
2 - Medium wall
8 - Thick wall

Number of Cores
1, 2, 3 etc.

Conductor Type
1 - Tin plated copper
2 - Silver plated copper.
3 - Nickel plated copper etc.
0 - Special construction eg Alumel/Chromel

Wire Size
30 - 00 AWG

Core, Base Colour
See colour code

External Spiral or Jacket Colour
See colour code

International Colour Code

0 - Black, 1 - Brown, 2 - Red, 3 - Orange,
4 - Yellow, 5 - Green, 6 - Blue, 7 - Violet,
8 - Grey, 9 - White

Example Colour Coding

2/6/54 - 9

3 cores, Red, Blue and Green with a Yellow stripe and a White outer jacket.

SEA HARRIER CABLES

Fepsil Cables

21 These cables do not support combustion and are unaffected by chemicals, fuels, hydraulic fluids and ester-based lubricants. They are identified at intervals throughout their length, by the name and AWG size, printed in black lettering. Although their operating temperature range, voltage and frequency, are as for Tersil type cables. their outer braid and FEP sheath gives extra

protection against the fluids mentioned and also provides good flexibility at low temperature. They are similar in overall diameter to Tersil cables, but are heavier.

Note ...

When Fepsil is heated above 330°C, toxic compounds are evolved which can cause unpleasant effects if inhaled. Cables should therefore be prepared in a well ventilated room and no smoking is permitted while working on the cable. All particles of FEP should be thoroughly removed from hands and clothing, on completion of job.

a. FEPSIL - Has strained nickel plated copper conductors insulated with silicone rubber, with outer protective covers of glass braid (or glass braid and PTP) coloured green and clear Fluorinated Ethylene Propylene (FEP). Cable sizes range from 22 AWG to 4 AWG.

b. FEPSILMET - Similar to Fepsil but with an additional outer braid of tinned copper wire. Cable sizes range from 22 AWG to 8 AWG.

c. FEPSILMETSHEATH - Similar to Fepsilmet but with an additional outer sheath of FEP coloured green. Cable sizes range from 22 AWG to 16 AWG.

Servicing

22 Minor damage to the outer sheath of FEPSIL cables can be repaired as follows:-

22.1 Clean sheath about 6 in. either side of damaged area with M.E.K. (or TRICHLOROETHANE) - fluid must not enter damaged area.

22.2 Slide a length of SPL sleeving over the damaged area, allowing ½ in overlap on either side.

22.3 For protection, apply either a fibre glass or PTFE tape around undamaged cable area and any adjacent cables.

22.4 The thermo-pistol to shrink SPL tubing and remove protecting tape.

FEPSIL AWG	TUBING	TUBING I.D. M.M. NORMAL	RECOVERED	REF: No. 5F/
22-16	SPL 40	4.061	ZERO	6420974
14-10	SPL 64	6.35	3.18	6420975
8-6	SPL 114	11.43	7.92	6420976

Pressure sensing Teflow tape	·1 in Wide	5F/1997876
Pressure sensing Fibre Glass tape	1 in Wide	5F/1981532
Adhesive Fibre Glass tape	½ in Wide	5F/9139582
Fibre Glass Tape	⅝ in Wide	5F/1999993

Chapter 9-1

WIRE CLASSIFICATION

General wiring can be expressed in terms of:-

1 The number of strands and the strand diameter in Imperial or Metric sizes. (ISO BAS).

2 Circular Mil Area (CMA), which is calculated by the formula;

$$CMA = D \times D \times N$$

Where D = Diameter of a single wire strand in Mils.
(A Mil being 0·001 in)
and N = Number of conductor wires or strands.

3 In American Wire Gauge (AWG) sizes, where a given number is related to the cross sectional area of the conductor. The higher the number the smaller the area and vice versa.

4 In Cross Sectional Area (CSA) Inches^2 or mm^2. Examples of the above relationships are given in the following table.

5 Panavia Code. This is represented by a 3 digit code which corresponds to AWG sizes.

CCC amp	Conductor strands & dia in in.	Area in in^2 conductor	Nominal wire dia in in.	CMA	AWG	Conductor strands & dia in mm ISO	Nominal wire dia in mm	Area in mm^2 conductor	Panavia Code
5	19/0.00472*	0.00033	0.024	418	24	19/0.118	0.59	0.208	002
5	7/0.0076	0.00032	0.023	434	24	7/0.2	0.5842	0.21	002
11	19/0.006	0.00054	0.031	680	22	19/0.15	0.75	0.336	004
11	14/0.0076	0.00064	0.034	808	22	16/0.2	0.8636	0.42	004
14	19/0.0076	0.00086	0.039	1100	20	19/0.20	1.0	0.597	006
14	23/0.0076	0.00104	0.046	1328	20	24/0.15	1.1684	0.67	006
18	33/0.0076	0.0015	0.050	1910	18	19/0.25	1.25	0.933	010
27	40/0.0076	0.0018	0.058	2310	16	19/0.30	1.5	1.34	012
31	70/0.0076	0.0032	0.074	4040	14	37/0.25	1.75	1.82	020
42	110/0.0076	0.0050	0.099	6350	12	37/0.315	2.205	2.89	030
61	73/0.012	0.0083	0.119	10510	10	37/0.40	2.8	4.65	050
82	120/0.012	0.0136	0.161	1728	8	114/0.30	3.84	8.11	090
115	182/0.012	0.0206	0.209	26210	6	182/0.30	4.72	12.85	140
160	294/0.012	0.0333	0.263	42340	4	294/0.012	6.02	20.75	220
200	203/0.018	0.0517	0.333	65770	2	203/0.45	7.5	32.2	340
230	248/0.018	0.063	0.372	80350	1	247/0.45	8.27	39.2	420
240	323/0.018	0.082	0.42	104700	0	323/0.45	9.48	51.2	530
270	416/0.018	0.106	0.475	134800	00	418/0.45	10.75	66.2	680
280	513/0.018	0.131	0.533	166200	000	518/0.45	12.0	82.0	-
350	666/0.018	0.170	0.6	215800	0000	666/0.45	13.6	105.5	-