



VFO

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MP - (polarization maintaining fiber)

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VFO - MP

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High performance series for singlemode fiber optic transmission

The VFO connector is based on our OPTABALL® design :
a connecting system with a sphere and cone which makes a dynamic coupling along the fiber axis,
thus guaranteeing excellent performance and repeatability.

This design minimizes problems associated with fiber tolerances.

Though, easy to use, and reliable because of the instant optical control of connection quality, the VFO connector is offered with two polishing options * :

- VFO (basic operation)

Straight polishing with index matching gel, for all applications requiring a very low insertion loss and able to tolerate a reflection rate ≤ -30 dB.

This version can be converted to an FR type at any time.

- FR (low reflection)

Slant polishing with index matching gel, resulting in an exceptionally low reflection rate ≤ -60 dB. This version is obtained by slant polishing on a previously straight polished and adjusted connector.

APPLICATIONS : high output networks (HDTV, CATV), analogue transmission systems sensitive to reflections, etc . . .

OPTION

- DF (dry slant polishing)

For all applications requiring connections without gel (measuring equipment) in moderate temperatures and able to tolerate slightly higher insertion losses, we can supply cable assemblies fitted with slant polished connectors for dry use. See page 26.

This technology requires special adjustment method ; only the performance of cable assemblies produced and measured in our factories will be guaranteed.

The process of slant polishing connectors makes it possible to use attenuators, fixed or adjustable, specially designed for this technology.

Consult the "Products" section in this catalog.

All traces of gel must in this case be removed from the optical surfaces. See cleaning procedure on page 44.

<i>Performance / characteristics</i>	<i>page 7</i>
<i>Polishing option identification</i>	<i>page 8</i>
<i>Tools required for each option</i>	<i>page 8</i>
<i>Possible coupling between the various options</i>	<i>page 8</i>

* except rack connectors : straight polishing only.

GENERAL

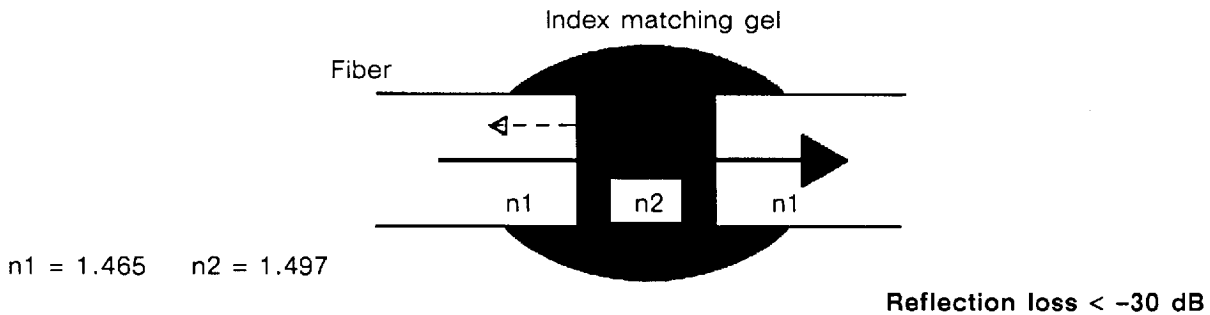
Analysis of connector associated losses

Lateral offset is the cause of the highest losses in a connection :

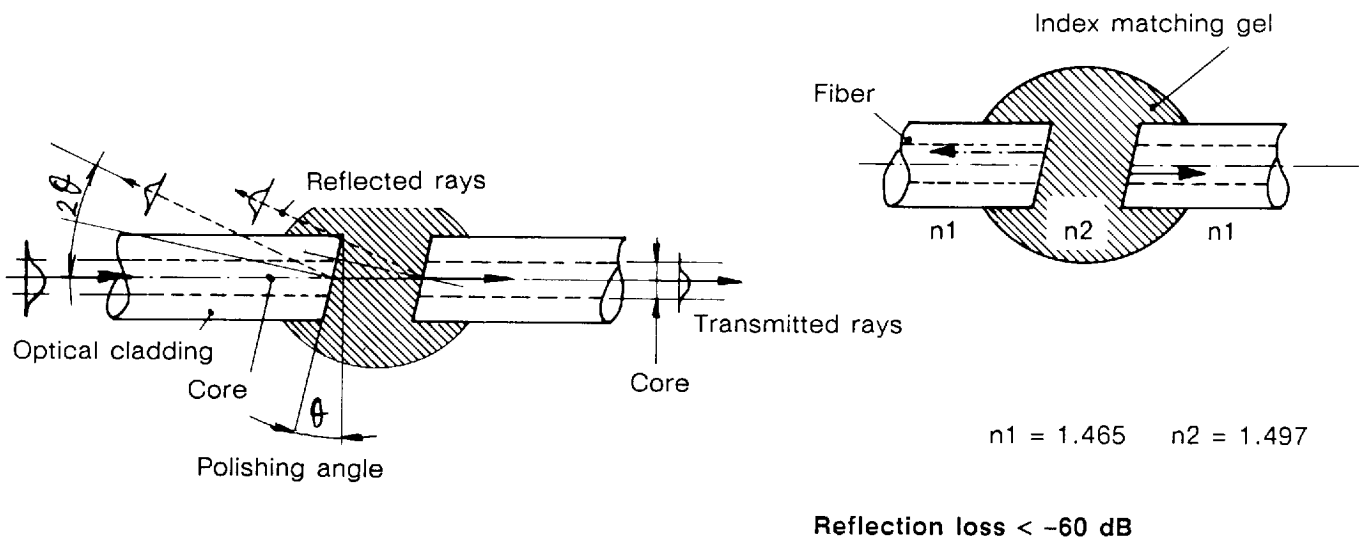
the OPTABALL system makes it possible to align 2 fibers to within $1\mu\text{m}$.

Two fibers with air separation have Fresnel losses :

– in the straight polishing option, use of an index matching gel between the end faces minimizes such losses.



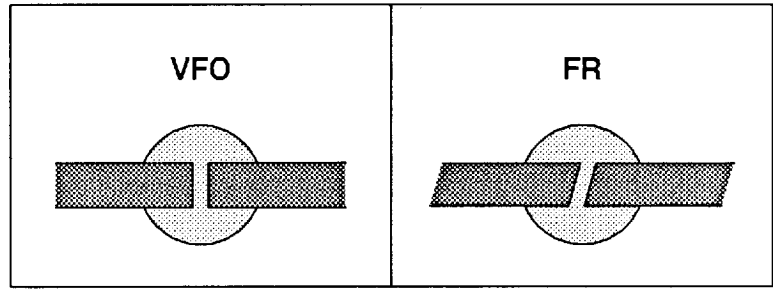
– in the slant polishing option, the fiber reflects light at a sufficiently high angle with respect to the centerline ; the reflected power cannot propagate and the rate of reflection is therefore very low.



PERFORMANCE / CHARACTERISTICS

STRAIGHT POLISHING
with index matching gel

SLANT POLISHING
with index matching gel



OPTICAL

Typical insertion losses
Standard deviation

Reflected power

Repeatability

$\leq .4$ dB
 $\leq .2$ dB

 ≤ -30 dB

 $\pm .1$ dB

$\leq .4$ dB
 $\leq .2$ dB

 ≤ -60 dB

 $\pm .1$ dB

ENVIRONMENTAL

Operating temperature

Damp heat

-25°C to $+70^{\circ}\text{C}$ -25°C to $+70^{\circ}\text{C}$
barring restrictions due to fiber or cable

93% HR 21 days

MECHANICAL

Durability

Vibrations

500 mating cycles (using nickel plated brass adapter)
1000 mating cycles (using stainless steel adapter)
10-500 Hz

PRODUCTS

Rack and panel connectors, adapters and attenuators, metal dust cap, cable assemblies, tooling.

MATERIALS

CONNECTOR

- Body : nickel plated brass
- Lock ring : nickel plated brass
- Centering cone : stainless steel

ADAPTOR

Body : nickel plated brass
or stainless steel

TERMINATION TECHNIQUE

- Bonding and polishing
- Visual inspection and mechanical alignment of the core of the fiber with a microscope.

POLISHING OPTION IDENTIFICATION

POLISHING OPTION	Polishing option identification		TOOLING	Set-up operations	REMARKS
	Connector	Adapter			
VFO Straight polishing + Index matching gel	GREY boot	GREY ring	F 780 116 000 (110V) or F 780 117 000 (220V)	Straight polishing - Adjustment - Bonding	- 1 - This option can be converted to FR type at any time. Then, remarks 2 and 3 of FR option apply.
FR Slant polishing + Index matching gel	GREY boot + BLUE adhesive tape (to be glued around the grey boot)	BLUE ring	F 780 116 000 (110V) or F 780 117 000 (220V) + F 780 220 000	Straight polishing - Adjustment - Bonding - Slant polishing reworking	- 1 - This option can be obtained from the VFO one. - 2 - Can be used with attenuator range (index matching gel must be removed from the optical face). - 3 - Connection between VFO and FR option is possible (then perfor- mances are as VFO option. The reflection rate will only be reduced to -60 dB if both coupled connec- tors are reworked in slant).

POLISHING OPTION	Polishing option identification		REMARKS
	Connector	Adapter	
DF/DF cable assembly Slant polishing dry connections	YELLOW boot	YELLOW ring	- 1 - Can not be coupled with any other option. - 2 - Compatible with attenuator range.

CONNECTORS are supplied with **GREY** boot.

BLUE adhesive tape must be ordered separately : part number **F 718 014 000** (132 adhesives)

ADAPTERS are supplied with all colour rings : 2 grey / 2 blue / 2 yellow.

Users having already in place a VFO installation (straight polishing) and wishing to transform it in FR option must be ordered :

- blue adhesive tapes for connector identification : part number **F 718 014 000** (132 adhesives)

- blue ring for adapter identification : part number **F 718 018 000** (50 rings)

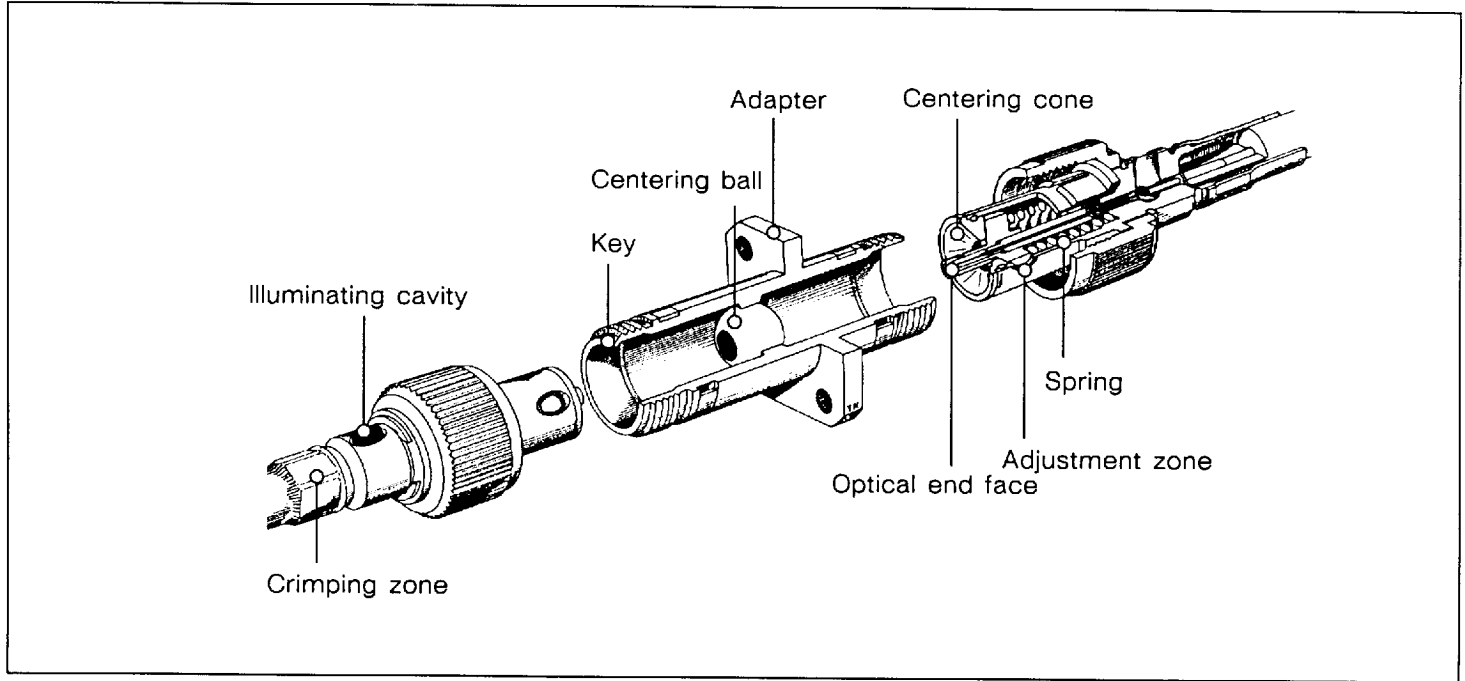
PRODUCTS

N.B. See from page 12 the product part numbers

STANDARD CONNECTOR AND ADAPTER

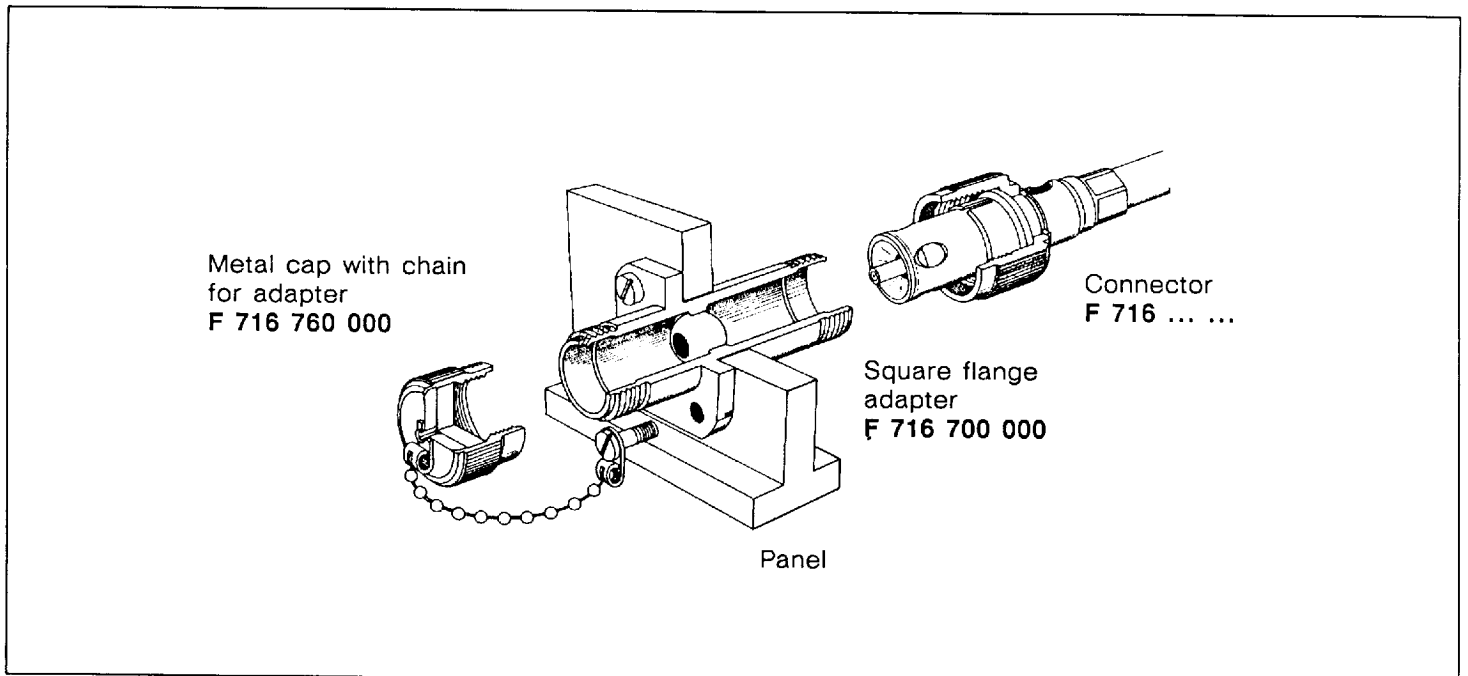
Cutaway view of an adapter and plug.

This diagram clearly shows the mating principle of the Optaball system.



Connector, adaptor onto panel, and dusty cap.

Note : there is also a protecting cap for connector : F 716 750 000.



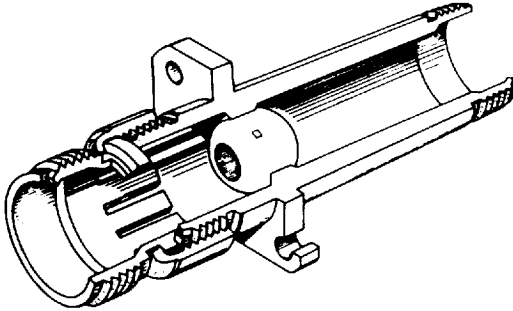
PRODUCTS

N.B. See from page 12 the product part numbers

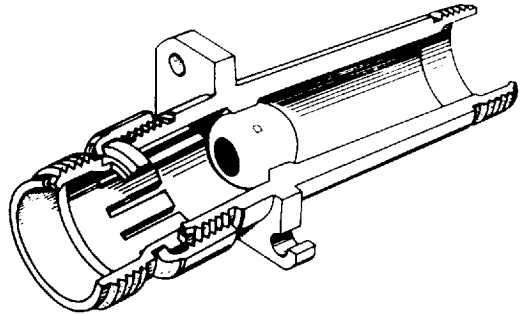
ATTENUATORS

Tunable flange attenuator

0 to 12 dB F 716 716 000



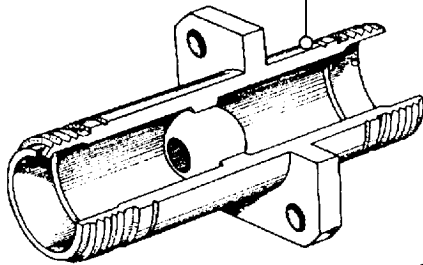
3 to 27 dB F 716 719 000



Fixed flange attenuator

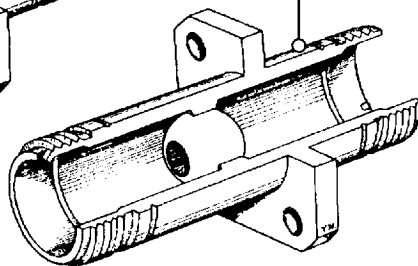
15 dB

Green color coded identification



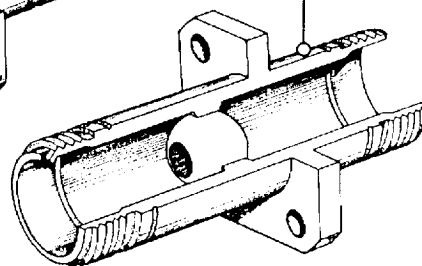
10 dB

Brown color coded identification



5 dB

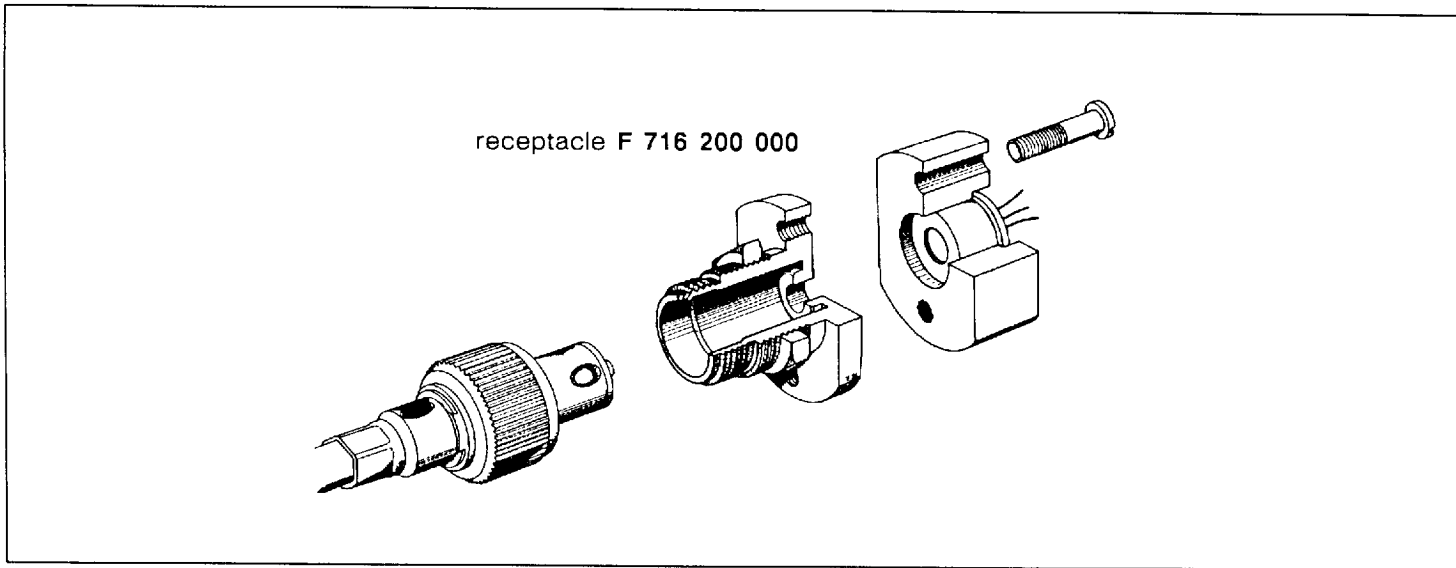
Black color coded identification



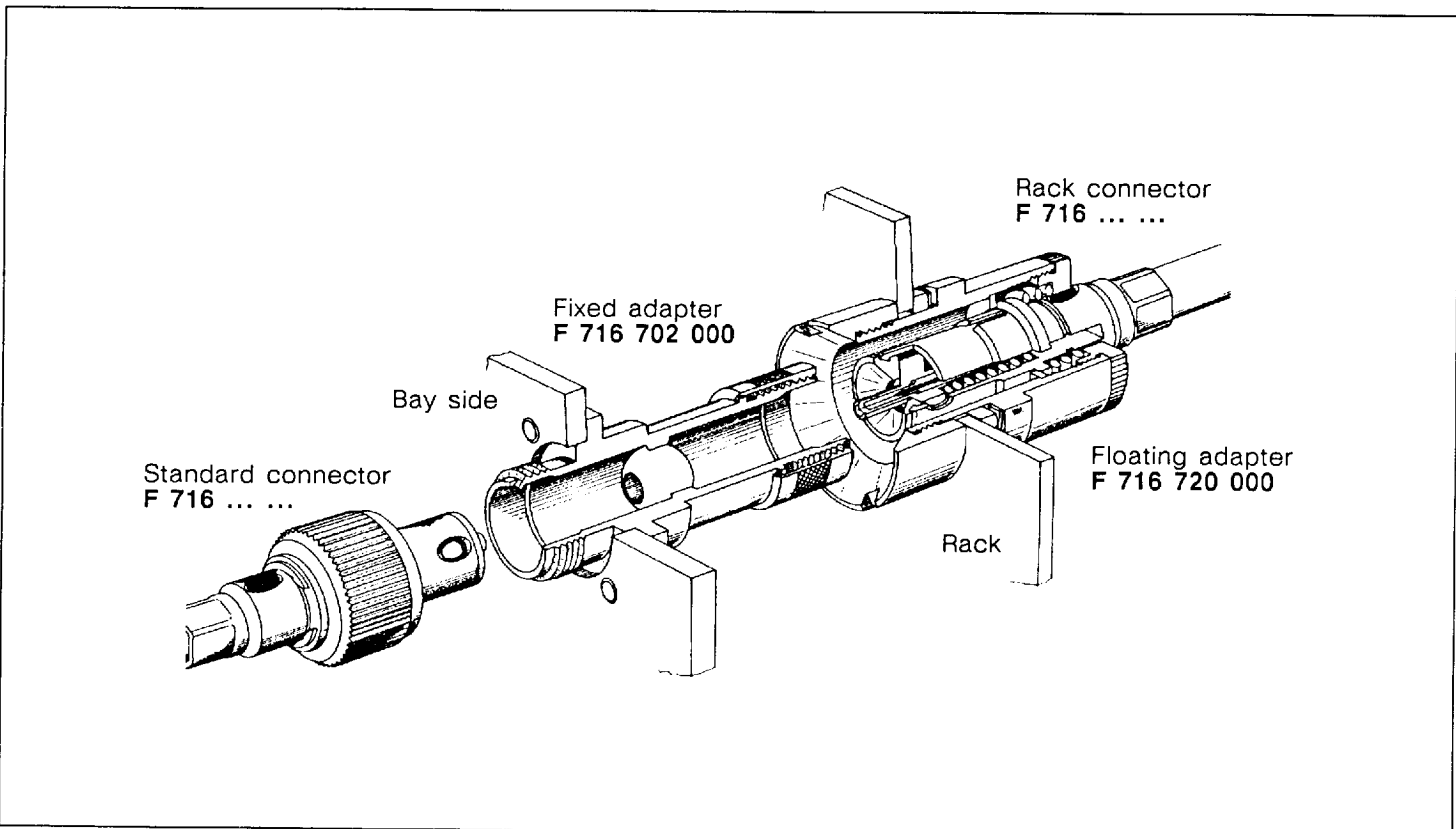
PRODUCTS

N.B. See from page 12 the product part numbers

Example for use of receptacle F 716 200 000



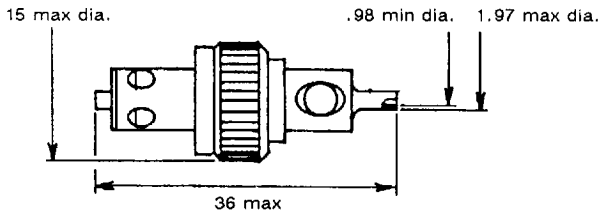
Cutaway view of a rack and panel connection



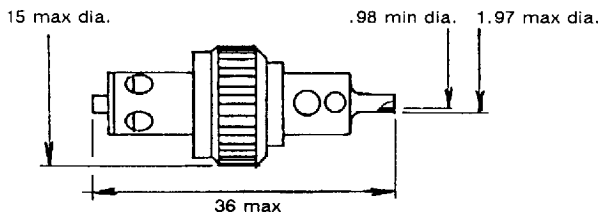
STANDARD CONNECTORS

Straight or Slant polishing – Classified according to cable size

Note – Crimping : see page 43 for crimp tools and hexagons to be used

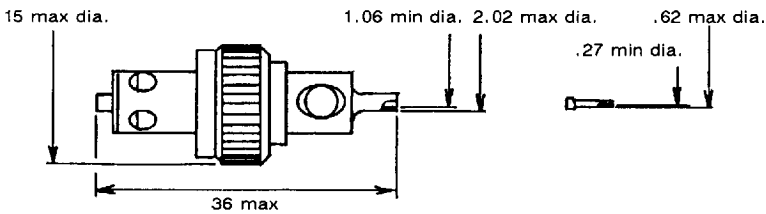


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.4/.85	900	F 716 001 000

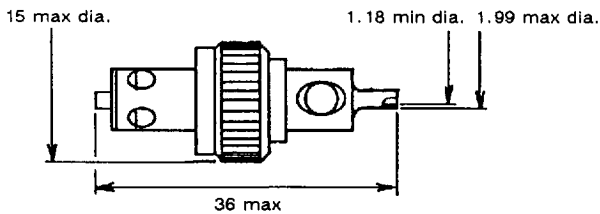


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.4/.85	900	F 716 012 000

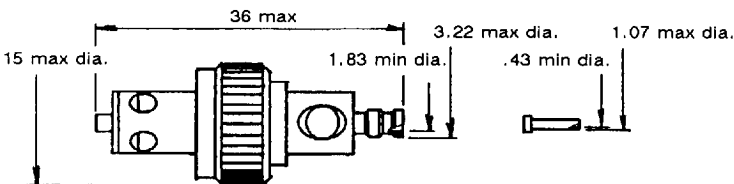
Must be used with special screw F 780 990 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.6/1	250	F 716 009 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.5/1.1	250	F 716 026 000

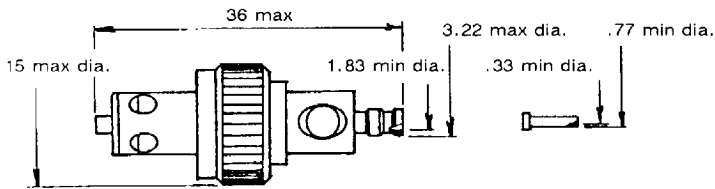


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.1/1.6	250	F 716 017 000

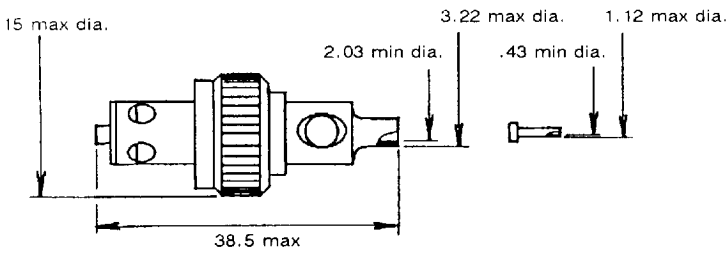
STANDARDS CONNECTORS

Straight or Slant polishing – Classified according to cable size

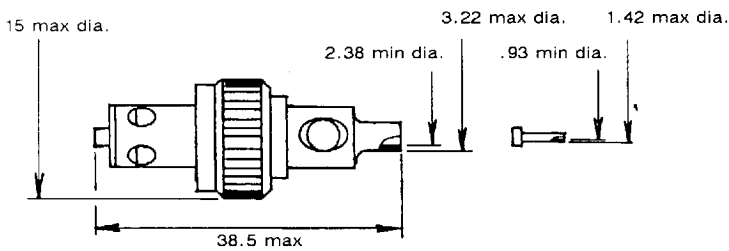
Note – Crimping : see page 43 for crimp tools and hexagons to be used



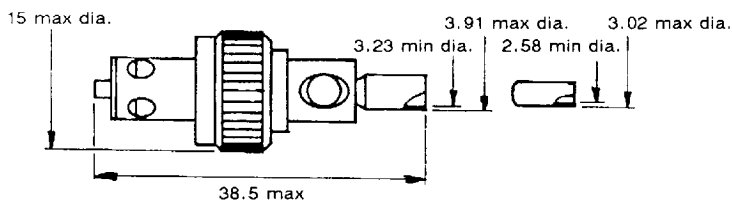
cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.8/1.6	250	F 716 023 000



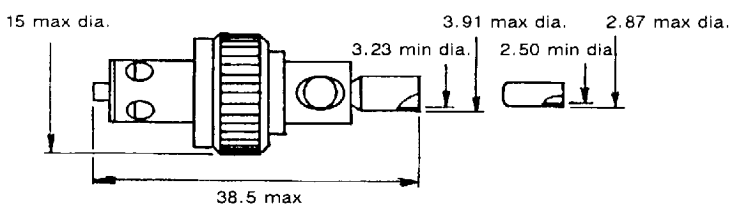
cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.1/1.8	250	F 716 007 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.4/2.2	900	F 716 032 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/2	250	F 716 030 000

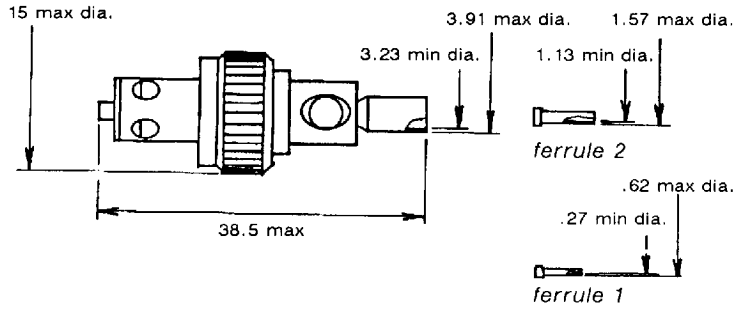


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/2.5 tight structure	900	F 716 027 000

STANDARDS CONNECTORS

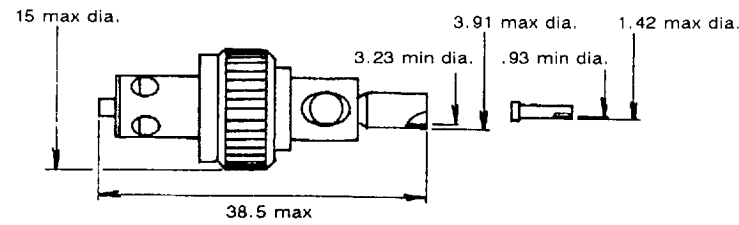
Straight or Slant polishing – Classified according to cable size

Note – Crimping : see page 43 for crimp tools and hexagons to be used

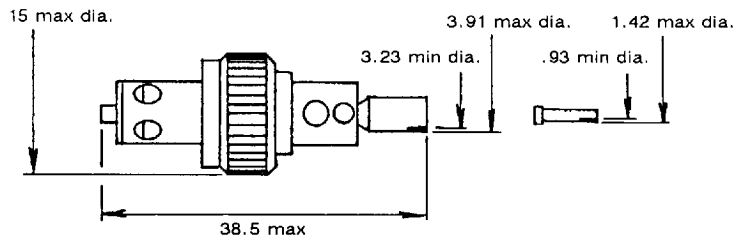


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.6/1+3 tight structure + tube	250	F 716 025 000

This connector can be used with 2 ferrules (Ferrule 1 : for .6/1 tube to guide the fiber, ferrule 2 : for crimping).

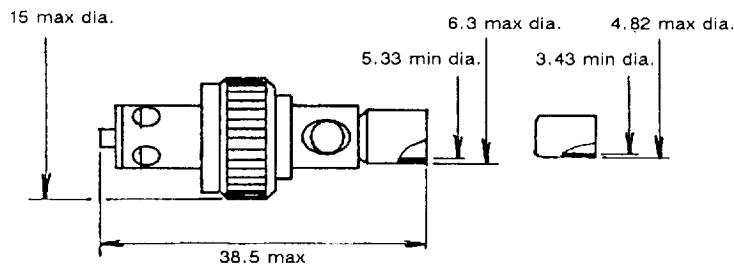


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/3 tight structure	900	F 716 002 000

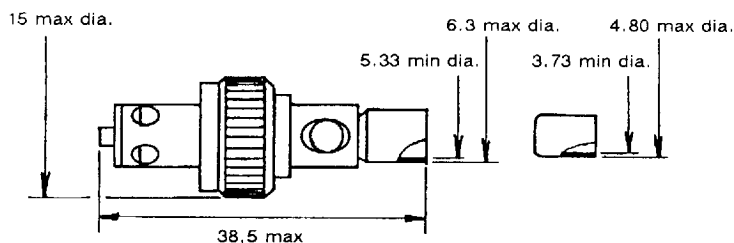


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/3 tight structure	900	F 716 013 000

Must be used with special screw F 780 990 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/3.2 tight structure	900	F 716 021 000

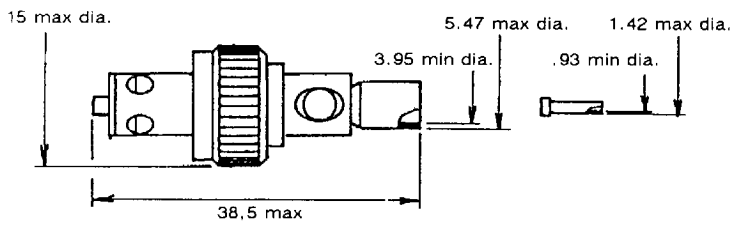


cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/3.5 tight structure	900	F 716 014 000

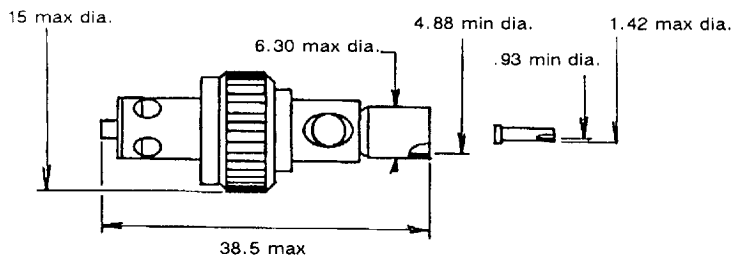
STANDARDS CONNECTORS

Straight or Slant polishing – Classified according to cable size

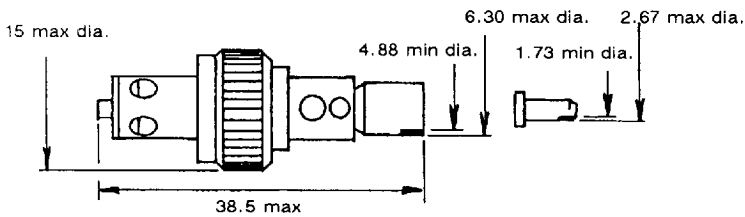
Note – Crimping : see page 43 for crimp tools and hexagons to be used



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.4/3.8	900	F 716 004 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.4/4.8	900	F 716 003 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
1.8/2.7+4.8 loose structure + tube	900	F 716 016 000

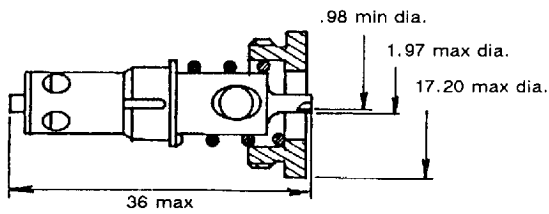
Instruction for use of special screw F 780 990 000

Some buffered fibers are difficult to illuminate sufficiently when the connector is coupled to the microscope. Therefore, a special screw is used to stress the fiber to improve the lighting view in the microscope. This screw is included in the tool kit and it also can be ordered separately.

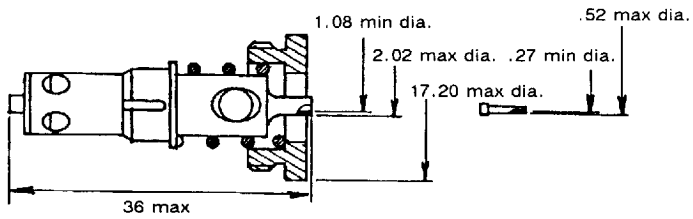
RACK CONNECTORS

Straight polishing – Classified according to cable size

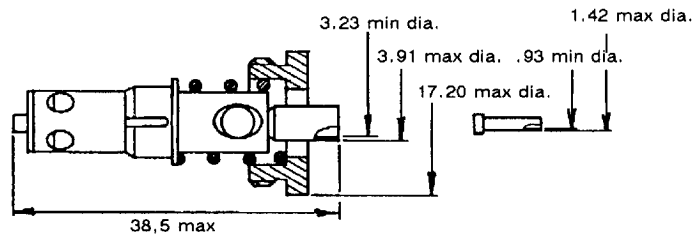
Note – Crimping : see page 43 for crimp tools and hexagons to be used



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.4/.85	900	F 716 005 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
.6/1	250	F 716 010 000



cable dia in/out (mm)	coating dia max (microns)	Part Numbers
/3 tight structure	900	F 716 006 000

CONNECTOR NUMERICAL INDEX

STANDARD VERSION

PART NUMBERS	cable dia in/out (mm)
F 716 001 000	.4/.85
F 716 002 000	/3 (A)
F 716 003 000	1.4/4.8
F 716 004 000	1.4/3.8
F 716 007 000	1.1/1.8
F 716 009 000	.6/1
F 716 012 000	.4/.85 (B)
F 716 013 000	/3 (A-B)
F 716 014 000	/3.5 (A)
F 716 016 000	1.8/2.7/4.8
F 716 017 000	1.1/1.6
F 716 021 000	/3.2 (A)
F 716 023 000	.8/1.6
F 716 025 000	.6/1/3 (A)
F 716 026 000	.5/1.1
F 716 027 000	/2.5 (A)
F 716 030 000	/2
F 716 032 000	1.4/2.2

RACK VERSION

PART NUMBERS	cable dia in/out (mm)
F 716 005 000	.4/.85
F 716 006 000	/3 (A)
F 716 010 000	.6/1

(A) Tight structure cable

(B) To be used with special screw F 780 990 000

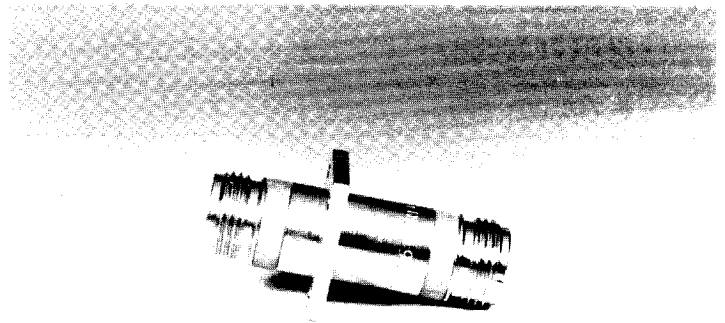
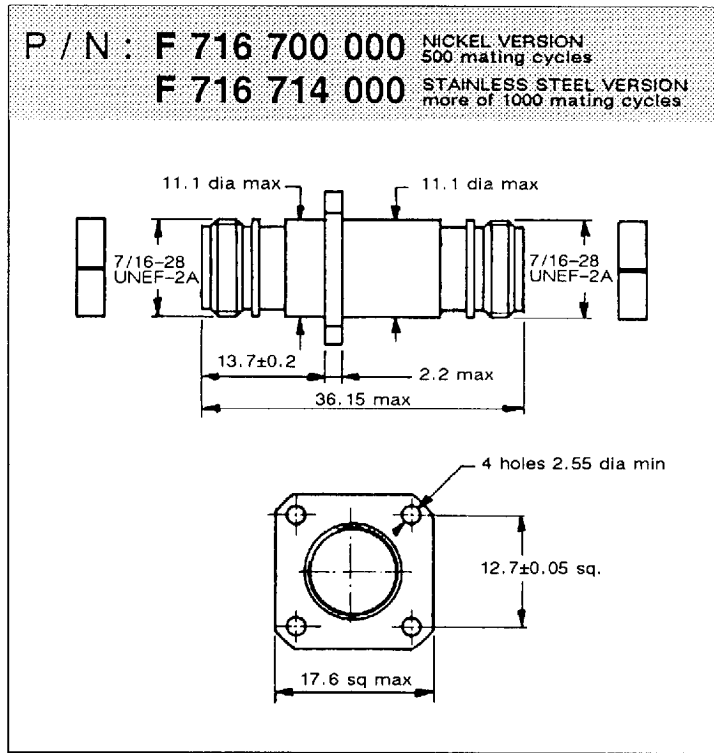
REMARK

In addition to the VFO series, there is a series of connectors designed specifically for the connectorisation of the polarization maintaining singlemode fibers, for which a special tooling is required (see MP series, page 27 of this catalog).

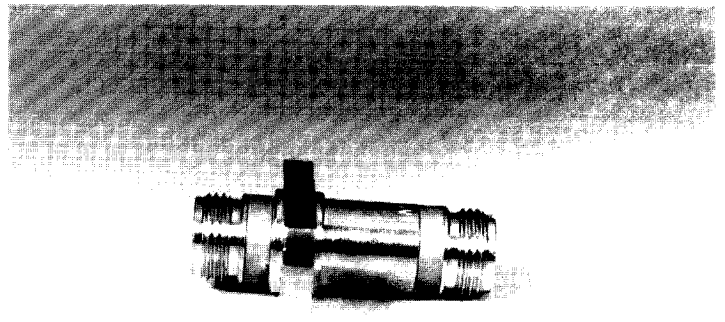
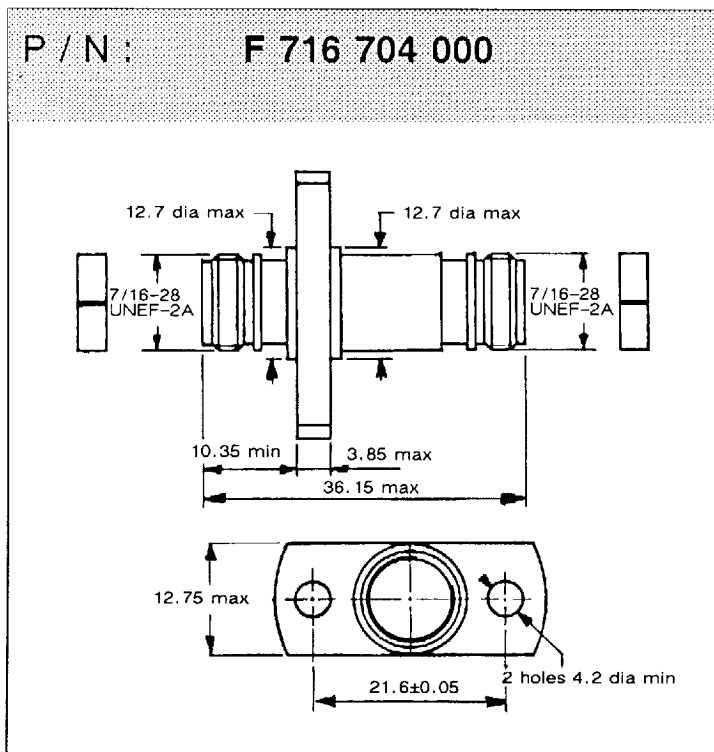
A VFO tool kit can be modified with a conversion kit for utilisation of MP series connectors (see page 40 : conversion of the tooling).

STANDARD ADAPTERS

SQUARE FLANGE ADAPTER



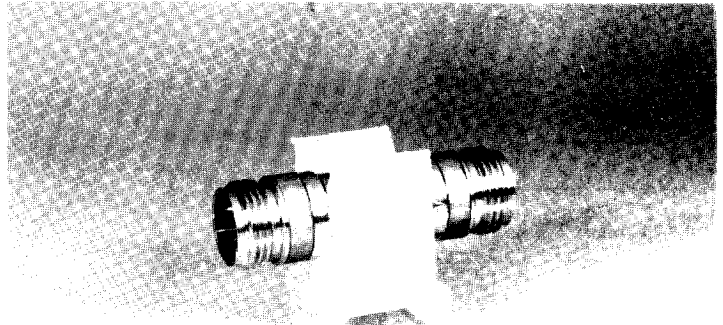
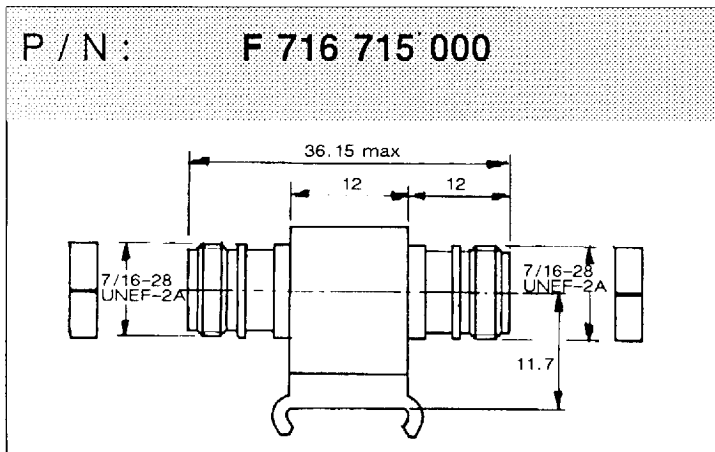
NARROW FLANGE ADAPTER



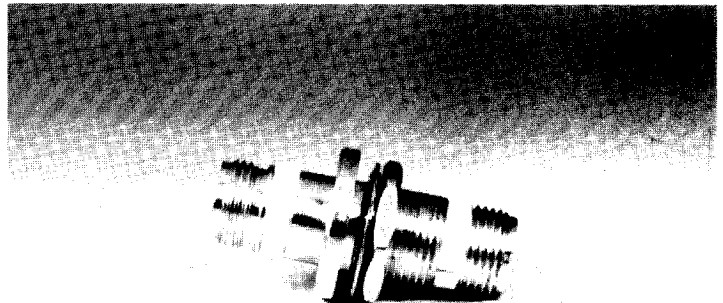
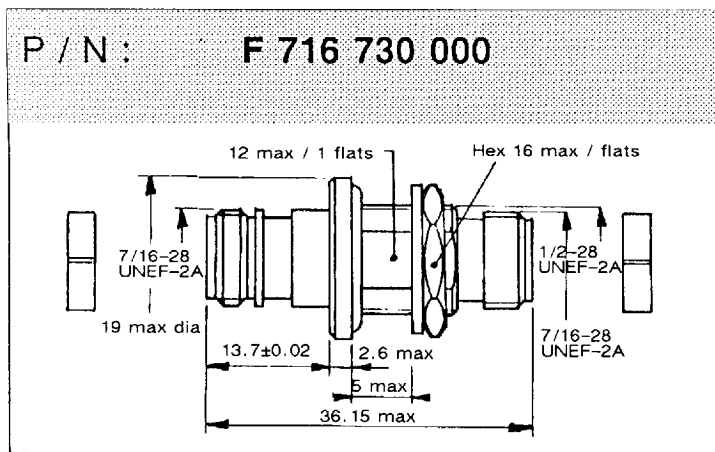
Panel cutout see page 23

STANDARD ADAPTERS AND RECEPTACLE

CLIP-ON ADAPTER



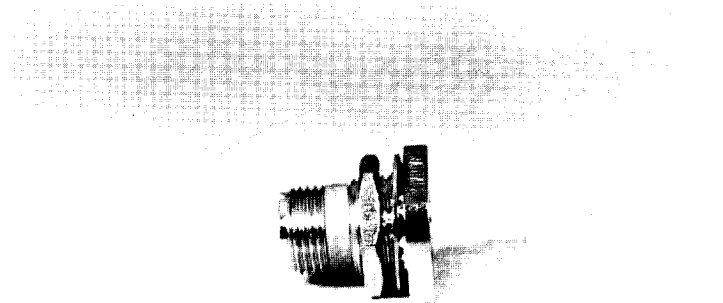
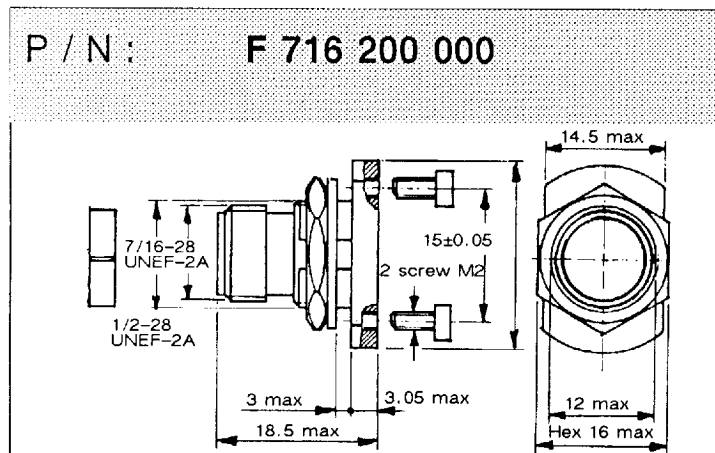
FEEDTHROUGH ADAPTER



FLANGE RECEPTACLE

For coupling a VFO connector with an equipment (emitter or receiver).

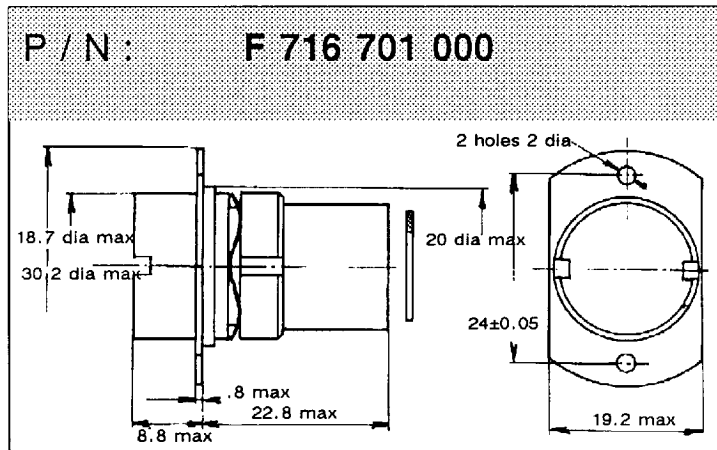
N.B. Consult factory for special device receptacles



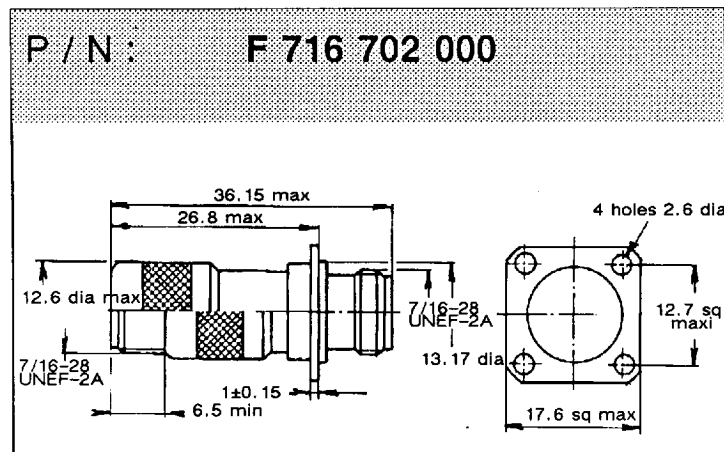
Panel cutout see page 23

RACK ADAPTERS

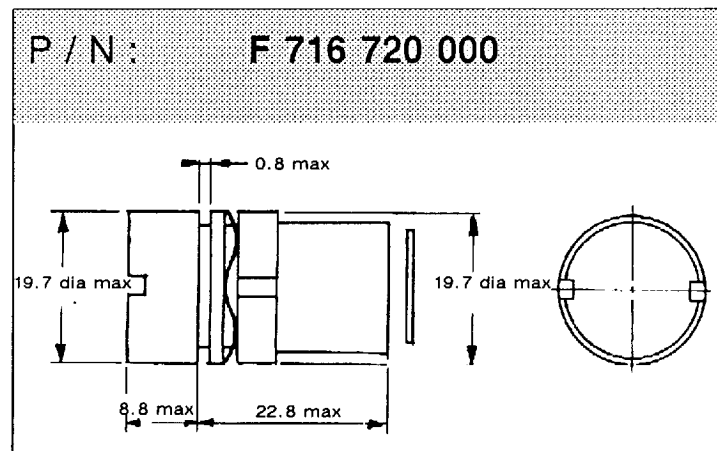
NARROW FLANGE ADAPTER (floating)



SQUARE FLANGE ADAPTER (fixed rack+panel)



FLOATING ADAPTER



Panel cutout see page 23

ATTENUATORS

Fixed or tunable low reflection attenuators for slant polished connections.

The attenuation depends on the mode field diameter of the fiber used.

All attenuators must be used with **dry** connectors only :

- DF version (already dry)
- FR version, after remaining index matching gel from the optical face. See cleaning procedure page 44.

FIXED ATTENUATORS

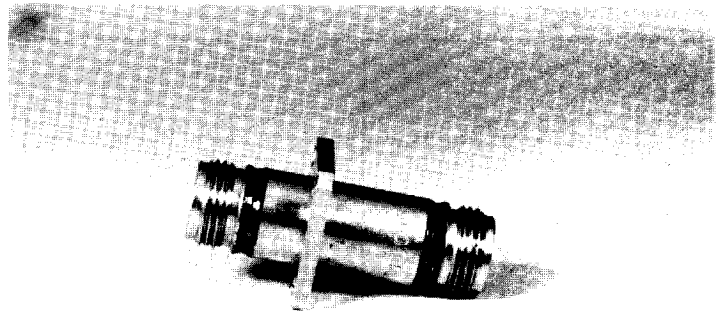
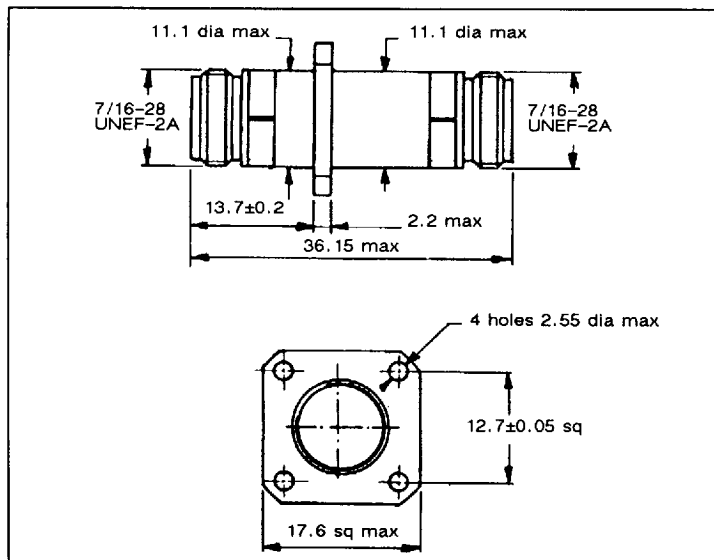
Nominal attenuations for connected fibers with mode field diameter $2w_0 = 10 \mu\text{m}$ à $\lambda = 1300 \text{ nm}$.

PART NUMBERS	Attenuation values *	Colour coded identification
F 716 711 000	5 dB	black
F 716 712 000	10 dB	brown
F 716 713 000	15 dB	green

* pour $2w_0 = 9 \mu\text{m}$ nominal attenuations come to 4 dB, 8 dB, 12 dB.

PERFORMANCE CHARACTERISTICS

Attenuation tolerance	: $\pm 2 \text{ dB}$ ($\lambda=1300 \text{ nm}$; $2w_0 = 10 \mu\text{m}$)
Reflection	: $\leq -40 \text{ dB}$
Durability	: 500 mating cycles
Vibrations	: 10–500 Hz
Temperature range	: -25°C to $+70^\circ\text{C}$
Humidity	: 93% HR, 21 days



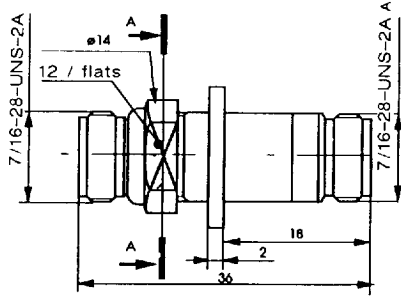
Panel cutout see page 23

ATTENUATORS

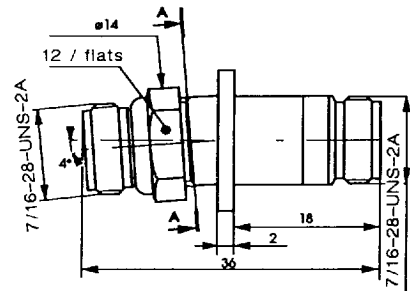
TUNABLE ATTENUATOR from 0 to 12 dB

INCLINED (4°) TUNABLE ATTENUATOR from 3 to 27 dB

P / N : **F 716 716 000**



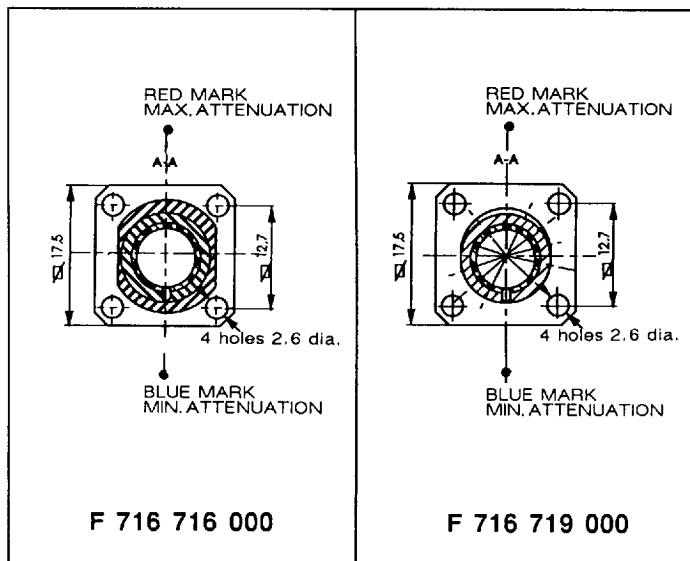
P / N : **F 716 719 000**



PERFORMANCE CHARACTERISTICS

Attenuation tolerance	:	See hereafter
Reflection	:	≤ -40 dB
Durability	:	500 mating cycles
Vibrations	:	10-500 Hz
Temperature range	:	-25°C to +70°C
Humidity	:	93% HR, 21 days

ATTENUATION



- To get the **minimum attenuation**, unscrew and remove the adjustable part, turn it to align the **blue mark** with the reference pin of the fixed part. Re-insert the adjustable part and fasten the screw.

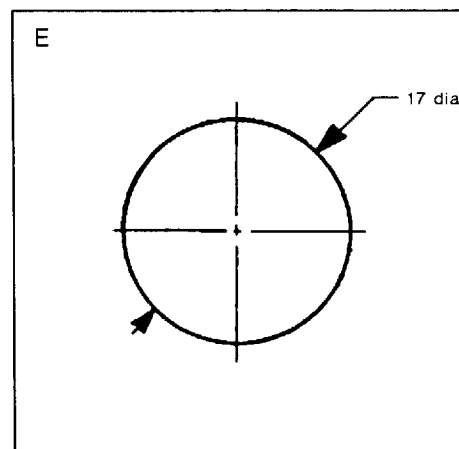
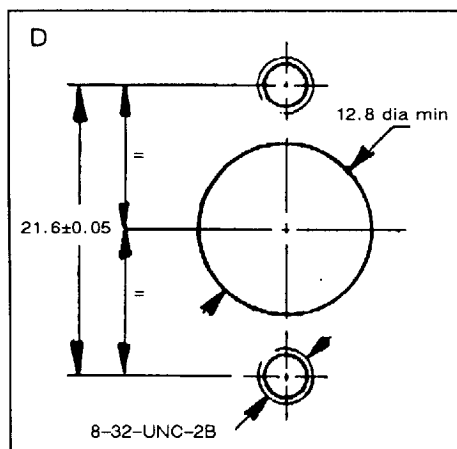
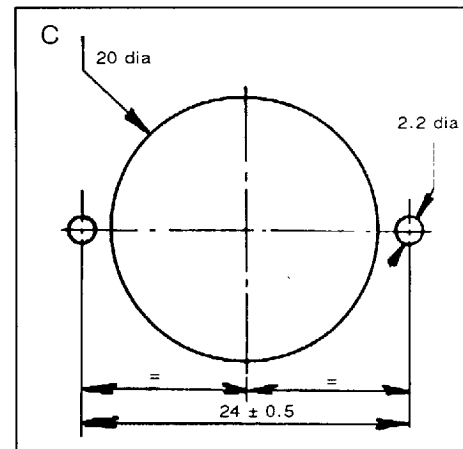
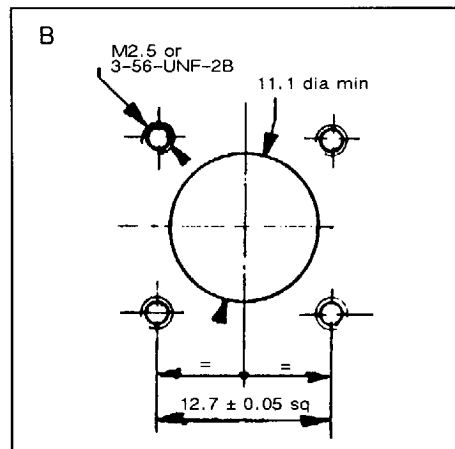
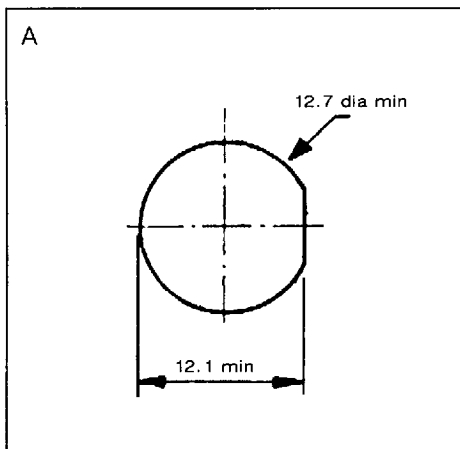
- To get the **maximum attenuation**, proceed as above to align the **red mark** of the adjustable part with the reference pin of the fixed piece.

Panel cutout see page 23

PANEL CUTOUT

PART NUMBERS	Panel cutout
F 716 200 000	A
F 716 700 000	B
F 716 701 000	C
F 716 702 000	B
F 716 704 000	D

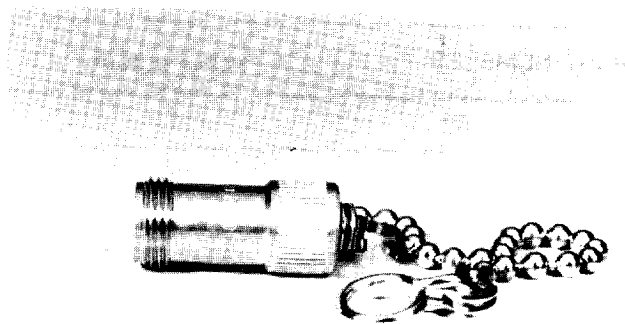
PART NUMBERS	Panel cutout
F 716 711 000	B
F 716 712 000	B
F 716 713 000	B
F 716 714 000	B
F 716 716 000	B
F 716 719 000	B
F 716 720 000	E
F 716 730 000	A



ACCESSORIES

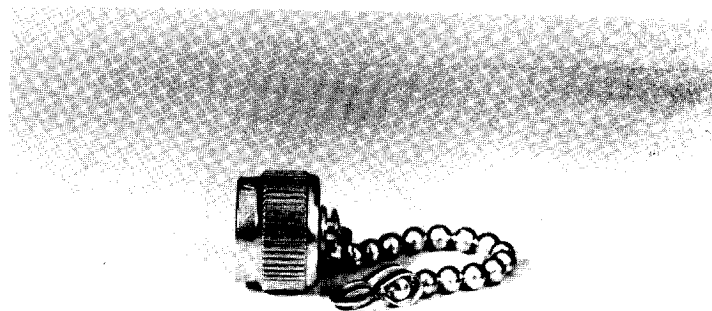
METAL CAP WITH CHAIN FOR CONNECTOR

P / N : F 716 750 000



METAL CAP WITH CHAIN FOR ADAPTER

P / N : F 716 760 000



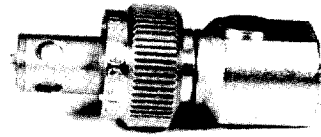
BAG OF 132 BLUE ADHESIVE TAPES

To identify the FR polishing option on connectors.

F 718 014 000

TEST PLUG FOR MEASUREMENT INSTRUMENTS

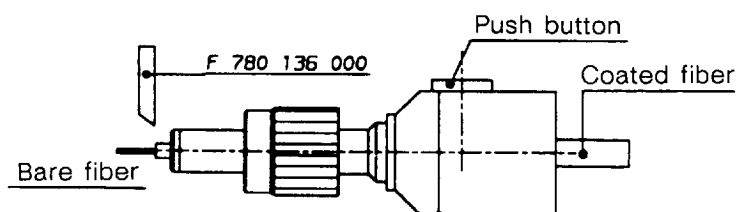
P / N : F 716 903 000



This plug permits the connection of a fiber to test equipment fitted with a F 716 200 000 VFO receptacle. This demountable connection (none crimp, none resined, none glued) cannot match the performance of the VFO series because coupling losses are dependent upon the quality of the fiber cut and the distance from the photodiode or LED. Nevertheless, a very satisfactory level of performance is achieved combined with a greatly simplified assembly procedure for laboratory use.

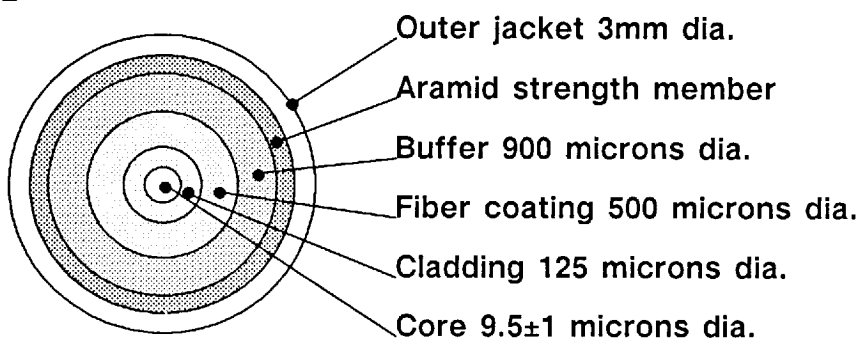
ASSEMBLY INSTRUCTION :

- Depress the push button.
- Insert fiber until it butts.
- Release the push button and cut the fiber using cutting plate F 780 136 000.



STANDARD CABLE ASSEMBLIES

CABLE STRUCTURE



PART NUMBERS :

Length	VFO straight polishing	FR slant polishing	DF slant polishing
	to be used with gel	to be used with gel	for dry connection
2 meters	F 793 010 200		F 793 020 200
3 meters	F 793 010 201	F 793 040 200	F 793 020 201
5 meters	F 793 010 202	F 793 040 201	F 793 020 202

OPTICAL CHARACTERISTICS

	Attenuation $\lambda=1300$ nm (CEI 874-1 or CECC 86000, method 6) :	Reflected Power
VFO	typical : $\leq .4$ dB max : $\leq .7$ dB	≤ -30 dB
FR	typical : $\leq .4$ dB max : $\leq .7$ dB	≤ -60 dB
DF	typical : $\leq .7$ dB max : ≤ 1 dB	≤ -55 dB

MECHANICAL CHARACTERISTICS

Durability	: 500 matings cycles (using nickel plated brass adapter) 1000 mating cycles (using stainless steel adapter)
Vibrations	: 10-500 Hz
Tensile strength	: 150 N max
Crush resistance	: 250 N/cm
Bend radius during installation	: 50 mm
Bend radius long term	: 30 mm
Cable retention	: 100 N max

ENVIRONMENTAL CHARACTERISTICS

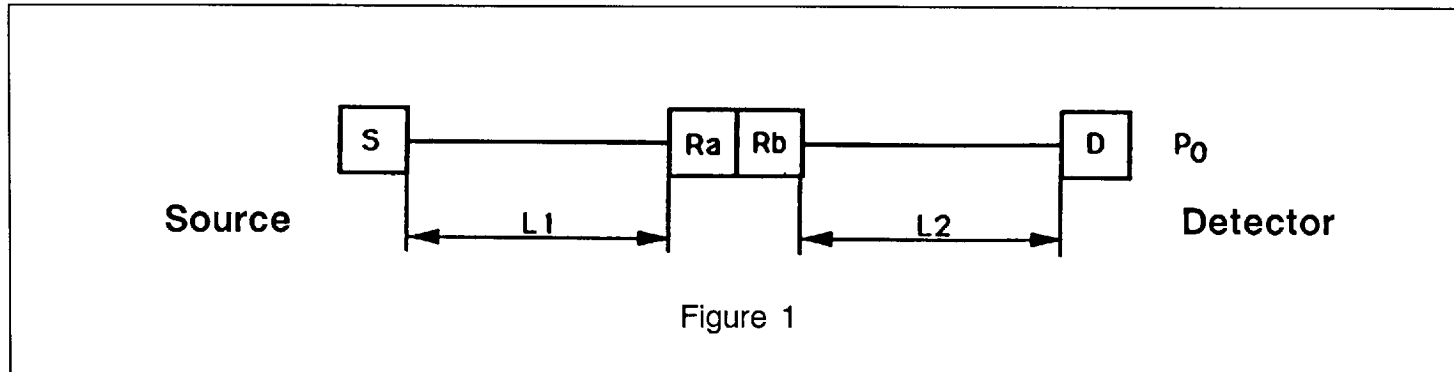
Operating and Storage temperature	: -25°C +70°C
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MEASUREMENT METHOD

CEI 874-1 OR CECC 86000, method 6

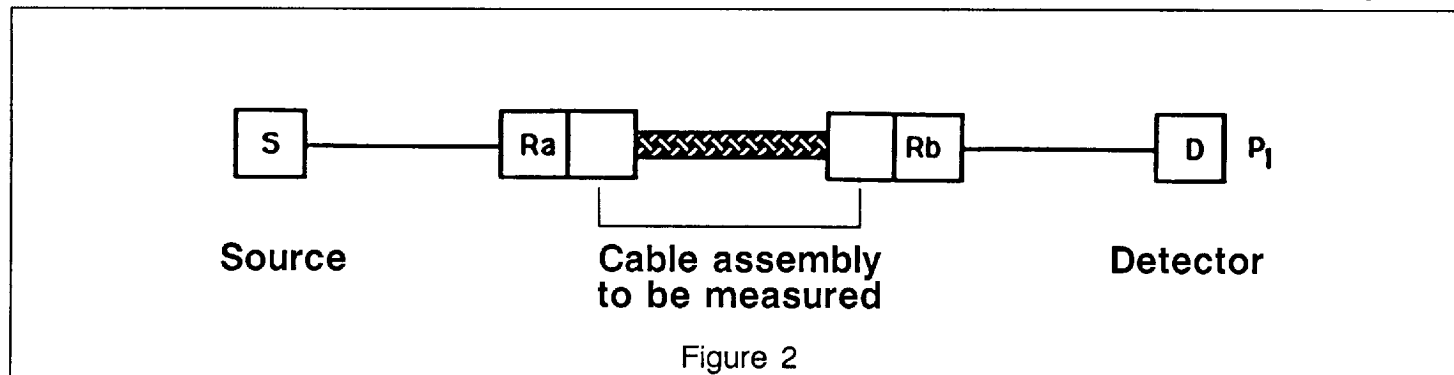
This method applies to patchcord connector sets and uses a reference connector set.

☞ Configure the test set-up as shown in figure 1:



☞ Measure power level (P0)

Disconnect the reference connector set and insert the patchcord connector set as shown in figure 2.



☞ Measure power (P1)

☞ Calculate the insertion loss using the following equation :

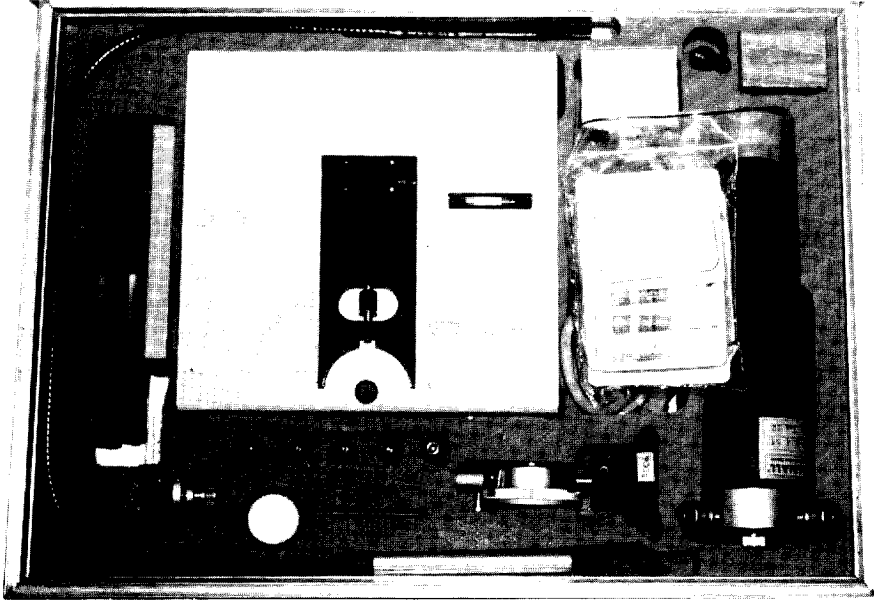
$$a_c(\text{dB}) = -10 \log \frac{P_1}{P_0}$$

TOOLING

ASSEMBLY KIT

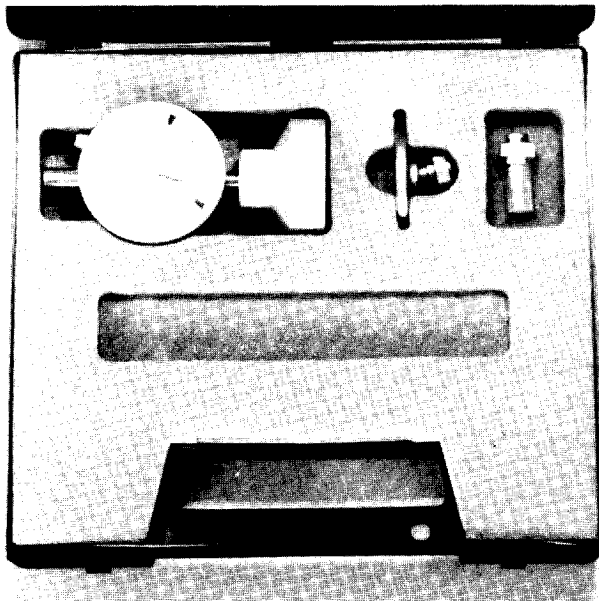
Delivered with assembly instructions

This kit includes all accessories for straight polishing option



Tension	Part Number
110 V	F 780 116 000
220 V	F 780 117 000

COMPLEMENTARY KIT FOR SLANT POLISHING



F 780 220 000

All the accessories included in these kits can be ordered separately. See next page.

TOOL KITS CONTENTS

ASSEMBLY KIT	F 780 116 000 110 V	F 780 117 000 220 V
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Adjustment microscope :

- illuminator
- flexible light guide
- case F 780 114 000 F 780 115 000
- extension cord
- adjustment wrench

Master plug (polishing)	F 716 910 000
Adjustment plug (microscope calibration)	F 716 901 000
Fiber viewing screw	F 780 990 000
Resin applicator (yellow)	F 780 132 000
Index gel applicator (green)	F 780 133 000
Cutting blade	F 780 136 000
5 tubes of resin	F 780 122 000
Polishing gauge	F 780 121 000
Dial indicator	F 785 001 000
Polishing base	F 780 124 000
10 lapping disks 12 µm	F 780 131 000
10 lapping disks 3 µm	F 780 135 000
10 lapping disks 3 µm	F 780 129 000
6 tubes of glue	F 780 311 000
Index matching gel	F 780 134 000
Spare lamp illuminator	F 780 106 000
Crimp tool (hex : 2.66-3.25-4.52)	R 282 211
Crimp tool (hex : 1.73-5.41-6.48)	R 282 223
Fiber stripping tool	F 780 029 000

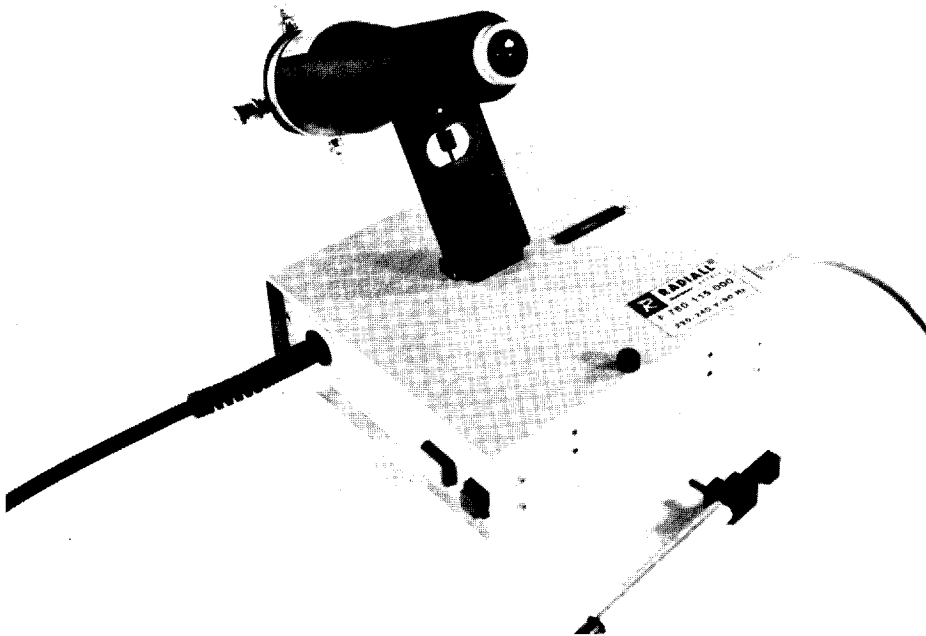
COMPLEMENTARY KIT	F 780 220 000
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Master plug 12°	F 716 900 000
Polishing gauge 12°	F 780 119 000
Dial indicator	F 785 002 000

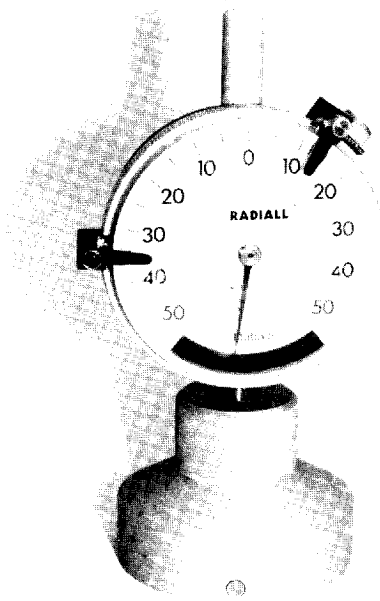
OPTION

Cable stripping tool	F 780 036 000
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Consult factory for the maintenance of your tool kit

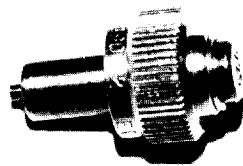


Optical equipment including :
- *adjustment microscope*
- *illuminator*
- *flexible light guide*

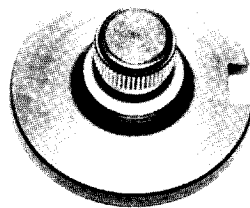
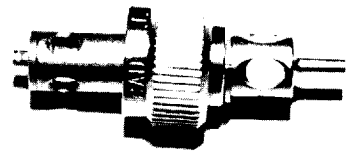


Dial indicator
for polishing dimensions check

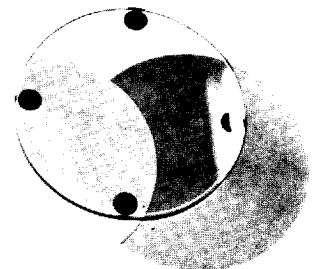
Master plug
F 716 910 000
*for dial indicator
adjustment*



Adjustment plug
F 716 901 000
for microscope adjustment

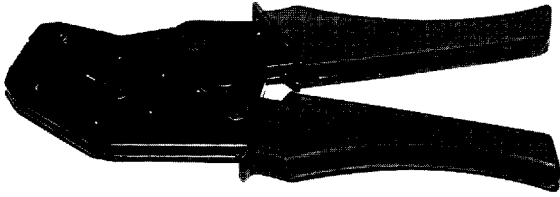


Polishing gauge
F 780 121 000



Polishing base and lapping disks
F 780 124 000

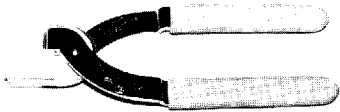
TOOL KITS CONTENTS



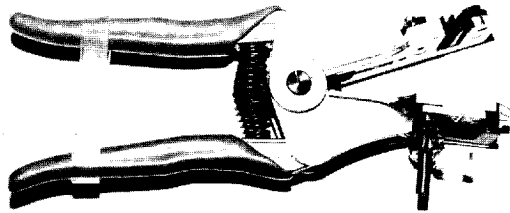
Crimp tools

R 282 211 (hex. 2.66–3.25–4.52)

R 282 223 (hex. 1.73–5.41–6.48)



Fiber stripping tool F 780 029 000

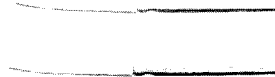


Cable stripping tool F 780 036 000

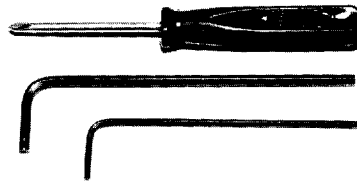


Glue
F 780 311 000

Resin
F 780 122 000



Resin and index matching gel applicators
F 780 132 000 – F 780 133 000



Maintenance kit for microscope