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SERVICE GUIDE

Pushrod cable re-termination guide

RE-TERMINATION OF PEARPOINT P330+/P340 AND GATORCAM3+/GATORCAM4 PUSHRODS

90/PP_RETERM/04 ISSUE 4 02/2012

READ AND UNDERSTAND THIS GUIDE IN FULL BEFORE PROCEEDING

Pearpoint®

Radiodetection®

P330+/P340, GC3/GC4 Pushrod Cable Retermination guide

This guide defines when and how to re-terminate the camera end of the following pushrods:-

Pearpoint P341 Plumbers Reel	(30m/100')	GatorCam4 Plumbers Reel
Pearpoint P341 Plumbers Reel	(60m/200')	GatorCam4 Plumbers Reel
Pearpoint P331 and P341 Reel	(35m/115')	GatorCam3+ and GatorCam4 Mini Reel
Pearpoint P332 and P342 Reel	(60m/200')	GatorCam3+ and GatorCam4 Std Reel
Pearpoint P332 and P342 Reel	(120m/400')	GatorCam3+ & GatorCam4 Std Reel
Pearpoint P333 and P343 Reel	(150m/500')	GatorCam3+ & GatorCam4 Std Reel

Note: onwards we shall refer to the current Sales brands Gatorcam 4 and P340 throughout this manual. The above table is a reference to the equivalent P330 and Gator3 ranges.

Table of Contents

PLEASE BE CERTAIN TO HEED THE SAFETY WARNINGS ON PAGE 3

1. Before you begin

Re-terminations should be performed by a competent technician.

We cannot guarantee or warrant any repairs made by any employee outside of our business, including other unaffiliated service centres.

It is possible to cause further damage to systems, consequential damage caused by poor worksmanship will not be covered and the warranty will be considered void. This document is intended as a guide for customers wishing to re-terminate the reels, however we cannot accept responsibility for any damages resulting from poor application of our guide.

Due to continuous development of our product details may change. We only offer this guide to support those customers who agree to assume responsibility for maintaining their own product. We can offer training and support packages for customers on how to perform this competently. Enquire with Sales or Service.

Before any re-termination ensure the system is disconnected from the power supply and mains to ensure safe working. The cameras can become hot, do not look directly into the camera due to the bright lights, they may cause temporary blindness or longer-term issues.

Potentially hazardous current and voltage sources contained within system when live.

Gloves and other appropriate PPE are strongly advised based on your risk assessment due to various mechanical, hygienic, electronic and other hazards. If the system is being re-terminated in a clean area ensure it has been suitably cleaned for the purpose.

Before you attempt any re-termination it is worth checking the video settings are correct for your reel. For each different length of reel a different amplifier is used to boost the video signal. If this is set incorrectly it will give a poor signal that may be misinterpreted as a cable fault.

You will need a colour copy of this guide due to colour coded wires and information.

Be aware of and take precautions against ESD. It is advised as part of your risk assessment you consider the MSDS sheets available online from the 3rd party products required for some repair operations. Consider PPE as part of this review.

Warning

Use extreme caution when using tools or industrial products or preparations.
When using the junior hacksaw, avoid inhaling or ingesting the glass fibre dust. Consider PPE.
When using the epoxy potting compound, avoid contact with skin.

2. Tools & Equipment

Some or all of the following tools will be required depending on which re-termination is being done :-

- Junior Hacksaw (150mm / 6”)
- Fine wire cutters / Adjustable precision wire stripper, 0.25-0.80mm.
  (such as RS® Stock No. 622-721)
- Triple-action cable stripping tool, 4.5-29mm strip
  {such as Tavismanor ROT29RTGRS01/001 (RS Stock No. 262-0151)}
- Scalpel / craft knife
- Heatgun appropriate for small heatshrink applications (see pictures)
- Scotchweld® DP100 needle applicator
- Digital Volt Meter
- Soldering iron \ Solder
- Pressure test Jig Part: 09/RP3210Z2 with regulated airline or foot pump with pressure gauge
- 15mm & 16mm open-ended spanners
- Open-ended torque spanner with 15mm/16mm heads
- Internal circlip pliers
- “C” Spanner

Special Tools:-

Dual Size “C” Spanner,
- Available from Pearpoint / Radiodetection, part number 70/GC2011N14

	Torque wrench
	Typical wire stripper

	Typical multi-purpose cable stripper
 	Scotchweld DP100 two-part quick-set epoxy structural adhesive (50ml cartridge). Adhesive dispenser gun, 50ml cartridge.

Warning

Use extreme caution when using sharp tools.
When using the junior hacksaw, avoid inhaling or ingesting the glass fibre dust.
When using the epoxy potting compound, avoid contact with skin.

Additional materials to be obtained locally:-

- Loctite® 222 as required *(Farnell / Element14 Stock No.1370113)*
- Loctite 243 as required *(Farnell / Element14 Stock No. 1370152)*
- PTFE grease (e.g. Super Lube) *(Farnell / Element14 Stock No. 537159)*
- 1.6mm Heatshrink
  (Farnell / Element 14 stock no. Allied Electronics stock no)
- Scotchweld DP100 two-part quick-set epoxy structural adhesive (50ml cartridge)
  (Farnell / Element14 stock No. 1702758 / Allied Electronics stock no. 617-7001)
- Adhesive dispenser gun, 50ml cartridge

(Farnell® / Element14® stock no. 1711526/ Allied Electronics stock no. 365-7000)

- DP8005 mixer nozzle
  (Farnell / Element14 Stock No. 1691657 / Allied Electronics stock no. 365-7005)
- Additional needle applicators
  (Farnell / Element14 stock no. 3975575 / Allied Electronics stock no.984-3187 / 984-3190)

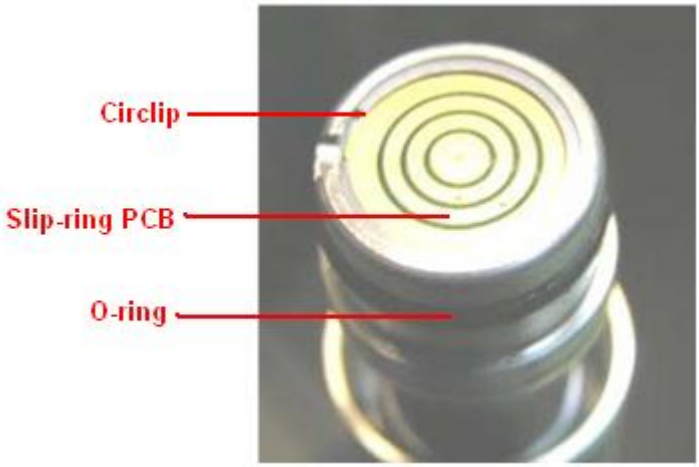
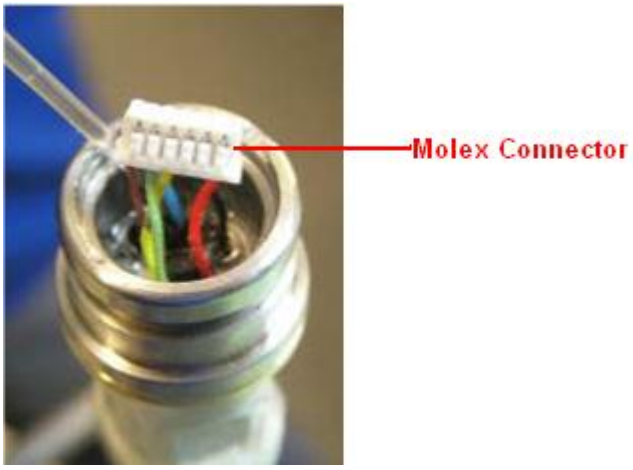
Third party part numbers are quoted for reference only. Any third-party products mentioned in this manual are for instructional purposes only and are not an endorsement by Radiodetection Ltd and SPX Corporation.
Radiodetection Ltd does not accept any liability for loss or damage to equipment or materials when using any third-party products.

3. Slipring Replacement – All Versions

There are two types of slipring PCB, they are not interchangeable and should never be mixed. Poor video quality will result.

The 10/RP2809-4 ROD-END slipring PCB is at the end of the ROD and has a 6-way connector.
Kit Contains: Rod termination Slipring PCB, O-ring, Circlip

The SONDE-END Slipring PCB goes at the end of the SONDE, it has a different PCB and a 4-way connector to prevent accidental use (the PCB is visually similar - beware).
Order: 09/RP2816ZBD-V0 (PCB), 04/XVH62S02 (circlip), 07/B01204016 (o-ring).

	Slide back the shroud nut and carefully secure the connector in a vice. Using a 2mm – 3mm screw-driver or similar, carefully prise out the circlip that secures the slip-ring PCB. One end of the circlip is tapered to facilitate this.
	Using a craft knife or similar, lift out the slip-ring PCB and remove the mini-Molex® connector from the back of the PCB.

Plug the mini-Molex connector into the rear of the new slip-ring PCB then push the wires and the PCB down into the connector being careful not to squash or damage any wires.

Secure the PCB in position with the new circlip**,** ensuring the circlip is properly seated in its groove.
Remove the old O-ring. Lightly grease the new O-ring with PTFE grease and fit to the connector.

4. P341 Plumbers or GC4 Plumbers Reel (7mm dia.) 93/RP3144Z10

Rod Camera-End Retermination

Materials required:-

Rod Re-termination Kit 93/RP3144Z10

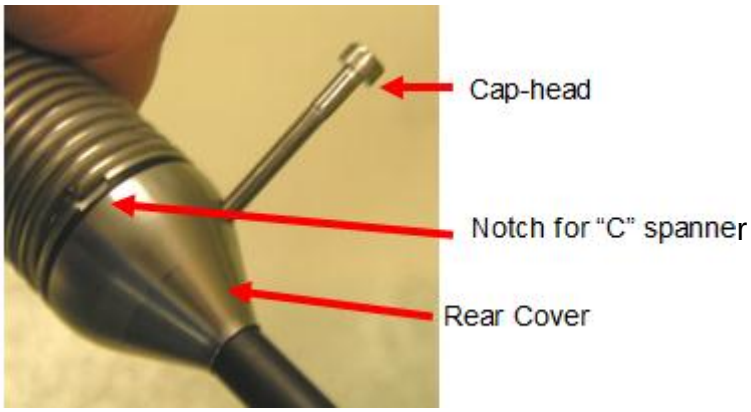
These instructions detail the re-termination procedures for both the P341 30m / 60m Plumbers reels and GatorCam4 30m / 60m Plumbers reels. Ensure that you read and understand these instructions in full before proceeding.

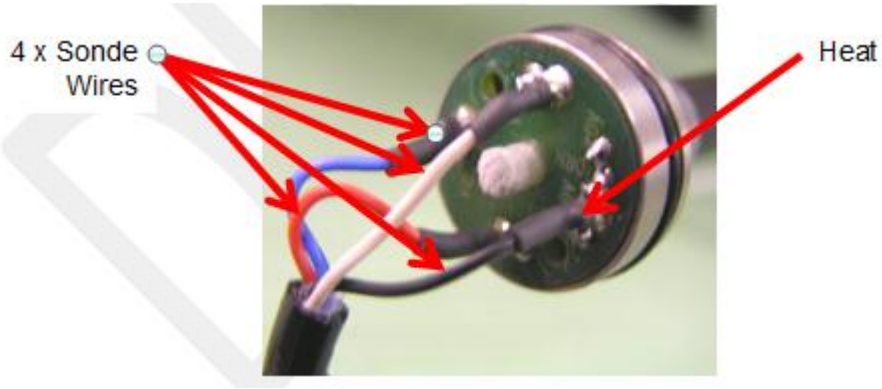
4.1. 93/RP3144Z10 Rod-end Re-termination Procedure

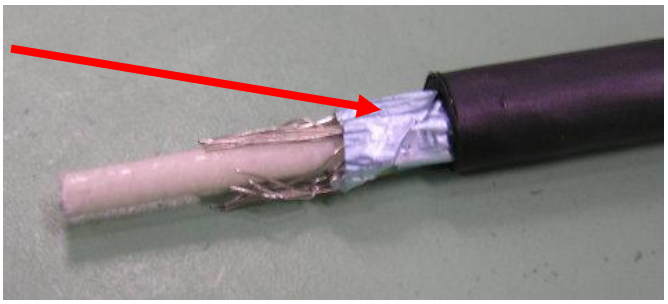
Remove the camera from the sonde spring, place out of the way.

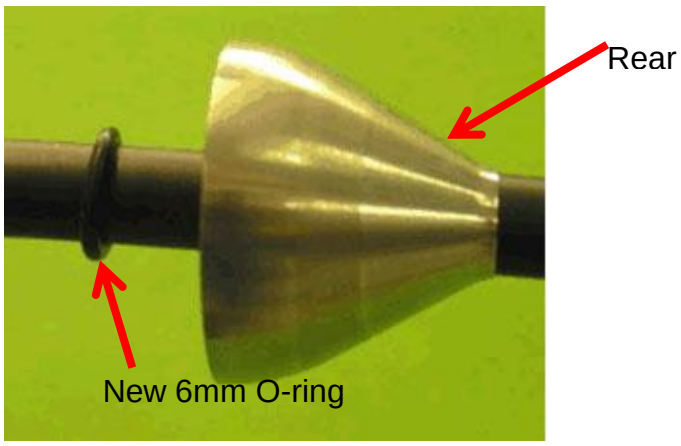
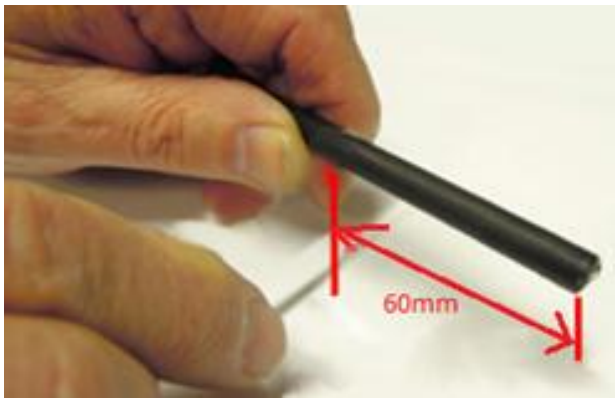
Ensure that all damaged rod is removed from the reel. Cut off the damaged rod with the junior hacksaw.

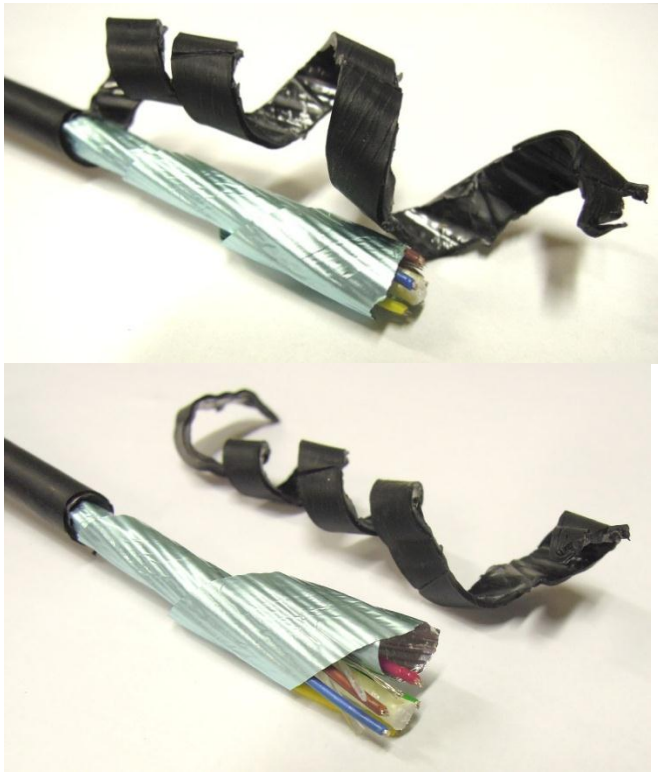
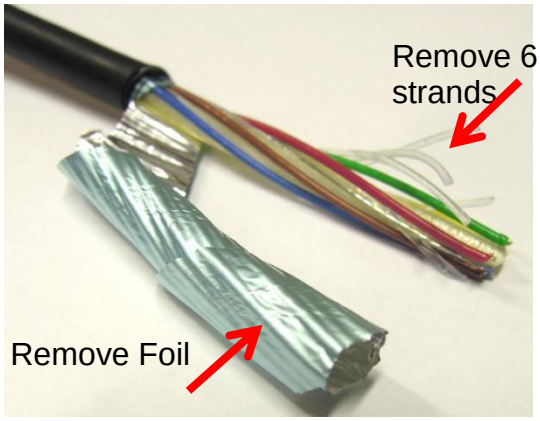
Pull out sufficient rod from the reel to facilitate the repair and lock the brake.

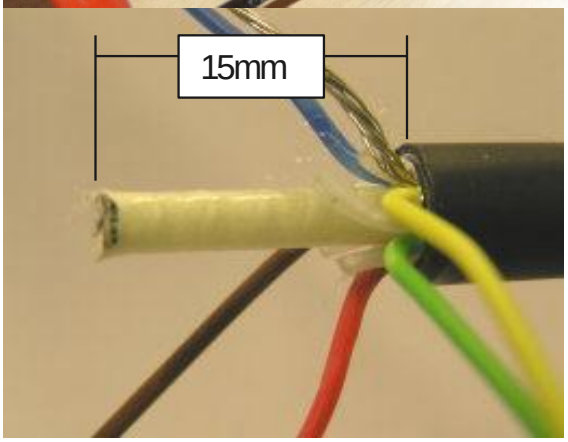
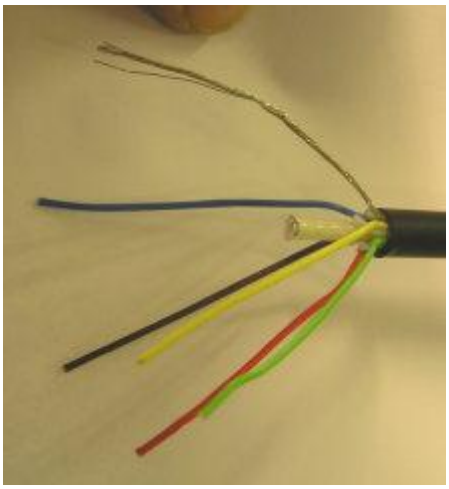
	Remove the M3 x 4 grub screw from the side of the rod cover, using the 1.5mm AF Allen key. This screw is secured with Loctite 222.
	Insert the M3 x 25mm caphead screw into the grub screw socket until it is hand-tight.

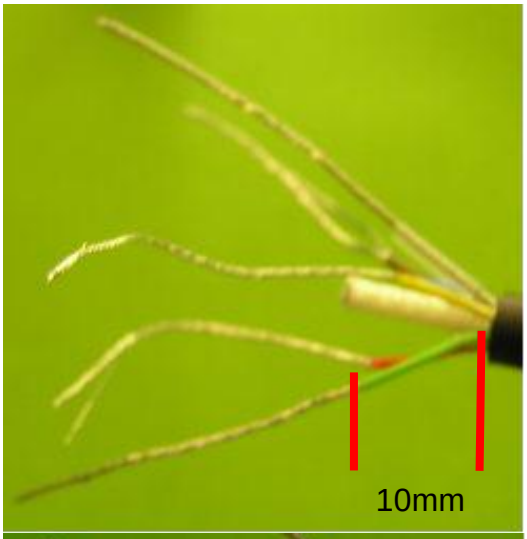
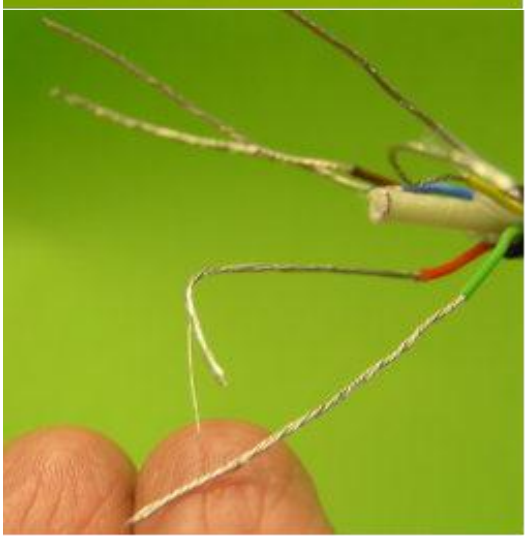
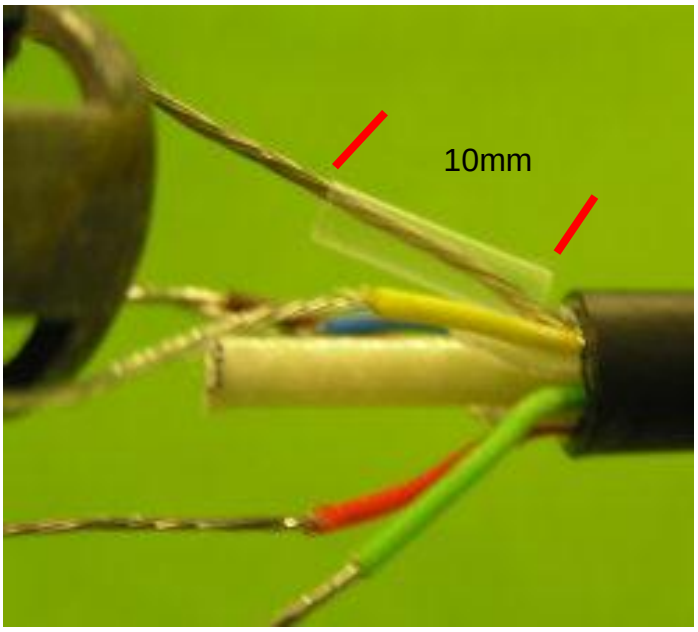
 	Using the “C” spanner to hold the spring body, loosen the rod cover from the spring body by using the caphead screw as leverage. Undo the rod cover and slide it away from the sonde spring. Remove and discard the 6mm and 15mm O-rings.
	Ease the termination nut out the spring body, taking care not to damage the four wires. Using a scalpel or craft knife carefully slit the heat shrink that covers the four solder posts and the ends of the wires, cutting from the base of the posts. De-solder the wires and discard the heatshrink. Warning: If the insulation on any of the wires is damaged, they will have to be cut back, stripped of 4-5mm of insulation and tinned. If too much of any wire is removed, the sonde cableform assembly will have to be replaced.

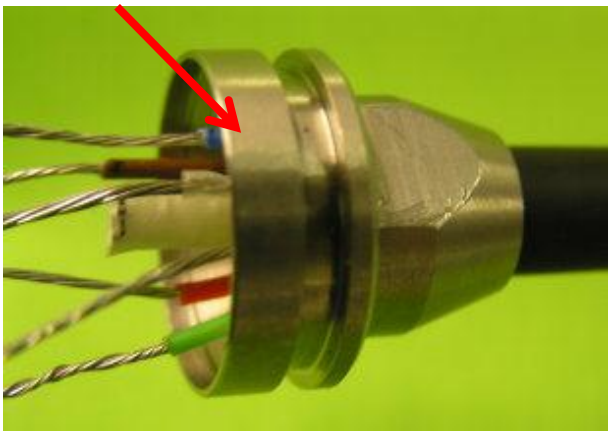
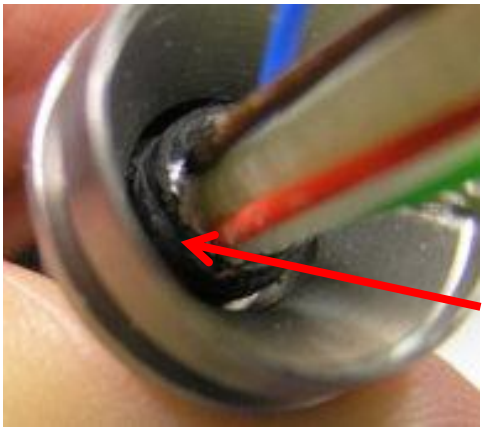
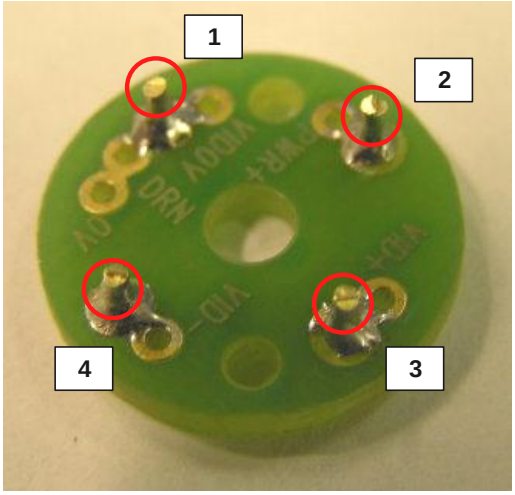
	Remove and discard any damaged rod

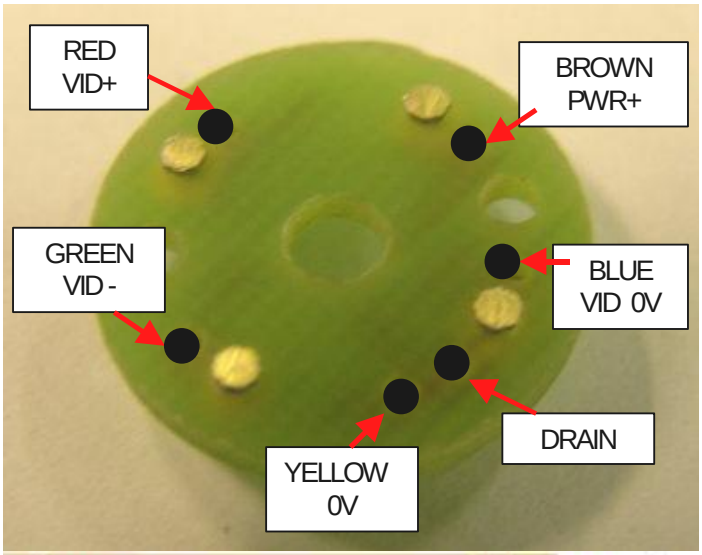
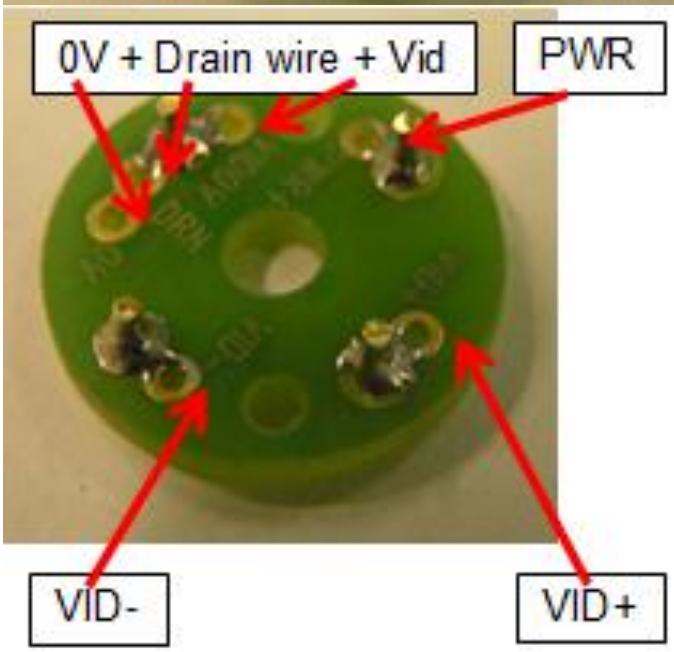
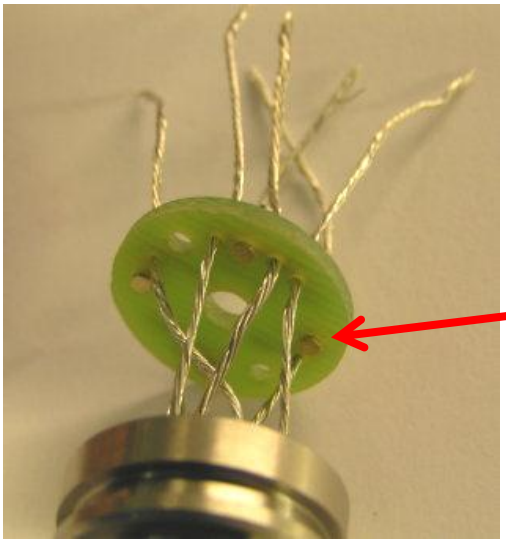
	Cut the end of the rod squarely with the junior hacksaw.
	Slide the rear cover over the end of the Rod followed by the new 6mm O-ring. Push back out of the way.
	Score through full thickness of the outer sheath at 60mm from the end of the rod, taking care not to cut into the inner foil layer. Use suitable rotary cable stripping tools. (NOTE: we have found scalpels to be unsuitable and dangerous for this task. Do not use them)

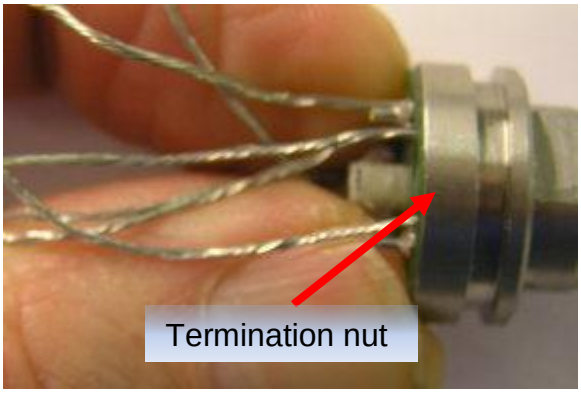
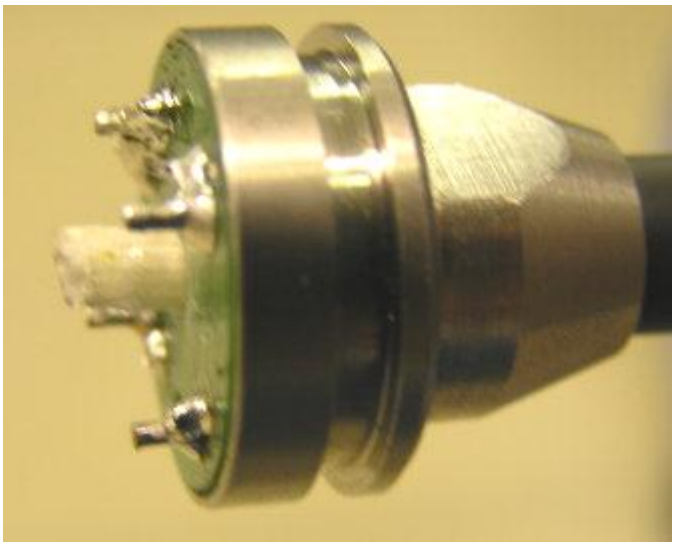
	Typical multi-purpose cable stripper
	Strip off the 60mm of the outer sheath, using a suitable Multi-purpose Cable Stripping tool to avoid damage to the inner foil and wires. Ensure that the cutting depth of the stripping tool is correctly set to cut the outer sheath through without damaging the inner foil wrapping layer. Several attempts may be necessary to set the tool to the correct depth.
	Uncoil and remove the foil layer. Cut away the 6 x plastic filler strands back to the end of the outer sheath.

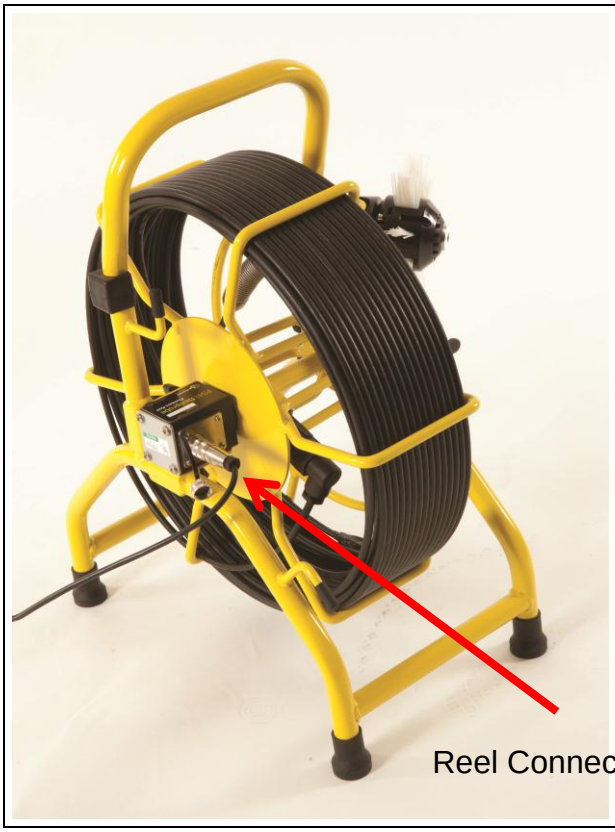
 	Cut the fibreglass core to 15mm from the outer sheath of the rod, using the junior hacksaw.
	Cut the brown, green, yellow, red, blue and drain wires back to 50mm long.

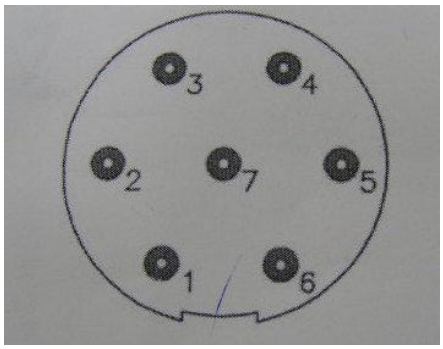
 	Strip the insulation of the green, brown, red, blue and yellow wires back to 10mm from the outer sheath of the rod, using the precision wire stripper or small wire cutters. Twist the bare strands of each wire to ease the fit into the PCB.
	Slide a 10mm length of 1.6mm heatshrink over the drain wire, push down until it touches the cable outer sheath and apply heat to shrink.

Termination Nut 	Check that the termination PCB fits snugly into the termination nut. If necessary, carefully trim the edge of the board with a fine file or craft knife. Note: using cutting tools by hand can be dangerous. Consider gloves, PPE or the file as a safer alternative.
 Outer Sheath	Screw the threaded termination nut squarely onto the end of the rod until the outer sheath is flush with the inside rear of the metalwork.
	Tin the four pins of the terminal PCB.

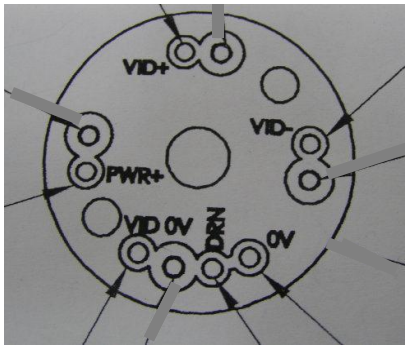
 	Feed the correct colour wires through the rear of the termination PCB, as shown
	Feed the correct colour wires through the rear of the termination PCB.

	Push the PCB down over the fibreglass core, keeping the wires taut, onto the termination nut until it is flush with the top of the metalwork.
	With the termination PCB in position check that none of the wires are shorting out either to each other, or the metalwork, by connecting a DVM between each individual wire and all the other wires in turn, as well as to the case.
	Keeping the PCB flush with the top of the metalwork, solder the wires to the PCB and crop all of the wires to 2mm from the board. Disconnect the reel connector from the hub assembly by turning the round, ridged plug connector through 90° anti-clockwise.

	Using the DVM, check for continuity from the reel connector to the termination PCB.



Reel Connector



Termination PCB

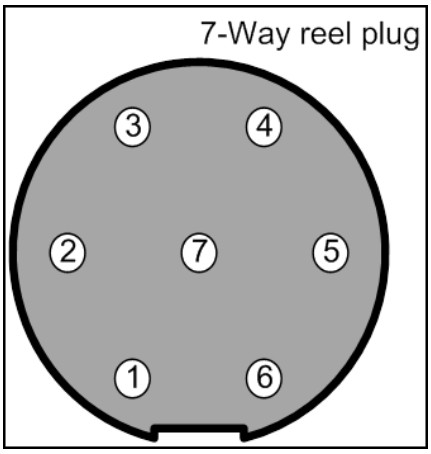
7 WAY REEL PLUG	ROD WIRE	PCB
1		
2		
3	RED	VID+ ONLY
4	BLUE / DRAIN / YELLOW	VID 0V/ DRAIN / 0V
5	GREEN	VID- ONLY
6	DRAIN / YELLOW / BLUE	DRAIN / 0V / VID0V
7	BROWN	PWR+ ONLY

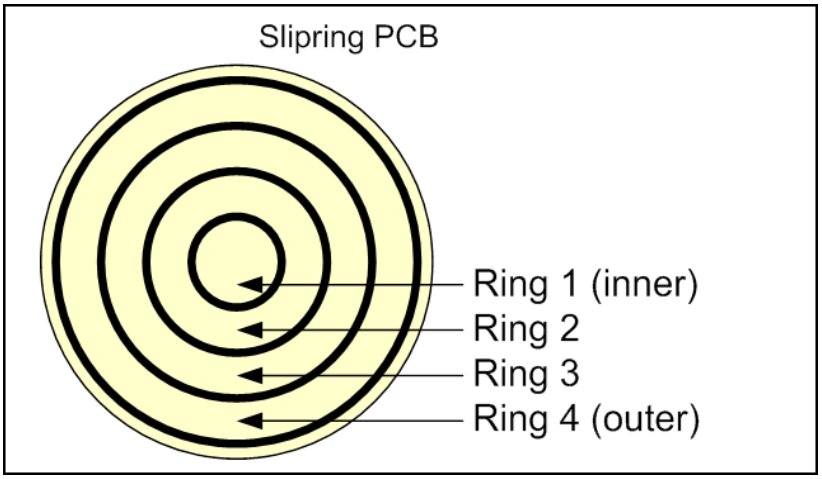
NOTE: Positions 1 and 2 at the seven way plug are wired to the reel counter reed switches, therefore pins 1 and 2 will alternate from open to closed circuit relative to pin 4 as you rotate the reel.

P341 Plumbers & GC4 Plumbers		Termination PCB			
		VID+	VID-	PWR+	GND
Reel connector	1				
	2				
	3	< 10Ω	∞	∞	∞
	4	∞	< 10Ω	> 10kΩ	< 10Ω
	5	∞	45 to 60Ω	> 10kΩ	45 to 60Ω
	6	∞	< 10Ω	> 10kΩ	< 10Ω
	7	∞	> 10kΩ	< 10Ω	>10kΩ

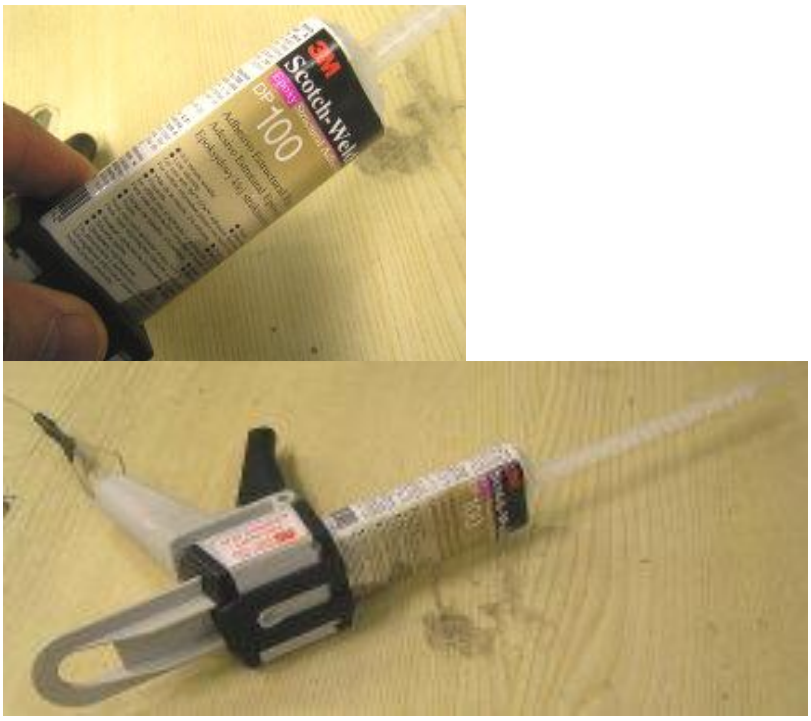
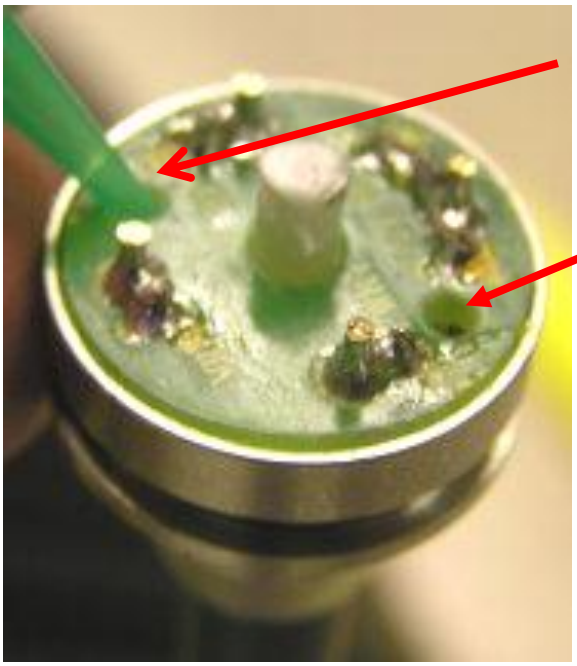
4.2. Typical Reel Resistances

7-Way reel plug	Signal	Slipring PCB	**30m/100' Reel** Resistance (Ω)	**60m/200' Reel** Resistance (Ω)
1	Not Connected			
2				
3	Vid +	Ring 1 (centre)	2.9	5.4
4	Gnd	Ring 4 (outer)	2.9	5.4
5	Vid -	Ring 2	50.1	52.3
6	Gnd	Ring 4 (outer)	1.1	1.9
7	Power +	Ring 3	2.8	5.4

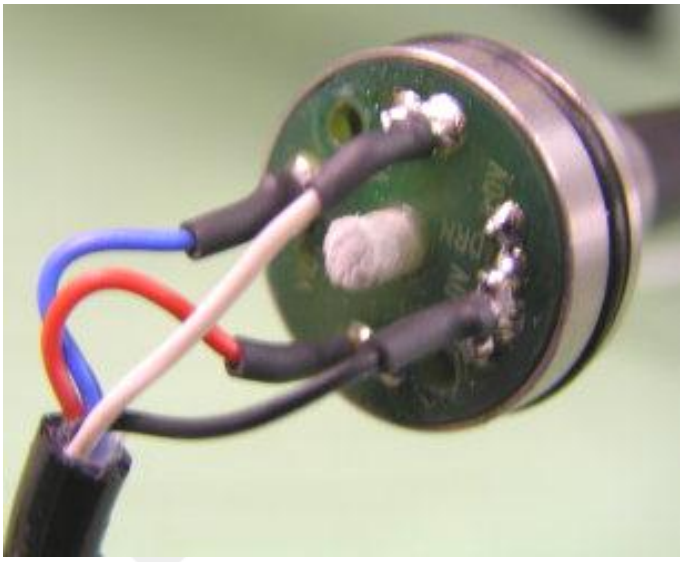




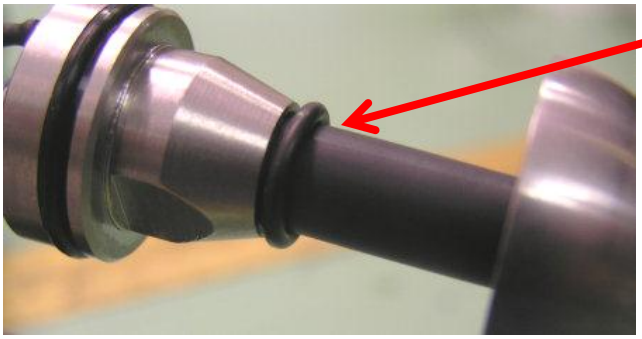
Be aware that these values may change if the reel length has been significantly changed or cut back during service operations!

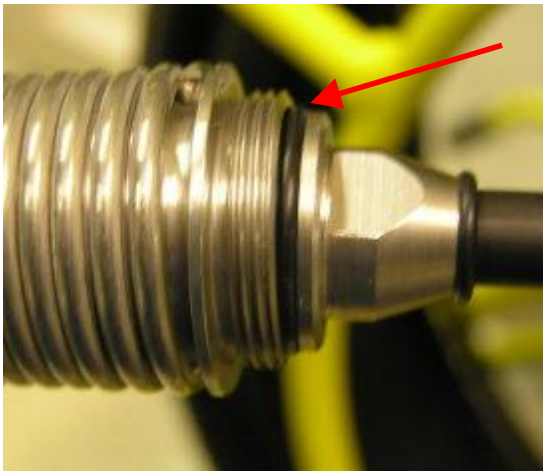
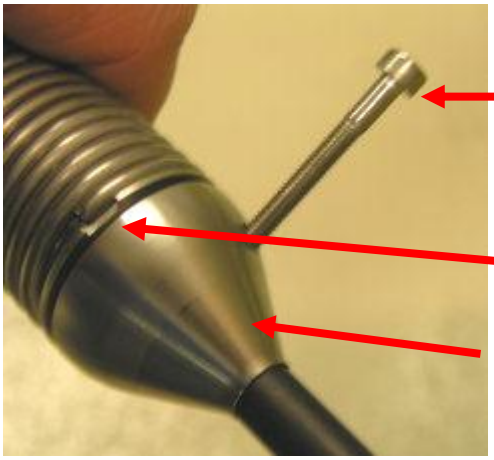
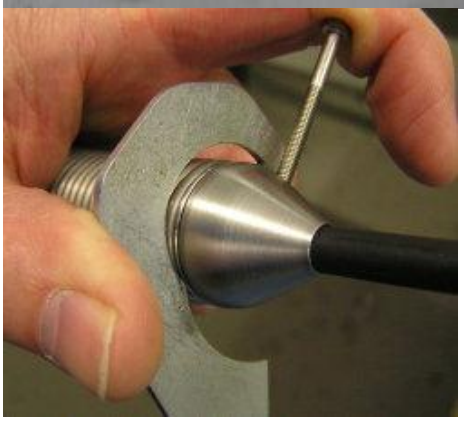
	Load a tube of two-part quick set epoxy resin into an application gun. Use a needle applicator to pot the termination PCB into the termination nut.
	Insert the resin into the runner hole in the PCB until it appears out of the riser hole. Ensure that the PCB is level and flush with the top edge of the termination nut. Keep the assembly level and allow the epoxy to settle for 3-5 minutes and top up if necessary. Leave epoxy to set for at least 15 minutes, it will cure fully in 24 hours.

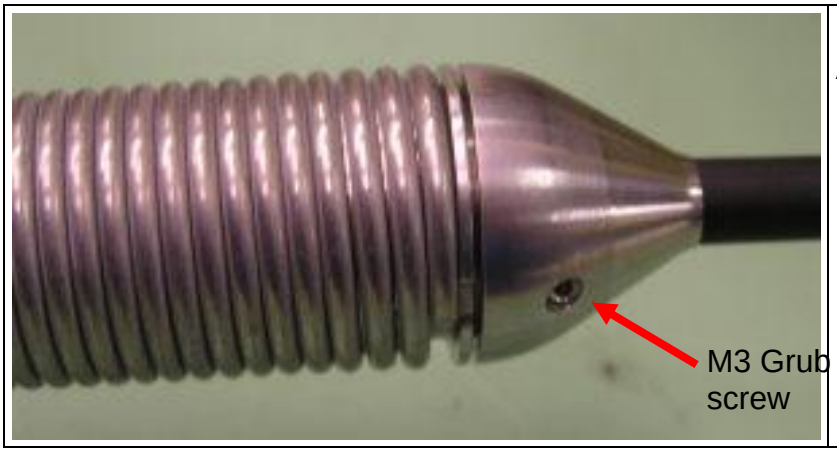
<table>
<tr>
<td>  </td>
<td>Lightly coat the new 15mm O-ring with PTFE grease and fit onto the terminal nut.

If the sonde wires have had to be cut back, strip the insulation on the four wires back to 4-5mm and twist and tin the ends.</td>
</tr>
<tr>
<td> 
</td>
<td>Slide a 5mm length of the 1.6mm heatshrink over each of the four wires from the rod end of the sonde.</td>
</tr>
<tr>
<td> 
<table>
<tr><th>SONDE WIRE</th><th>TERMINAL PCB</th><th>POS</th></tr>
<tr><td>BLACK</td><td>VID 0V</td><td>1</td></tr>
<tr><td>RED</td><td>PWR+</td><td>2</td></tr>
<tr><td>BLUE</td><td>VID+</td><td>3</td></tr>
<tr><td>WHITE</td><td>VID-</td><td>4</td></tr>
</table></td>
<td>Solder the four wires from the rod end of the sonde to the termination PCB as shown in the chart above.

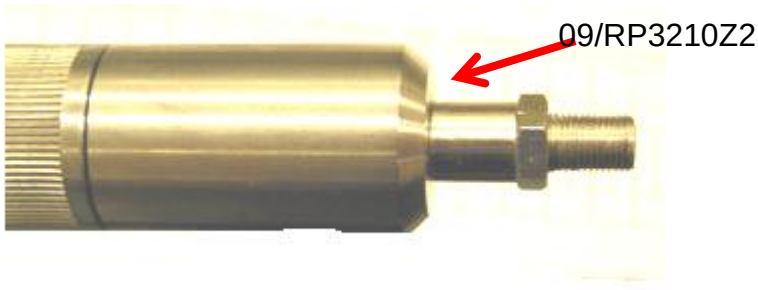
NOTE: Solder the wires on the inside of the pins to minimise the chance of shorting to the metal-work.

Slide the heatshrink over the joints and apply the heat gun to shrink.</td>
</tr>
<tr>
<td> 
</td>
<td>Slide the 6mm O-ring along the rod up to the rear of the terminal nut.</td>
</tr>
</table>

	Check that the new 15mm O-ring is in position on the terminal nut. Slide the spring body of the sonde onto the terminal nut, ensuring none of the four wires is trapped by the metal work.
	Slide the rod cover along the rod and temporarily insert a M3 x 25mm caphead screw into the side. Loosely thread the rear cover onto the spring body by using the caphead screw as leverage.
 	Using the “C” spanner to hold the spring body, fully tighten the rod cover onto the spring body by using the caphead screw as leverage.

	Remove the caphead screw. Apply Loctite 222 to the threads of the M3 x 4 grub screw and tighten it fully into the side of the rod cover.

4.3. Pressure Testing

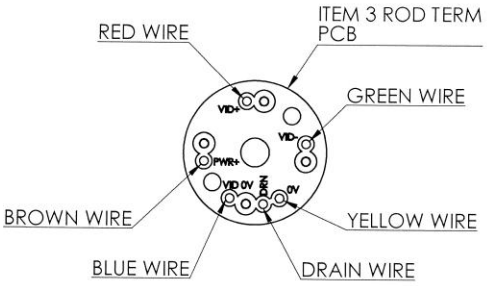
	If the required test equipment is available, carry out a pressure test. Check that the O-ring is greased and fitted correctly to the jig. Fit pressure test Jig 09/RP3210Z2 to the end of the rod.
 	Attach a foot pump to the jig and pressurise to 2 bars (30 psi). Submerge the end of the rod into water and check for air leaks. Remove the foot pump and pressure test jig.

4.4. Bill of Materials / Assembly Drawing

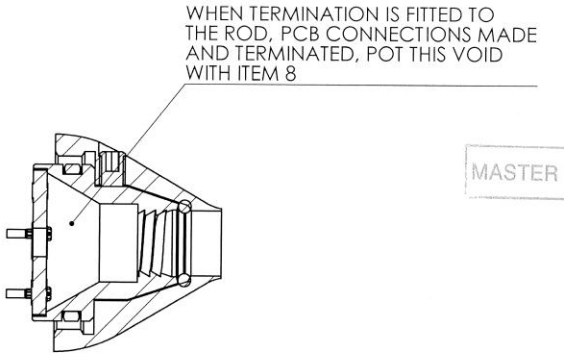
93/RP3144Z10 PLUMBERS ROD RE-TERM KIT

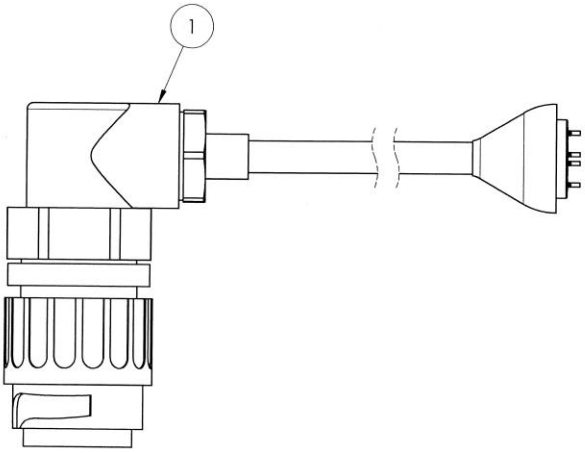
Bill of Materials

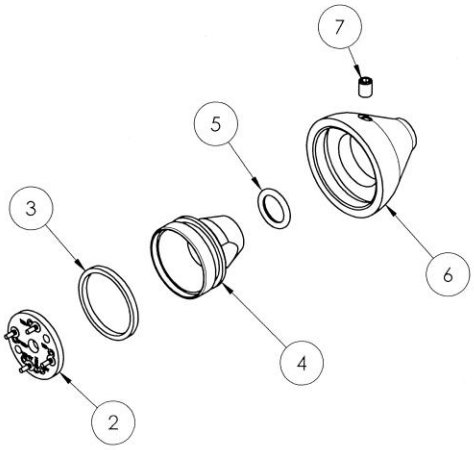
Drawing position No.	Part Description	Qty per Assembly
2	MINI SPRING TERM PCB ROD TO FLEXI	1
3	O RING 15.00 ID x 1.5 SECT NITRILE	1
4	MINI CABLE TERMINATION NUT	1
5	O-RING 6MM ID x 1.5 SECT	1
6	MINI TERM REAR COVER	1
7	SCREW-M3x4 SKT HD GRUB SS *F	1
8	SCOTCH WELD 100 (RS 458-7258)	1

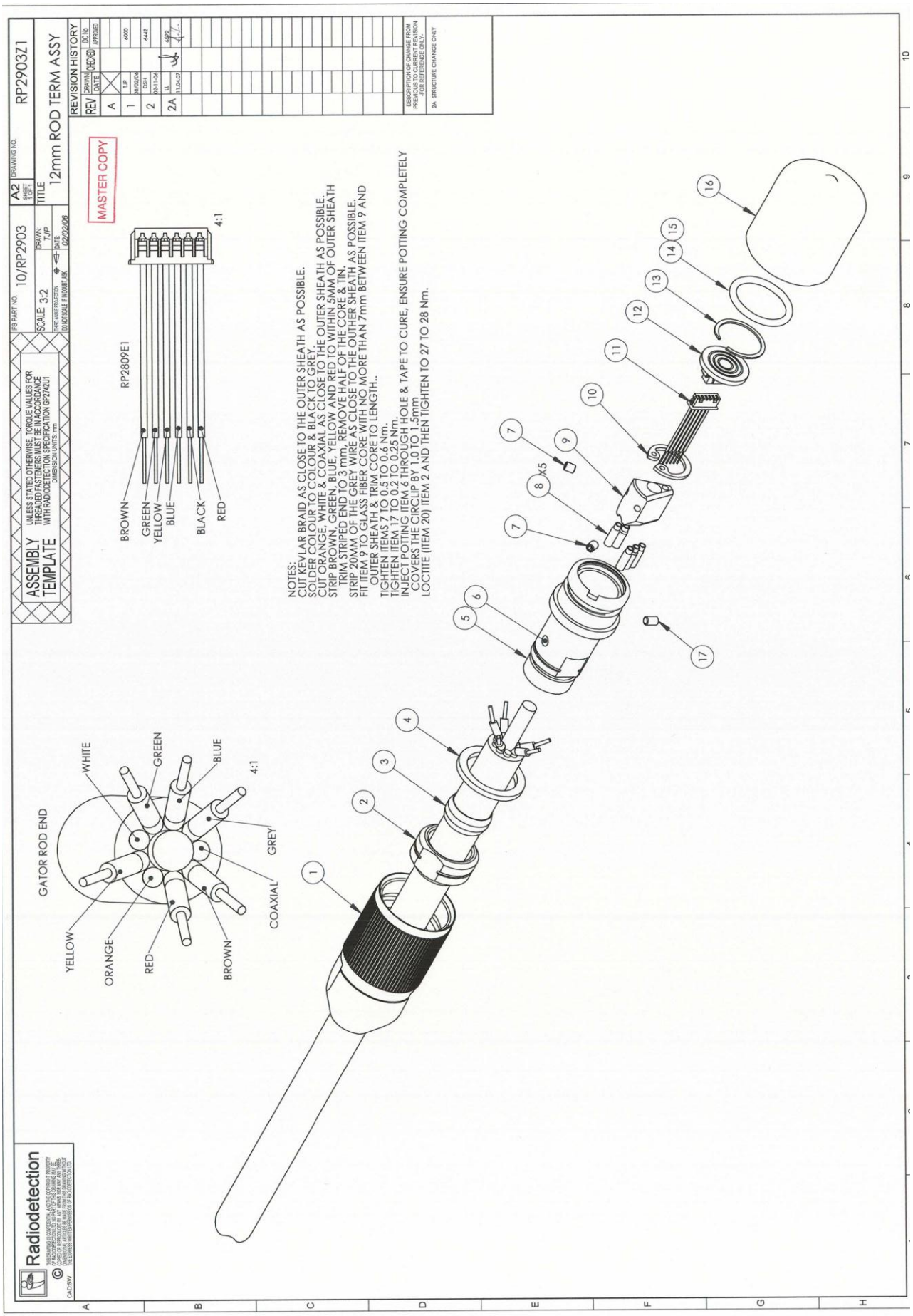


TERMINATION PCB SOLDERING INFO









5. P341 or Gatorcam 4 Mini Reel (35M/115', 12mm dia.) 10/RP3181

Materials required:-

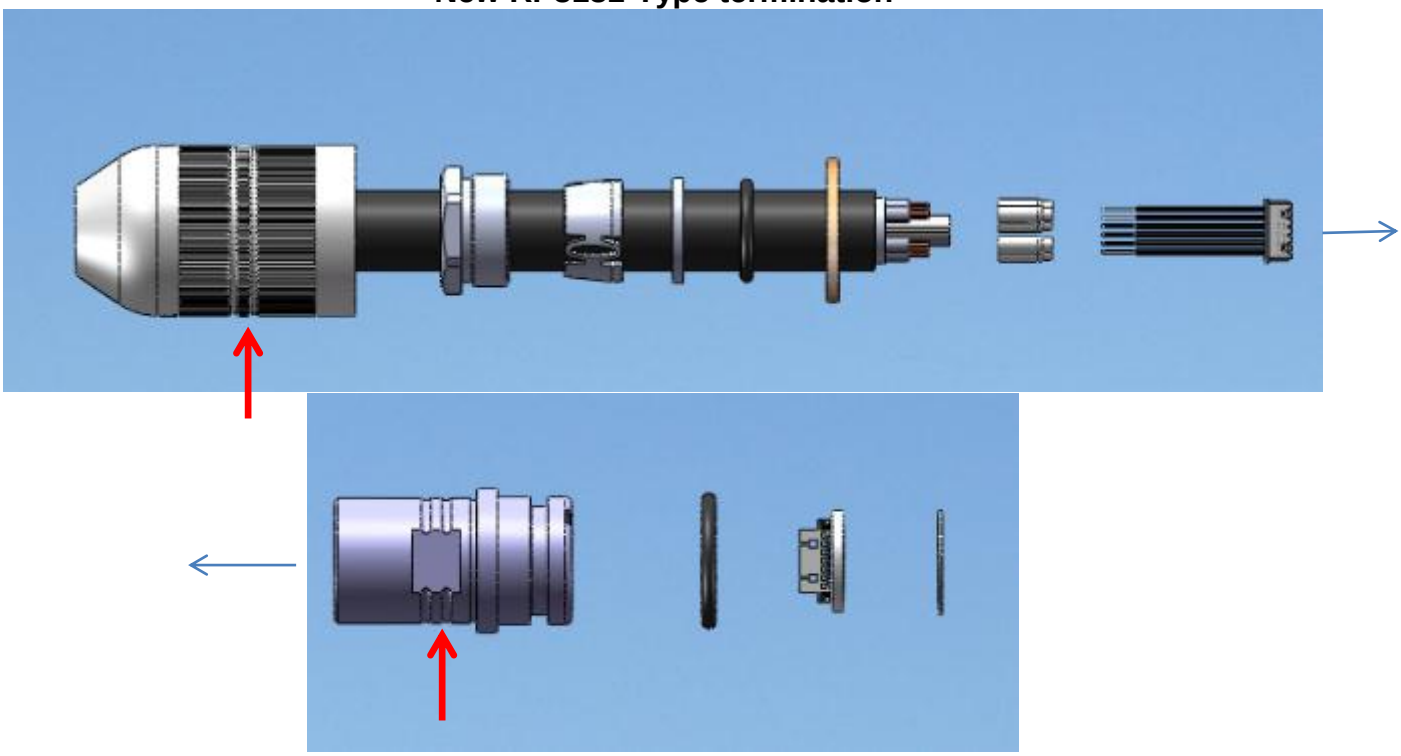
P341/Mini Termination Assy 10/RP3181

There are two revisions of termination on the P341. Both do the same job; the current version is the RP3181.

Old RP2903-Type termination

A lack of rings on items 1 and 5 identify this when compared to the next type.

New RP3181-Type termination



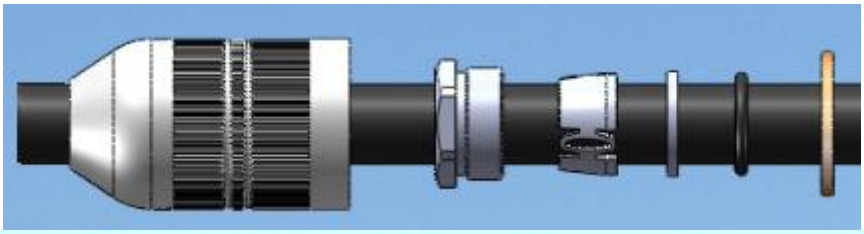
Note the two rings that identify the newer RP3181-type (marked with red arrows)

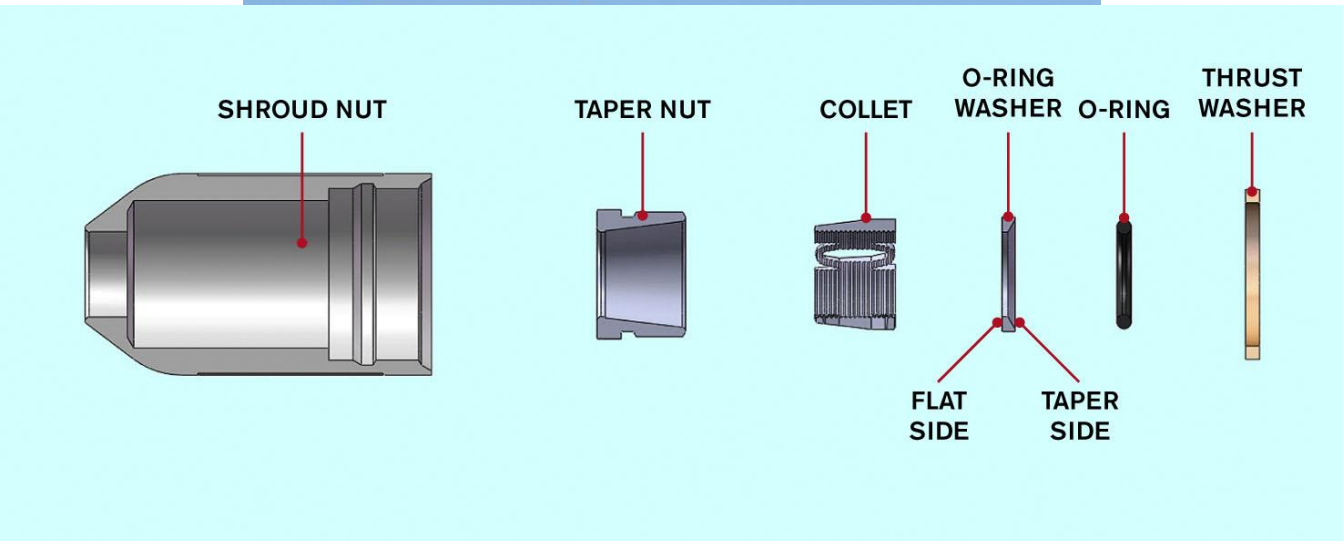
The Bill of Materials and General Assembly drawings are at the end of this section.

5.1. RP3181 Rod-End Re-termination Procedure

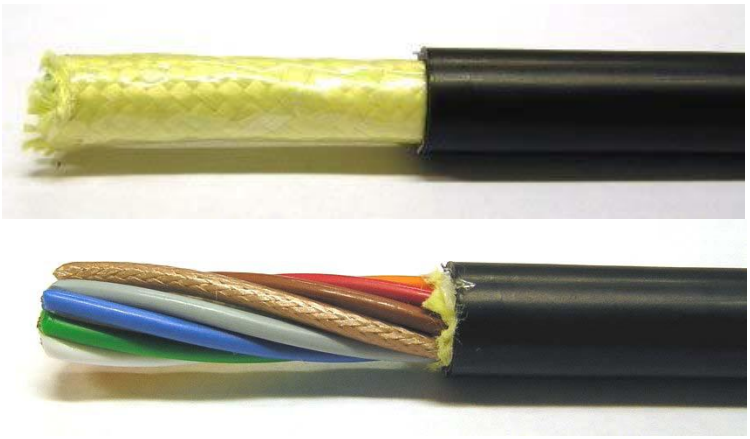
Examine the full length of the rod for damage, particularly any penetration of the outer sheath or kinking.

Cut off the old termination including any damaged rod.



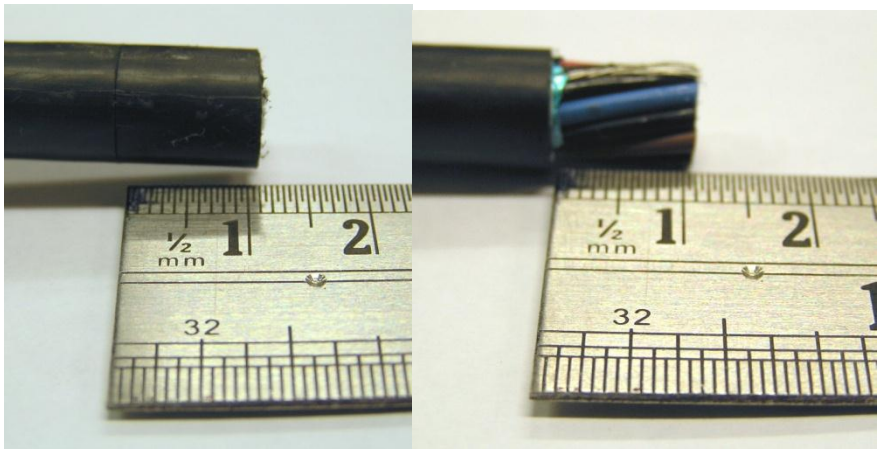
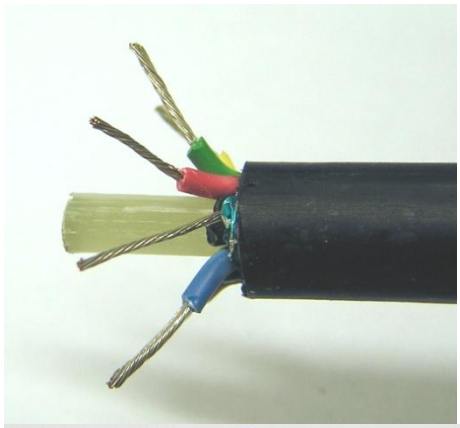
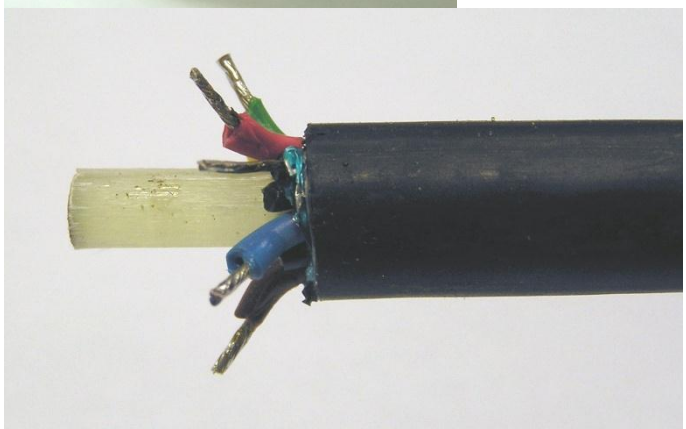


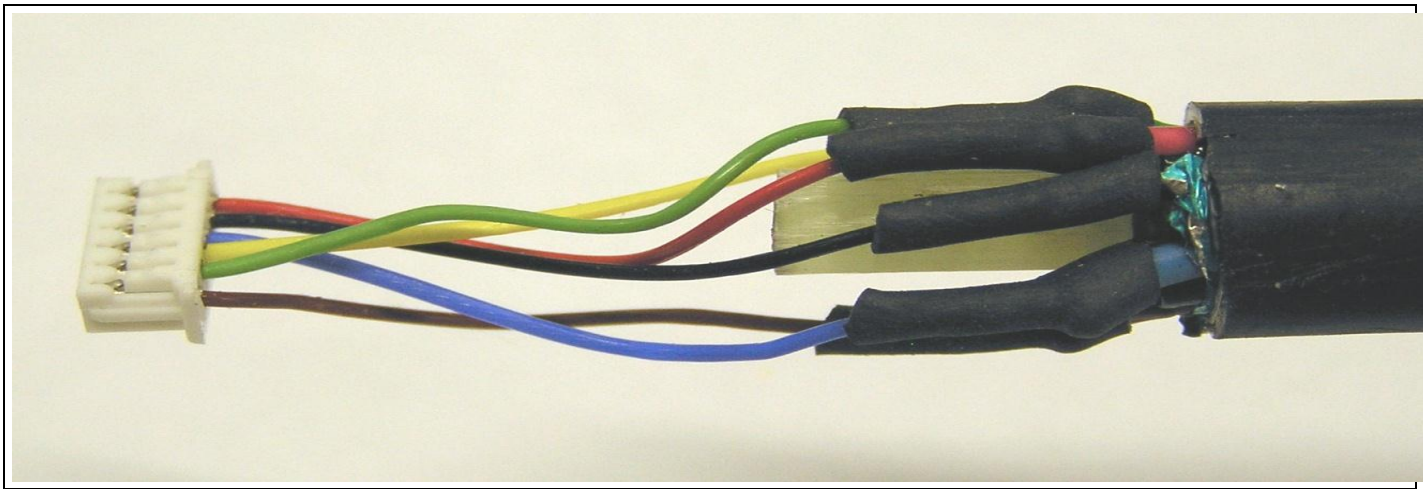
Slide the Shroud nut, Taper nut, Thrust washer, Nylon collet (narrow-end towards taper nut), O-ring washer (with flat surface towards nylon collet, taper side towards O-ring) and the 12mm O-ring onto the termination end of the rod.



Remove 11mm of the outer insulation from the rod. Remove the Kevlar braid.

Trim it as close to the black outer sheath as possible.

	Trim wires and inner core back to 11mm as shown.
 	Cut the orange, white and coaxial cables as close to the black outer sheath as possible. Trim all wires shorter than the white inner core. Tin all the wires and trim back as shown.



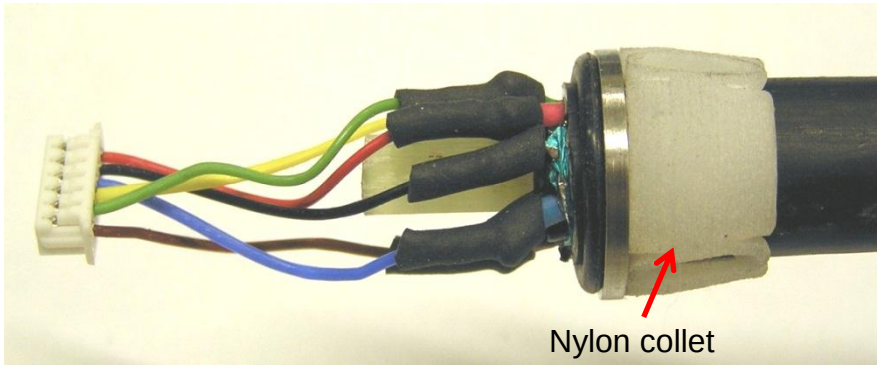
Cut six lengths of 2.4mm heatshrink, 7 - 8mm long.
Slide a length of heatshrink over each of the six wires of the Molex loom assembly.
Solder the loom onto the tinned wires of the rod, solder colour to colour, except black that goes to grey.

BROWN TO BROWN
YELLOW TO YELLOW
GREEN TO GREEN
BLUE TO BLUE
RED TO RED
BLACK TO GREY

Slide the lengths of heatshrink over each solder joint, ensuring none of the heatshrink extends beyond the end of the fibreglass core and that no soldered wire is exposed.

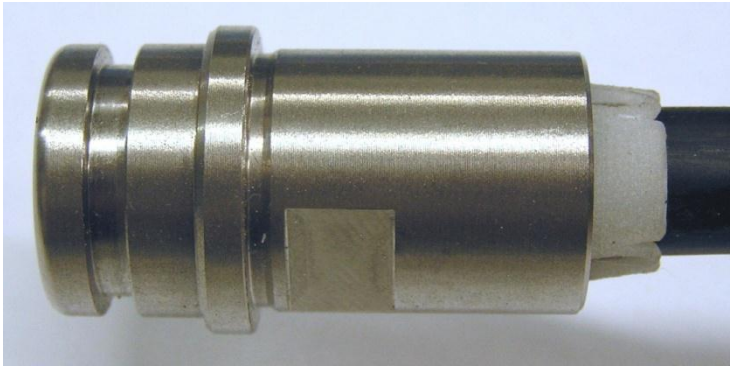
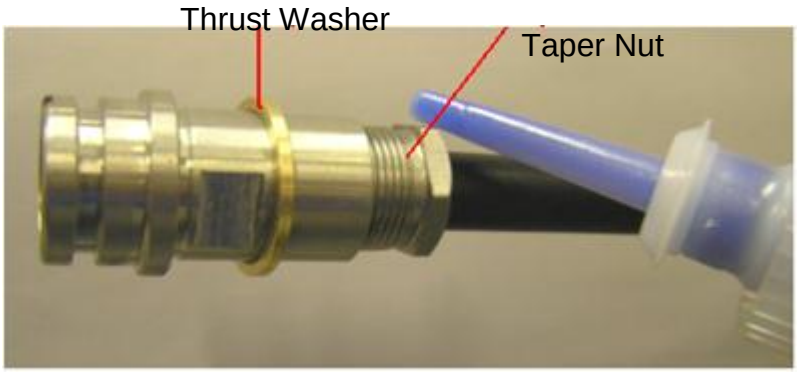
Apply heat to the heatshrink with a heat-gun until it is fully shrunken. Leave to cool.

NOTE: Ensure that the top of the heatshrink is below the tip of the fibreglass rod.

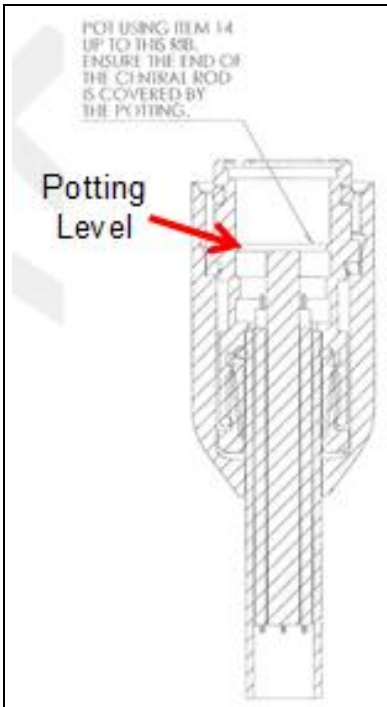
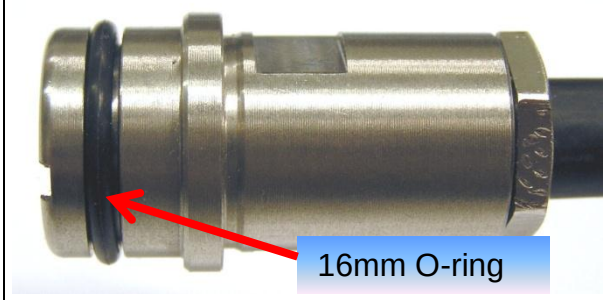
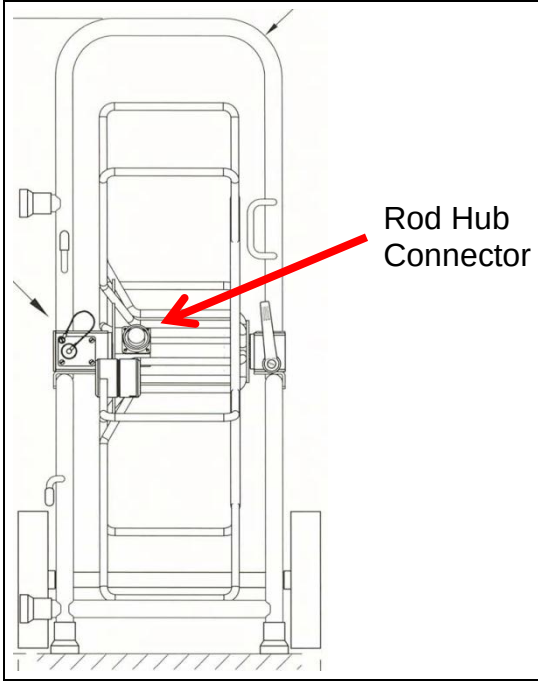


Push the O-ring, O-ring washer, and nylon collet up to the end of the outer insulation of the rod.

Apply a thin smear of PTFE grease around the O-ring.

	Gently bend the six-way Molex connector through 90° to allow clear access and feed it through the rod connector, pushing the connector onto the O-ring at the end of the rod outer insulation.
	Slide the thrust washer over the outside diameter of the rod connector. Use a small amount of PTFE grease to temporarily hold the thrust washer in place. Apply Loctite 243 to the thread of the taper nut. Slowly screw the taper nut into the rear of the rod connector whilst making sure the rod remains pushed up inside of the connector.

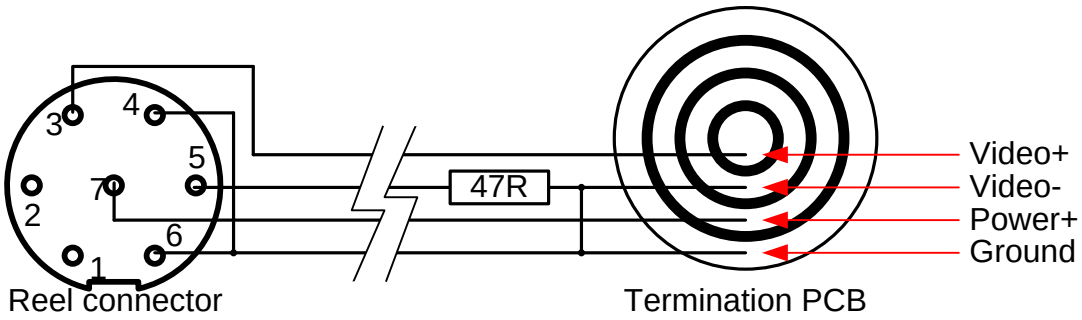
Use a 17mm A/F open-ended spanner to hold the taper nut. Using a 16mm A/F open-ended torque spanner, tighten down the connector body to 24-25 Nm torque or until it is fully on the taper nut. Ensure the rod is fully seated in the connector body at all times during this operation and that the thrust washer remains on the body of the connector.

	Check that the tip of the fibreglass core and the heatshrink are below the potting-level machined ring.
	Apply PTFE grease to the 16mm O-ring and fit it to the end of the rod connector. Temporarily fit the slip ring PCB onto the Molex connector.
	Remove the 8-way cable plug on the inside end of the rod from the hub socket.

With the DVM set to the highest resistance range, check for isolation between each ring on the slip-ring PCB and from each ring to the connector body.
Slip rings 2 & 4 may show zero ohms as they are both earth rings.

With the slip ring PCB fully fitted with the circlip there may be continuity between ring 4 and the connector shell.

With the DVM set to a suitable low resistance range, check for continuity from end to end of the rod.



Reel Connector

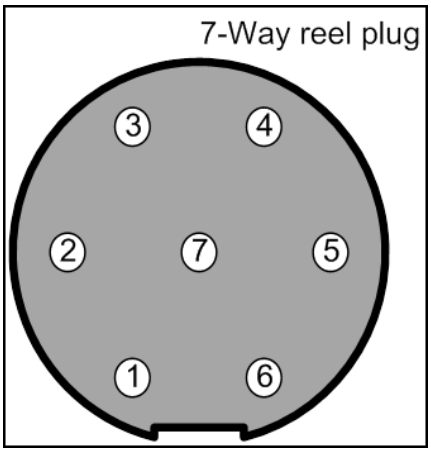
Termination PCB

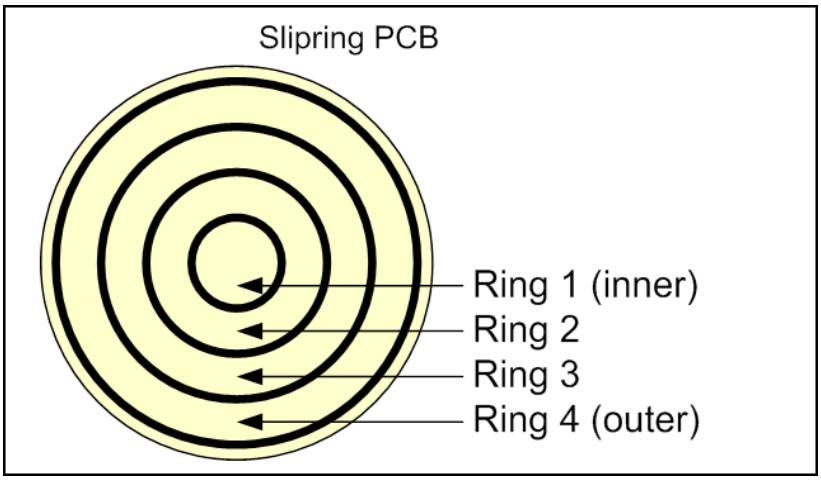
7-Way reel plug	Termination PCB
1	
2	
3	VIDEO +
4	GROUND
5	47Ω resistor to GROUND and VIDEO -
6	GROUND
7	POWER +

NOTE: Positions 1 and 2 at the seven way plug are wired to the reel counter reed switches, therefore pins 1 and 2 will alternate from open to closed circuit relative to pin 4 as you rotate the reel.

5.2. Typical Reel Resistances

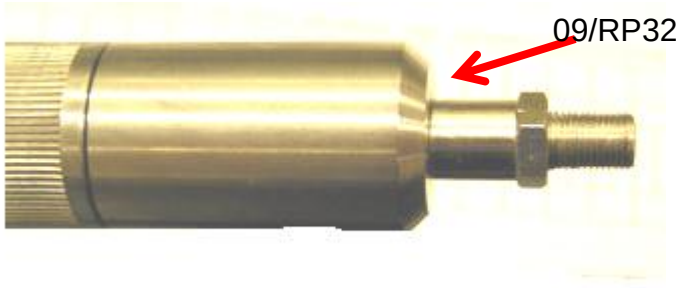
35m/115' reel			
7-Way reel plug	Signal	Slipring PCB	Resistance /Ohms
1	NC		
2			
3	Vid +	Ring 1 (centre)	1.0
4	Gnd	Ring 4 (outer)	0.9
5	Vid -	Ring 2	48.1
6	Gnd	Ring 4 (outer)	0.5
7	Power +	Ring 3	0.9





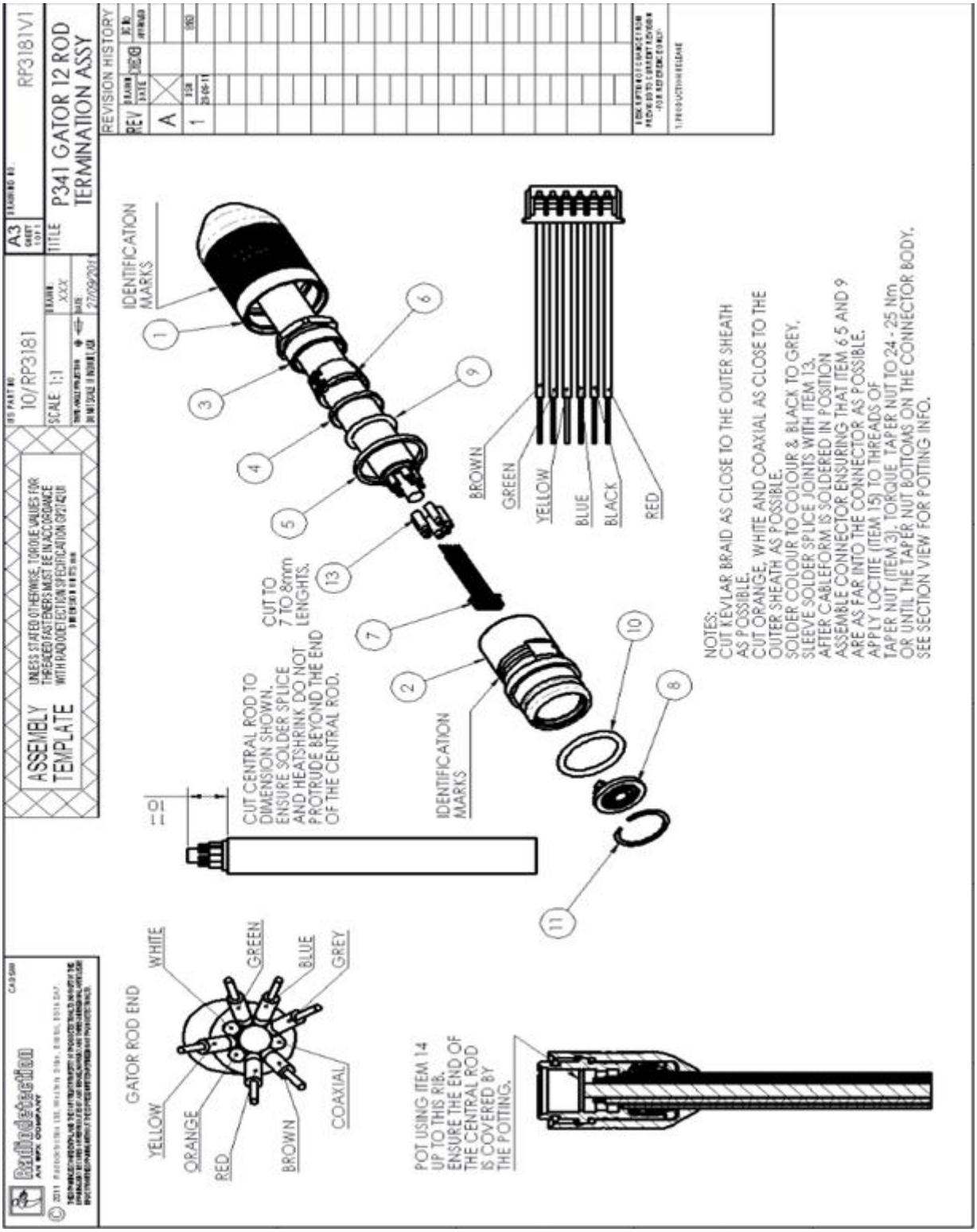
Be aware that these values may change if the reel length has been significantly changed or cut back during service operations!

5.3. Pressure Testing

	If the required test equipment is available, carry out a pressure test. Check that the O-ring is greased and fitted correctly to the jig. Fit pressure test Jig 09/RP3210Z2 to the end of the rod.
 	Attach a foot pump to the jig and pressurise to 2 bars (30 psi). Submerge the end of the rod into water and check for air leaks. Remove the foot pump and pressure test jig.

5.4. Bill Of Materials / Assembly Drawing

The Bill of Materials and exploded General Assembly for the re-termination kits below will help to clarify the procedure.



Drawing Position No	Part Description	Quantity Per Assembly
1	GATOR 12 Rod SHROUD NUT	1
2	GATOR 12 CONNECTOR BODY	1
3	GATOR 12 FEMALE TAPER NUT	1
4	GATOR 12 O RING WASHER	1
5	GATOR 12 ROD THRUST WASHER	1
6	GATOR 12 ROD COLLET SLS	1
7	ROD TERMINATION 6W MOLEX ASSY	1
8	P330 ROD TERM SLIPRING PCB	1
9	O-RING 10.82 ID x 1.78 SEC NITRILE	1
10	O-RING 16mmI/Dx2.0SECT NITRILE	1
11	CIRCLIP-WIRE RING 0.625"	1
12	PROTECTIVE CAP I D24.98 X 25.4L	1
13	2.4/1.2 BLACK HEATSHRINK - RS	0
14	SCOTCH WELD 100 (RS 458-7258)	0
15	THREAD LOCK - LOCTITE 243	0

6. P342 or Gatorcam 4 Midi Reel (60M/200' or 120M/400') 10/RP2809

Rod Camera-End Retermination

Materials required, one of:-

Rod Re-termination Kit (Full)	10/RP2809	(replaces all parts)
Rod Re-termination Kit (Partial)	10/RP2809-2	(re-uses original slipring PCB)
Rod Re-termination Kit (Basic)	10/RP2809-3	(re-uses slipring PCB, rod connector, collet and Shroud nut)
Slipring Re-termination Kit	10/RP2809-4	(slipring assembly only, includes circlip)

See Bill-of-materials and drawings later in this chapter to confirm what you need.

These instructions detail the re-termination procedures for both the P342 and GatorCam4 Midi 60m/200' and 120m/400' reels. Ensure that you read and understand these instructions in full before proceeding.

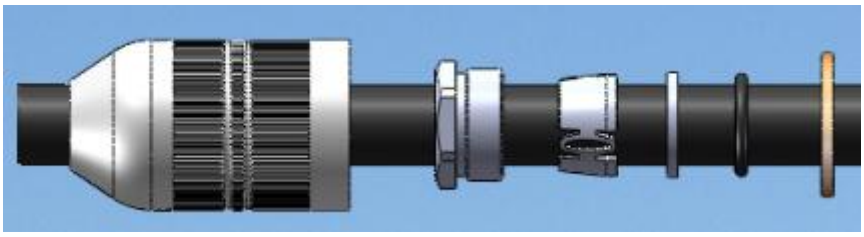
There are two versions of the P332 rod termination, version 8A and version 9.
The P342 rods use only the version 9 termination.

They can be identified by checking the clamp nut (8A)/taper nut (9).
The clamp nut of version 8A has two flats and the taper nut of version 9 has a hexagonal head.

Discontinued version

1) Shroud nut, 2) clamp nut, 3) thrust washer, 4) connector clamp ring (olive), and 5) rod connector.

Current version

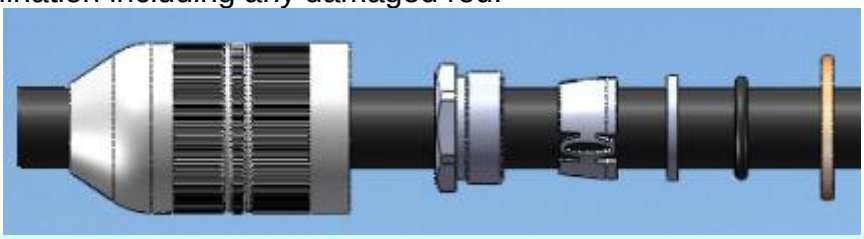


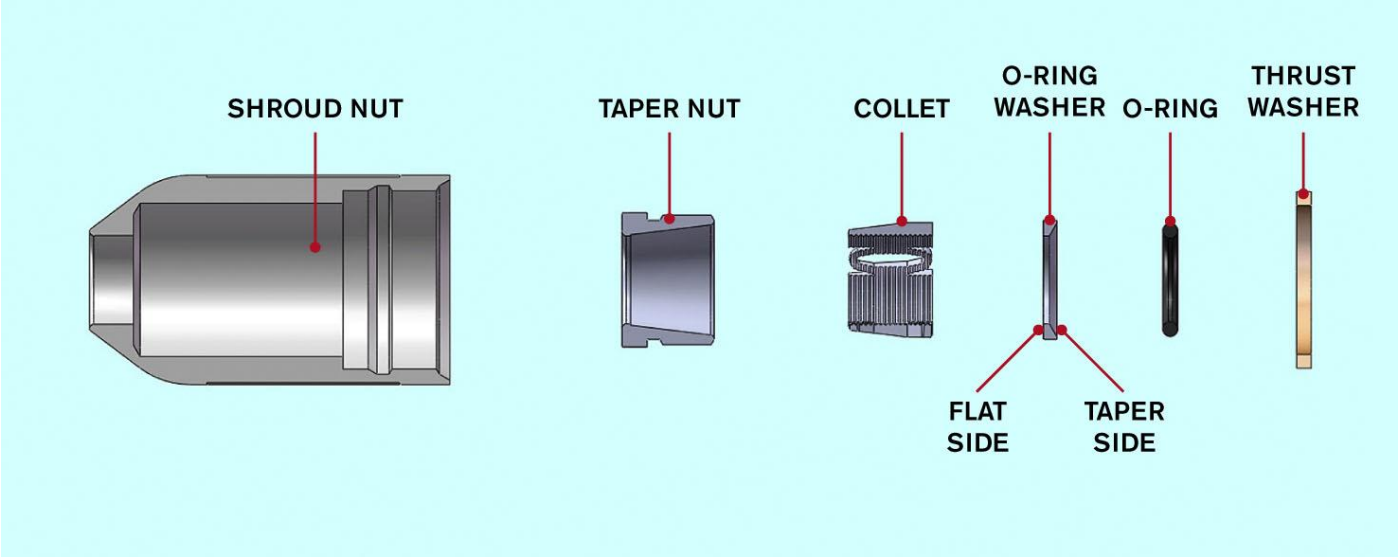
The Bill of Materials and General Assembly drawings are at the end of this section.

6.1. 10/RP2809 Rod-end Retermination Procedure

Examine the full length of the rod for damage, particularly any penetration of the outer sheath or kinking.

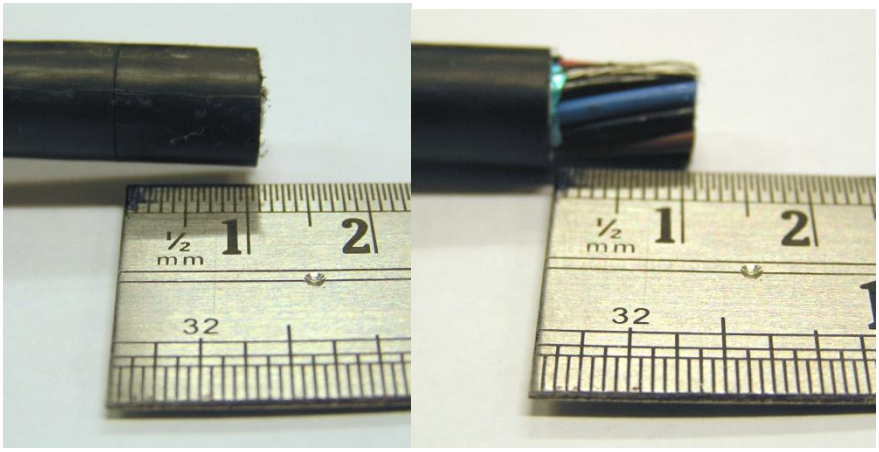
Cut off the old termination including any damaged rod.

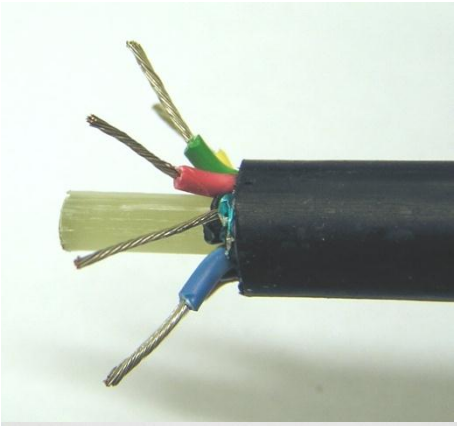


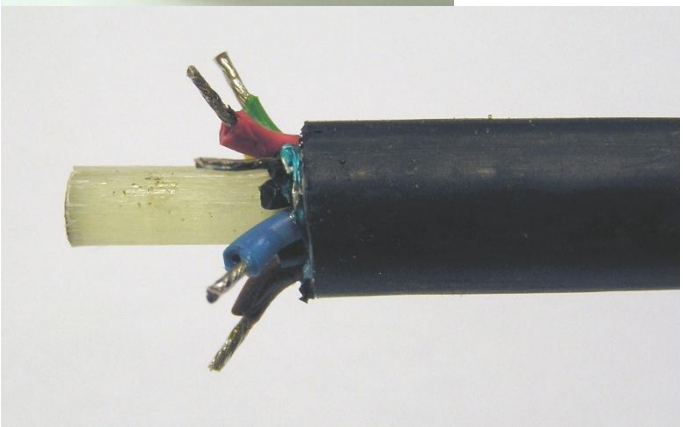


Slide the shroud nut, taper nut, thrust washer, nylon collet (narrow-end towards taper nut), O-ring washer (with flat surface towards nylon collet, taper side towards O-ring) and the 12mm O-ring onto the termination end of the rod. Before assembly, check that the webs of the collet are not damaged.

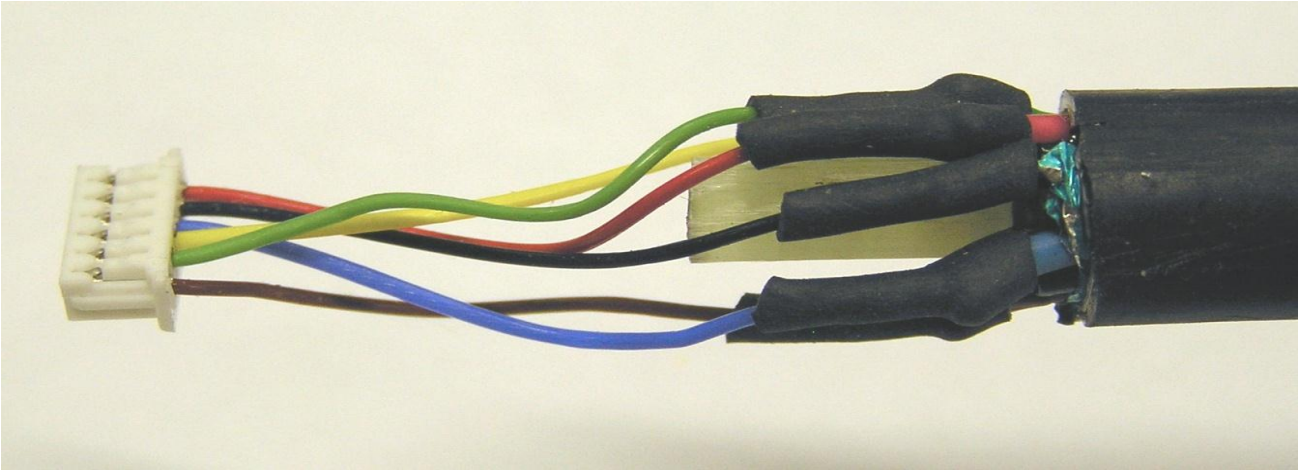
Discard damaged collets.

	Remove 11mm of the outer insulation from the rod. Remove the foil layer. **NOTE:** Be careful not to damage the screen wire.





Cut away all of the white filler cores and strip the wires to leave 5mm of insulation. Twist the ends of the wires to avoid any loose strands. Tin all the wires and trim them back to 5mm.



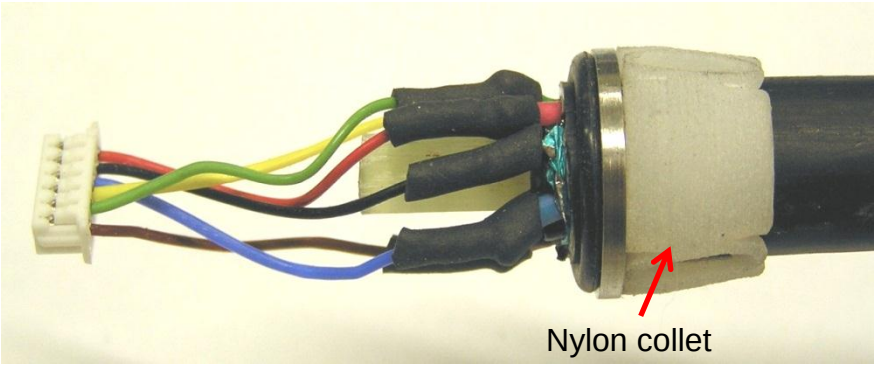
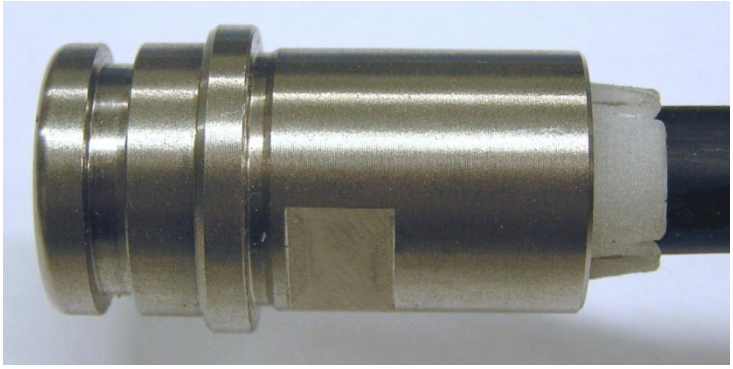
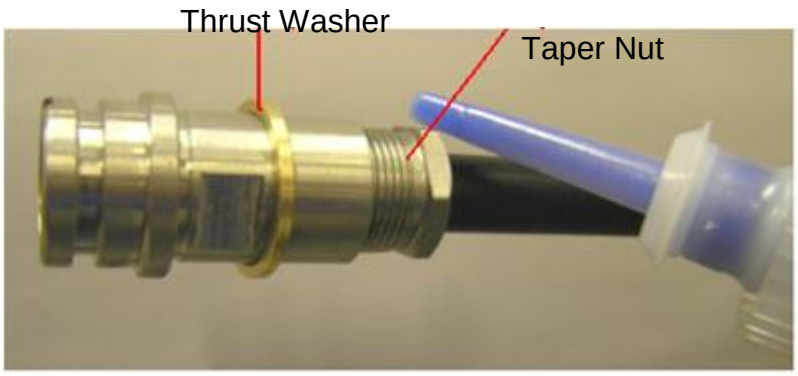
Cut six lengths of 2.4mm heatshrink, 7 - 8mm long.
Strip the six wires of the Molex loom assembly to 5mm and tin.
Slide a length of heatshrink over each of the six wires of the Molex loom assembly.
Solder the loom onto the tinned wires of the rod, colour to colour:-

BROWN TO BROWN
YELLOW TO YELLOW
GREEN TO GREEN
BLUE TO BLUE
RED TO RED
BLACK TO SCREEN

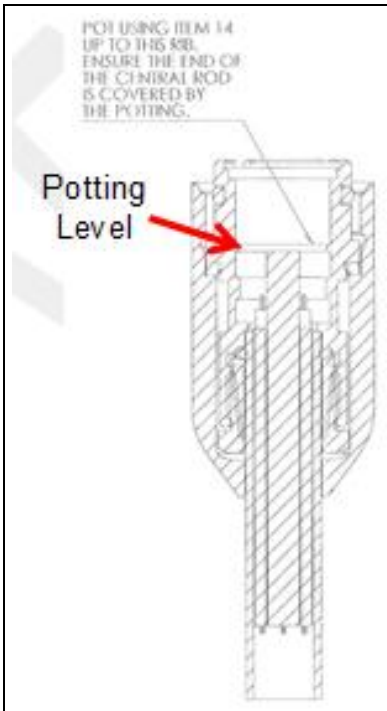
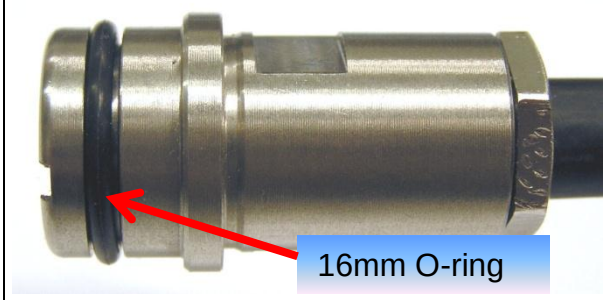
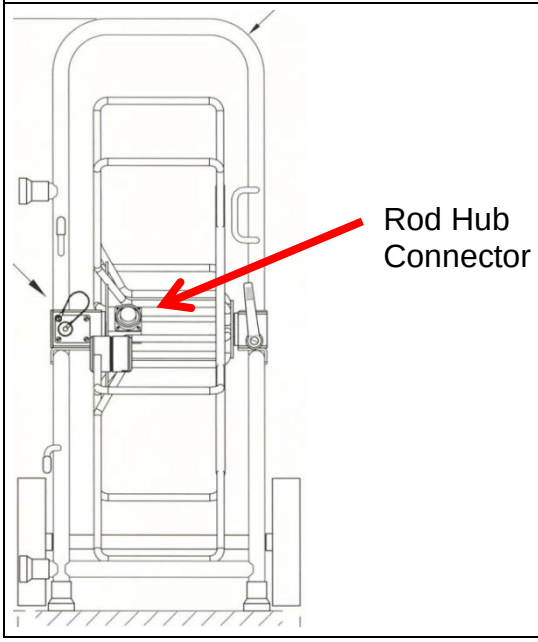
Slide the lengths of heatshrink over each solder joint, ensuring none of the heatshrink extends

beyond the end of the fibreglass core and that no soldered wire is exposed. Apply heat to the heatshrink with a heat-gun until it is fully shrunken. Leave to cool.

NOTE: Ensure that the top of the heatshrink is below the tip of the fibreglass rod.

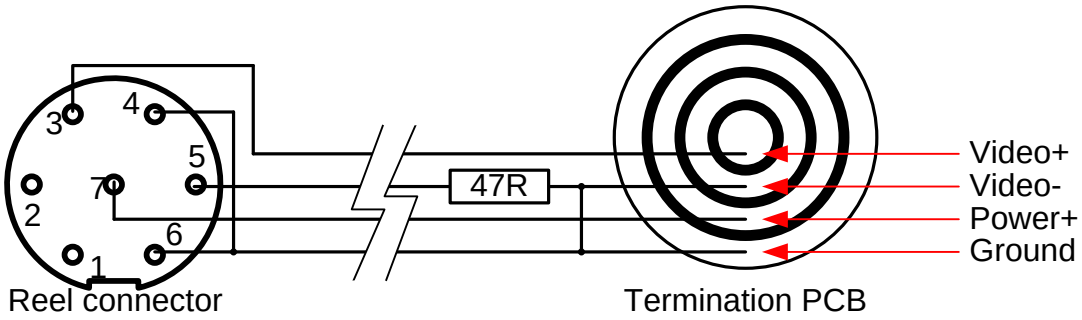
	Push the O-ring, O-ring washer, and nylon collet up to the end of the outer insulation of the rod. Apply a thin smear of PTFE grease around the O-ring and outside of the nylon collet.
	Gently bend the six-way Molex connector through 90° to allow clear access and feed it through the rod connector, pushing the connector onto the O-ring at the end of the rod outer insulation.
	Slide the thrust washer over the outside diameter of the rod connector. Use a small amount of PTFE grease to temporarily hold the thrust washer in place. Apply Loctite 243 to the thread of the taper nut. Slowly screw the taper nut into the rear of the rod connector whilst making sure the rod remains pushed up inside of the connector.

Use a 16mm A/F open-ended spanner to hold the taper nut. Using a 15mm A/F open-ended torque spanner, tighten down the connector body to 24-25 Nm torque or until it is fully on to the taper nut. Ensure the rod is fully seated in the connector body at all times during this operation and that the thrust washer remains on the body of the connector.

	Check that the tip of the fibreglass core and the heatshrink are below the potting-level machined ring.
	Apply PTFE grease to the 16mm O-ring and fit it to the end of the rod connector. Temporarily fit the slip ring PCB onto the Molex connector.
	Remove the 8-way cable plug on the inside end of the rod from the hub socket.

With the DVM set to the highest resistance range, check for isolation between each ring on the slip-ring PCB and from each ring to the connector body. Slip rings 2 & 4 may show zero ohms as they are both earth rings. With the slip ring PCB fully fitted with the circlip there may be continuity between ring 4 and the connector shell.

With the DVM set to a suitable low resistance range, check for continuity from end to end of the rod.



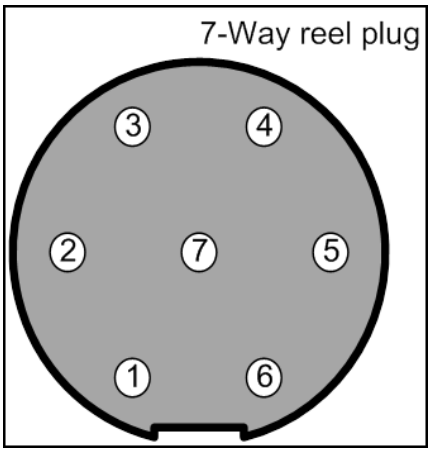
Reel Connector Termination PCB

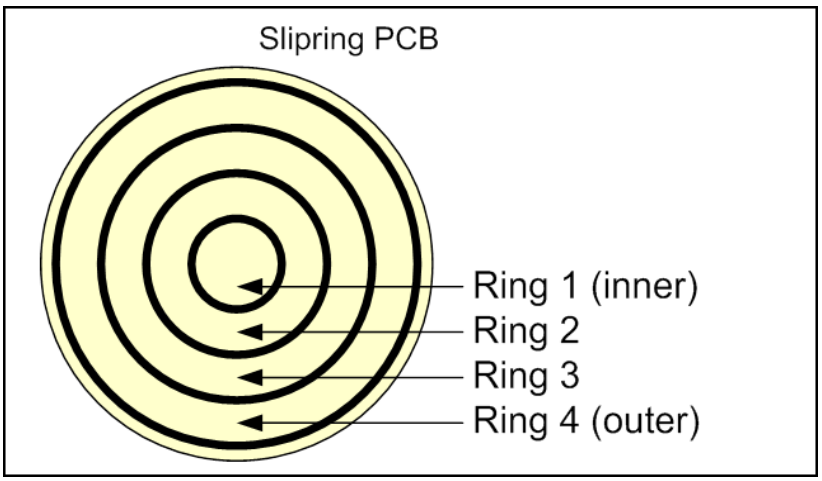
7-Way reel plug	Rod wire	Termination PCB
1		
2		
3	RED	VIDEO +
4	BLUE/DRAIN/YELLOW	GROUND
5	GREEN	47Ω resistor to GROUND and VIDEO -
6	DRAIN/YELLOW/BLUE	GROUND
7	BROWN	POWER +

NOTE: Positions 1 and 2 at the seven way plug are wired to the reel counter reed switches, therefore pins 1 and 2 will alternate from open to closed circuit relative to pin 4 as you rotate the reel.

6.2. Typical Reel Resistances

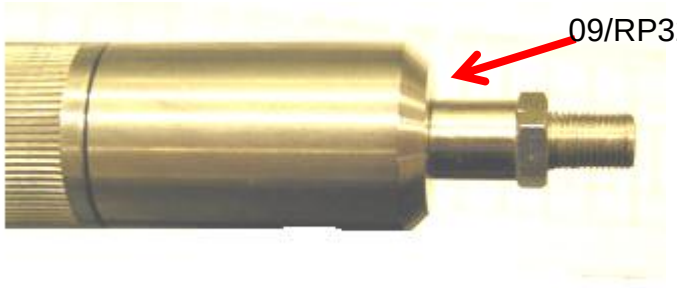
60m and 120m reels				
7-Way reel plug	Signal	Slipring PCB	**Resistance 60m/200' reel (Ω)**	**Resistance 120m/400' reel (Ω)**
1	NC			
2				
3	Vid +	Ring 1 (centre)	3.6	6.3
4	Gnd	Ring 4 (outer)	3.4	6.2
5	Vid -	Ring 2	51.4	53.3
6	Gnd	Ring 4 (outer)	1.0	3.4
7	Power +	Ring 3	3.4	6.2





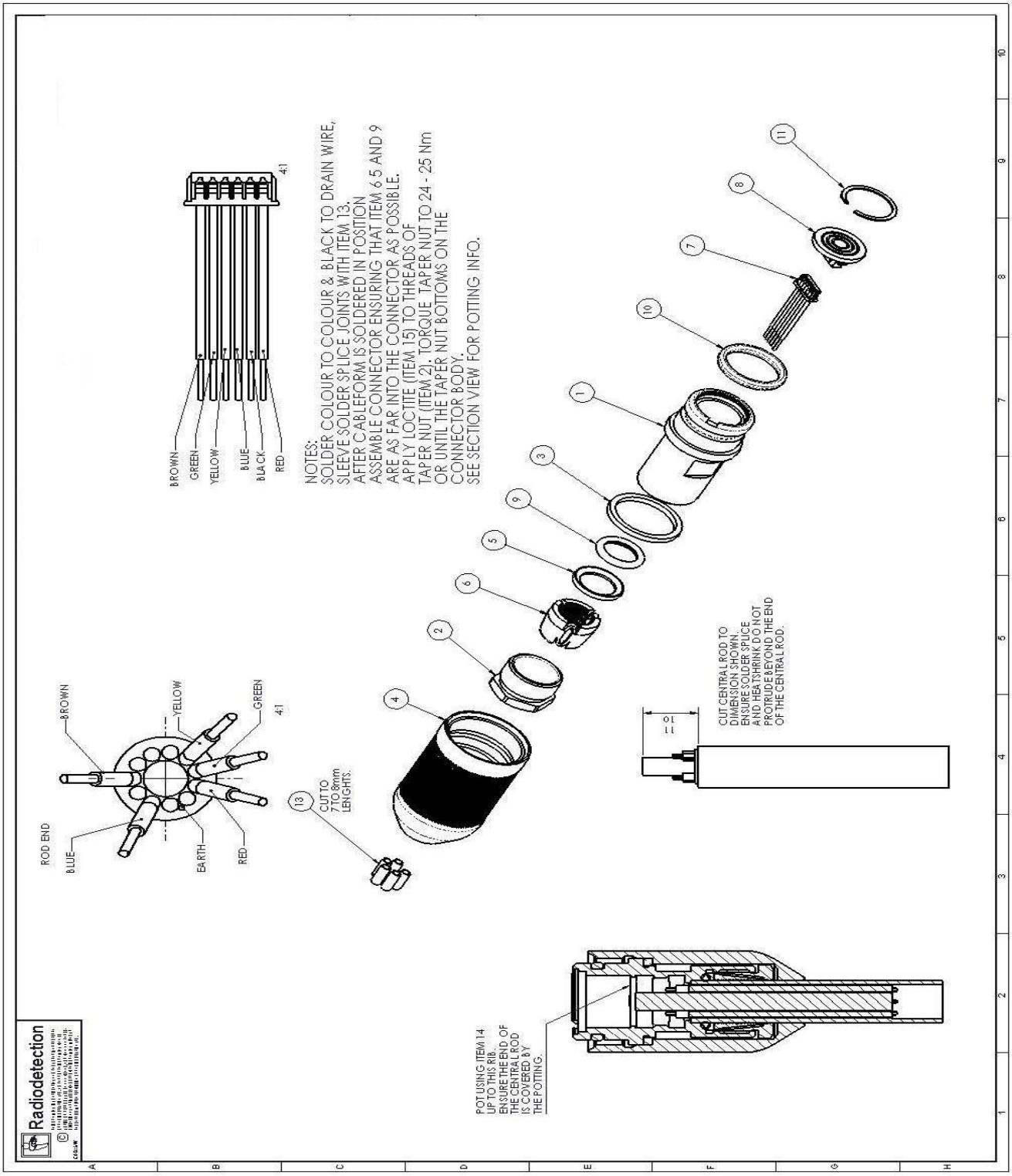
Be aware that these values may change if the reel length has been significantly changed or cut back during service operations!

6.3. Pressure Testing

	If the required test equipment is available, carry out a pressure test. Check that the O-ring is greased and fitted correctly to the jig. Fit pressure test Jig Part 09/RP3210Z2 to the end of the rod.
 	Attach a foot pump to the jig and pressurise to 2 bars (30 psi). Submerge the end of the rod into water and check for air leaks. Remove the foot pump and pressure test jig.

6.4. Bill Of Materials / Assembly Drawing

The Bill of Materials and exploded General Assembly for the re-termination kits below will help to clarify the procedure.



Full Retermination Kit P/N 10/RP2809

Item 1	ELS rod connector collet type
Item 2	Female taper nut
Item 3	ELS rod thrust washer
Item 4	ELS shroud nut collet type
Item 5	O-ring washer
Item 6	ELS rod collet SLS
Item 7	Rod termination 6w Molex assembly
Item 8	P330 rod term slip-ring PCB
Item 9	O-ring BS012
Item 10	O-ring 16mm diameter x 2.0 sect nitrile
Item 11	Circlip - wire ring 0.625 inch
Item 12	Protective Cap ID24.98 X 25.4L
Item 13	2.4/1.2 Black Heatshrink – RS

Partial Retermination Kit P/N 10/RP2809-2

Item 1	ELS rod connector collet type
Item 2	Female taper nut
Item 3	ELS rod thrust washer
Item 4	ELS shroud nut collet type
Item 5	O-ring washer
Item 6	ELS rod collet SLS
Item 7	Rod termination 6w Molex assembly
Item 9	O-ring BS012
Item 10	O-ring 16mm diameter x 2.0 sect nitrile
Item 11	Circlip - wire ring 0.625 inch
Item 12	Protective Cap ID24.98 X 25.4L
Item 13	2.4/1.2 Black Heatshrink – RS

Basic Retermination Kit P/N 10/RP2809-3

Item 2	Female taper nut
Item 3	ELS rod thrust washer
Item 5	O-ring washer
Item 6	ELS rod collet SLS
Item 7	Rod termination 6w Molex assembly
Item 9	O-ring BS012
Item 10	O-ring 16mm diameter x 2.0 sect nitrile
Item 11	Circlip - wire ring 0.625 inch
Item 12	Protective Cap ID24.98 X 25.4L
Item 13	2.4/1.2 Black Heatshrink – RS

Slip-ring Replacement Kit P/N 10/RP2809-4

Item 8	P330 rod term slip-ring PCB
Item 10	O-ring 16mm diameter x 2.0 sect nitrile
Item 11	Circlip - wire ring 0.625 inch

Common Material (to be sourced locally):-

Item 14	Quick-set epoxy resin (Scotch Weld DP100)
Item 15	Loctite 243

7. P343 or Gatorcam 4 Specialist Reel (150M/500') 93/RP2861

Rod Camera-End Retermination

Materials required:-

Rod Re-termination Kit (Full)	P/N 93/RP2861
Rod Re-termination Kit (Partial)	P/N 93/RP2861-1
Rod Re-termination Kit (Service Centre)	P/N 93/RP2861-2

Third party part numbers are quoted for reference only; similar tools from any other reputable manufacturer are acceptable. Any third-party products mentioned in this manual are for instructional purposes only and are not an endorsement by Radiodetection Ltd, Pearpoint and SPX Corporation.

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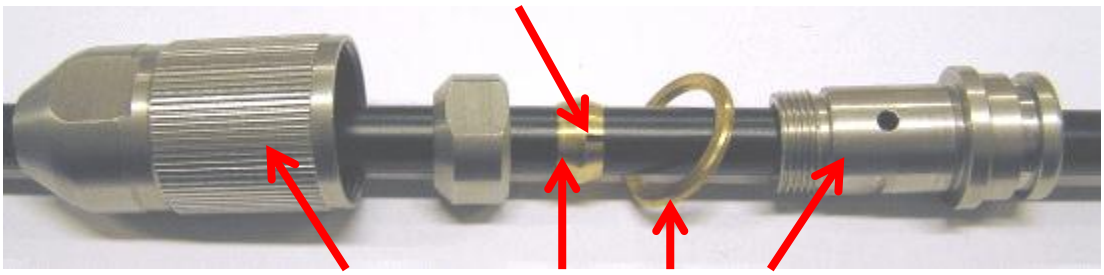
7.1. 93/RP2861 Re-termination Procedure

Remove the camera and/or the Flexi-Sonde, place out of the way.

Ensure that all damaged rod is removed from the reel. Cut off the damaged rod with the junior hacksaw.

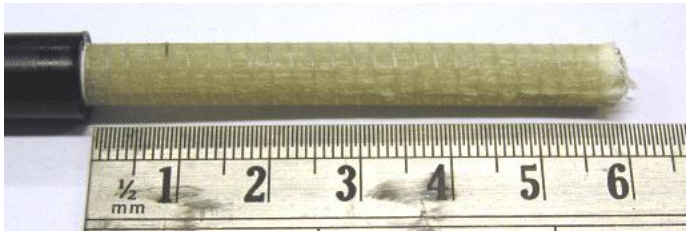
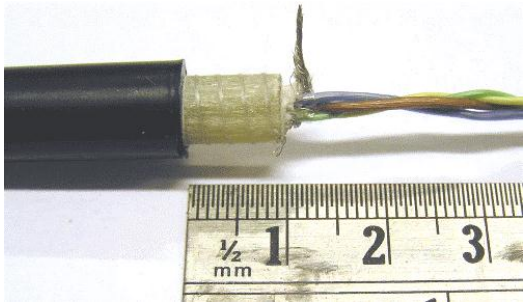
Pull out sufficient rod from the reel to facilitate the repair and lock the brake.

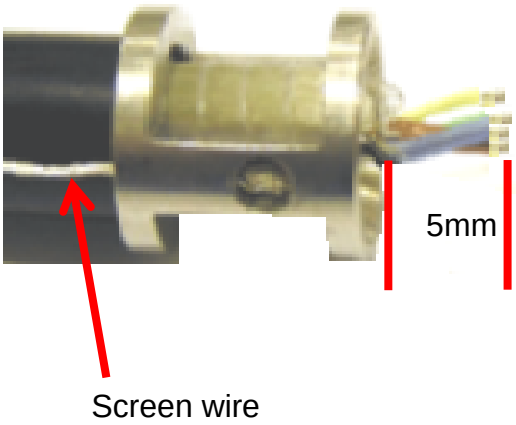
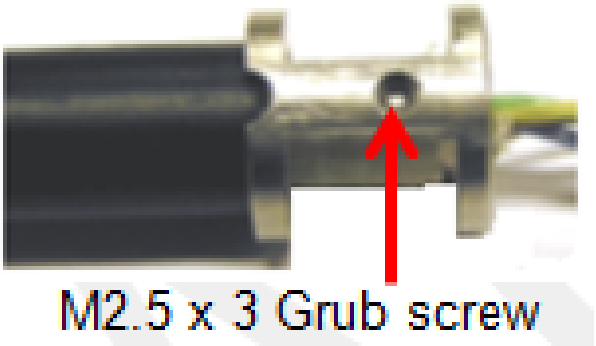
NOTE: THE ORIENTATION OF CUT OUT ON OLIVE.



Slide the component parts of the Maxi rod termination assembly onto the end of the rod in the order shown.
Shroud nut **item 13**, Connector clamp nut **item 12**, Clamp ring (Olive) **item 11**, Thrust washer **item10** and two piece rod connector **item 9**.

NOTE: The relief slots of Connector clamp ring (Olive) **item 11** need to be facing towards the two-piece rod connector.

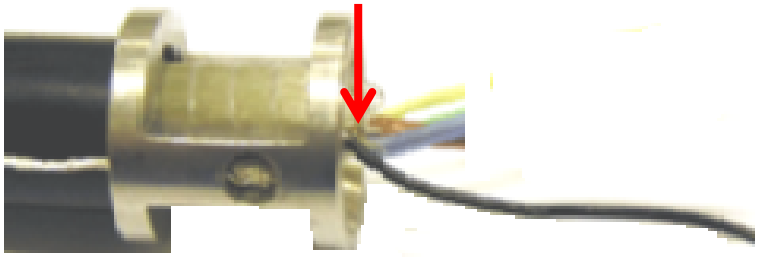
	Strip 60mm of the outer insulation from the rod end, using a suitable cable stripping tool. Ensure the fibre-glass layer is not damaged. It may take several attempts to set the cable stripping tool to the correct depth.
	Carefully remove 50mm of the fibreglass core, to leave 10mm of the core exposed, being careful not to damage the screen wire.

	Cut the **BROWN, BLUE, YELLOW, GREEN** wires back to 5mm in length. Leave the **SCREEN** wire long at this stage Strip and tin 3mm of insulation from the ends of each coloured wire. Slide the potting collar **item 7** over the fibreglass core in the orientation shown. Feed the screen wire back on itself through the potting collar so that it is visible through the hole in the collar.
	Secure the potting collar in position using one off M2.5 x 3 grub screw **item 8**.
	Cut the excess screen wire back to the rear of the potting collar as shown.

Prepare the mini Molex assembly by cutting off the red lead flush with back of the connector, cut the black lead to 20mm. Cut the brown, green, yellow and blue wires to 15mm from the back of the connector and slide a 5mm length of 1.6mm heatshrink onto each of these four wires.

Strip 3mm of insulation from each of the five wires and tin.

Solder the end of the black wire to the base of the screen wire.



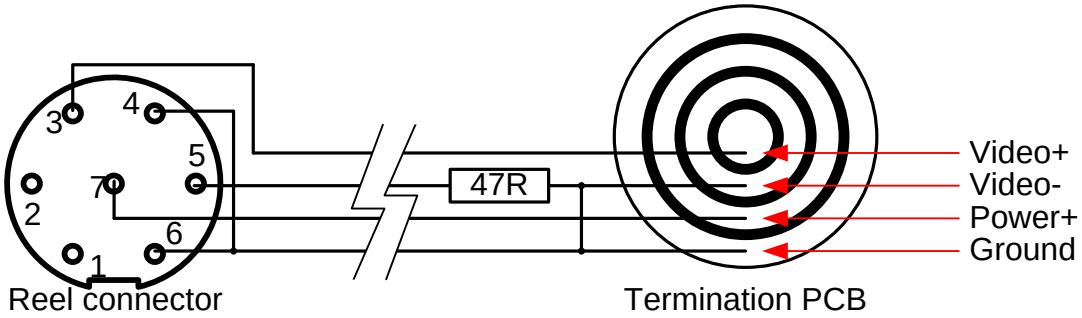
Splice the other four wires to the mini Molex assembly, colour to colour, as below. Slide the heatshrink sleeves over the soldered joints and apply heat to shrink.

BROWN TO BROWN
YELLOW TO RED
GREEN TO GREEN
BLUE TO BLUE
BLACK TO SCREEN

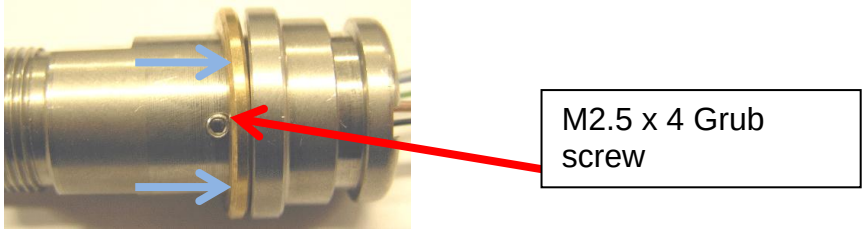
PERFORM CONTINUITY CHECK PRIOR TO FURTHER ASSEMBLY

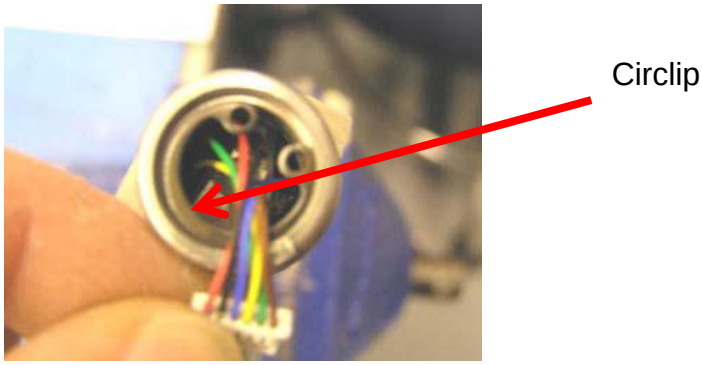
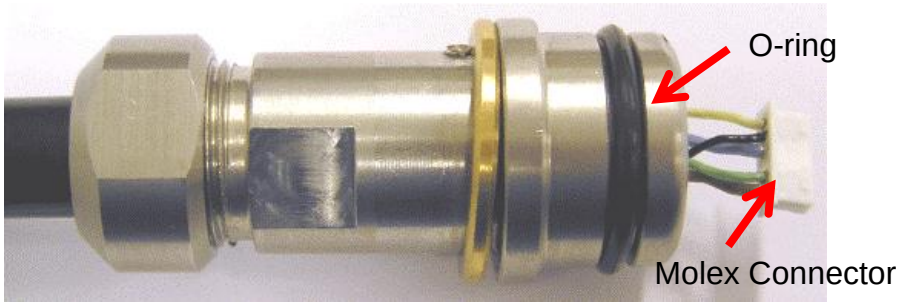
Plug the mini Molex connector into the socket on the slip-ring PCB and carry out a continuity / insulation test

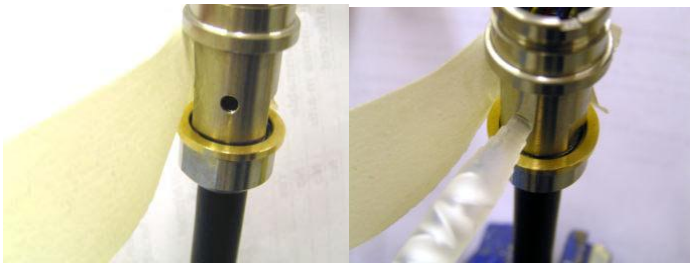
With the DVM set to a suitable low resistance range, check for continuity from end to end of the rod, and for the outer ring to be short-circuit to the potting collar. With the DVM set to a suitable high resistance range, check for open-circuit between each of the rings to all the other rings.



If the DVM tests are successful, remove the slip-ring PCB and continue assembling the rod connector.

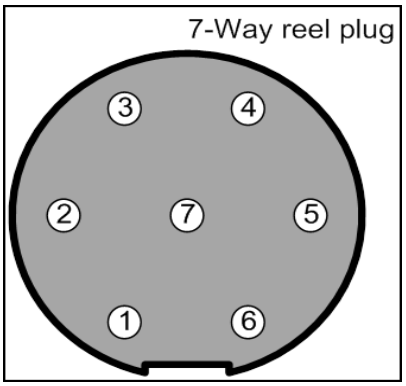
	Slide the rod connector up the rod as shown followed by the thrust washer, the clamp ring (Olive) and the clamp nut.
	Slide the thrust washer **item 10** up to the shoulder of the connector. Line up the grub screw hole and the screen wire hole of the potting collar. Apply Loctite 243 to one off M2.5 x 4 grub screw **item 14** and screw down on to the screen wire in the potting collar. **IMPORTANT: DO NOT OVER-TIGHTEN THE GRUB SCREW**
 	If a suitable torque spanner is available, carry out the following procedure, otherwise tighten the connector clamp nut using a 17mm open-ended spanner with a 14mm open-ended spanner on the connector body until the nut just touches the connector body. Use a fixed 14mm spanner and a 17mm torque spanner for the next part of the process.

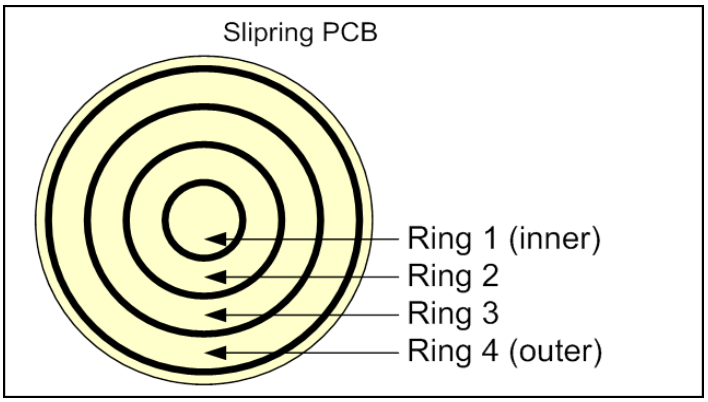
	Set the torque spanner to 24/25nm. **NOTE** the arrow on the torque spanner as this is the direction you must turn the torque spanner when you tighten the clamp nut.
	Screw the connector clamp nut onto the rod connector.
	Holding the rod connector in the fixed 14mm spanner turn the torque spanner in the direction of the arrow until the head clicks over at the 24/25nm setting.
	Fit Circlip **item 5** to the inside of the potting collar, using internal circlip pliers. Apply PTFE grease to O-ring **item 1** and fit to the rod connector.
	

 	Load a tube of epoxy resin Scotchweld 100 two-part, quick-set epoxy structural adhesive, into an application gun fitted with a mixer tube and a narrow dispensing needle.
	Wind some masking tape around the body of the connector but not covering the hole. SLOWLY apply 3M Scotch Weld 100 Epoxy adhesive **item 15** using a 2 part epoxy nozzle in the hole on the side of the connector until adhesive appears around side of circlip. Wrap masking tape around so as to cover the hole.
	To ensure equal amount of adhesive reaches both sides of rod clamp attach a thin nozzle to the syringe and insert it from top of connector, apply further adhesive where necessary to reach just above the level of the circlip. Allow to dry in upright position for at least 30 minutes

7.2 Typical Reel Resistances

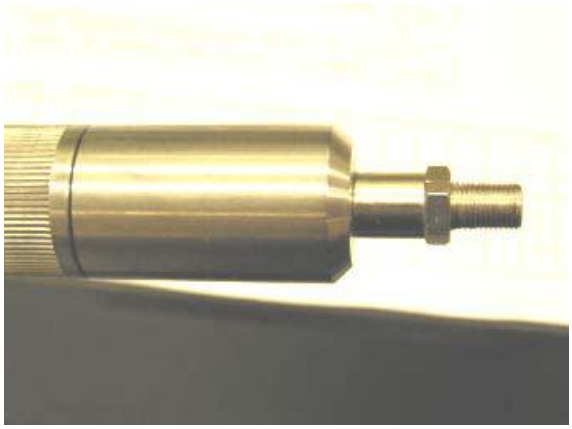
P343 and G4 Specialist - 150m/500' reel			
7-Way reel plug	Signal	Slipring PCB	Resistance /Ohms
1	NC		
2			
3	Vid +	Ring 1 (centre)	TBC
4	Gnd	Ring 4 (outer)	TBC
5	Vid -	Ring 2	TBC
6	Gnd	Ring 4 (outer)	TBC
7	Power +	Ring 3	TBC





Be aware that these values may change if the reel length has been significantly changed or cut back during service operations!

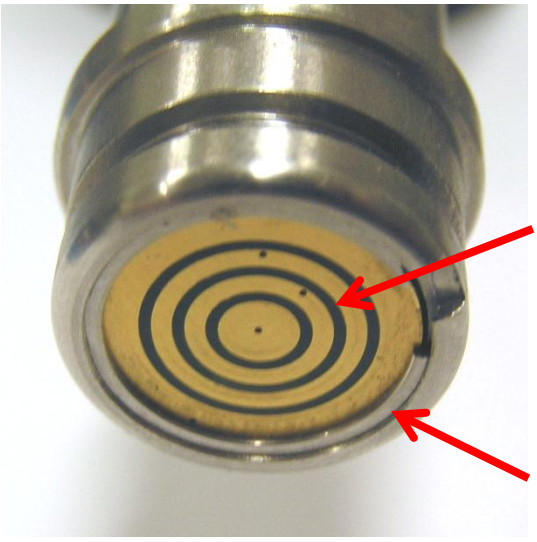
7.3 Pressure Test



If the following equipment is available, carry out a pressure test. Whilst this recommended, it is not essential.

Fit pressure test Jig 09/RP3210Z2 to the end of the rod.

	Attach a foot pump to the jig and pressurise @ 2 bar. Submerge the end of the rod into a bucket of water and check for air leaks.

	Plug the mini Molex into the rear of slip-ring PCB **item 3** then push the wires and the PCB down into the connector being careful not to squash or damage any wires. Secure the PCB in position with circlip **item 2,** being careful not to scratch the PCB in the process. Using a DVM set to its highest resistance range, meter between each wire and from each wire to the connector and ensure that all readings show open circuit Repeat the earlier continuity test.

7.4 Bill of Materials / Assembly Drawing

The Bill of Materials and exploded General Assembly for the retermination kits below will help to clarify the procedure.

Full Retermination Kit P/N 10/RP2861

Drawing Position No	Part Description	Qty per Assembly
1	O-RING 16mmI/Dx2.0SECT NITRILE	1
2	CIRCLIP-WIRE RING 0.625 inch	1
3	P330 ROD TERM SLIPRING PCB	1
4	ROD TERMINATION 6W MOLEX ASSY	1
5	STAINLESS CIRCLIP 13mm INTERNAL	1
6	HEATSHRINK 1.6mm	4
7	POTTING COLLAR	1
8	SCREW-M2.5x3 SKT HD GRUB SS *F	1
9	TWO PIECE ROD CONNECTOR	1
10	THRUST WASHER	1
11	CONNECTOR CLAMP RING	1
12	CONNECTOR CLAMP NUT	1
13	SHROUD NUT	1
14	SCREW-M2.5x4 SKT HD GRUB SS	1
16	PROTECTIVE CAP I D24.98 X 25.4L	1

Partial Retermination Kit P/N 10/RP2861-1

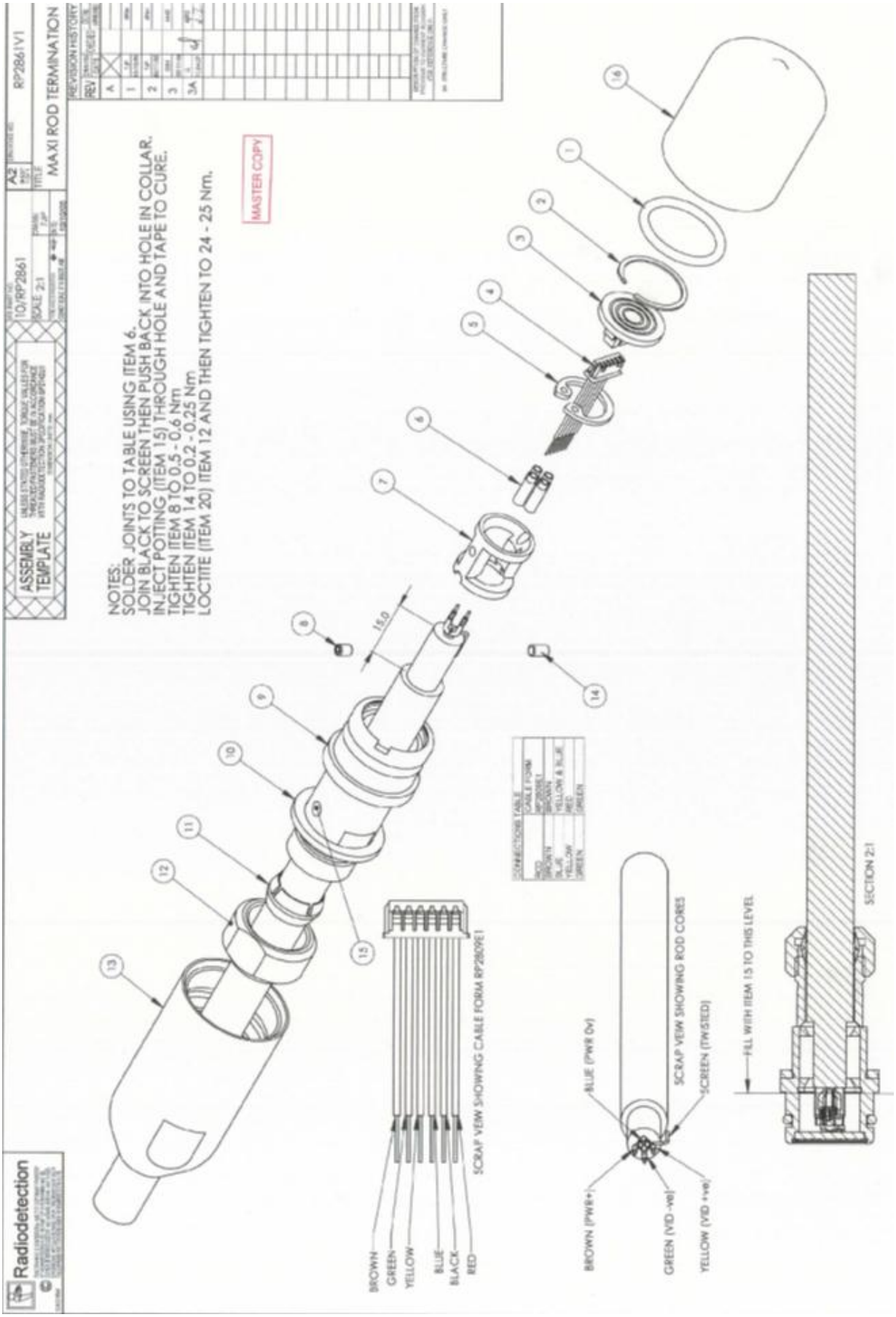
Drawing Position No	Part Description	Qty per Assembly
1	O-RING 16mmI/Dx2.0SECT NITRILE	1
2	CIRCLIP-WIRE RING 0.625 inch	1
3	P330 ROD TERM SLIPRING PCB	1
4	ROD TERMINATION 6W MOLEX ASSY	1
5	STAINLESS CIRCLIP 13mm INTERNAL	1
6	HEATSHRINK 1.6mm	4
7	POTTING COLLAR	1
8	SCREW-M2.5x3 SKT HD GRUB SS *F	1
9	TWO PIECE ROD CONNECTOR	1
11	CONNECTOR CLAMP RING	1
14	SCREW-M2.5x4 SKT HD GRUB SS	1

Service Centre Retermination Kit P/N 10/RP2861-2

Drawing Position No	Part Description	Qty per Assembly
1	O-RING 16mmI/Dx2.0SECT NITRILE	1
2	CIRCLIP-WIRE RING 0.625 inch	1
3	P330 ROD TERM SLIPRING PCB	1
4	ROD TERMINATION 6W MOLEX ASSY	1
5	STAINLESS CIRCLIP 13mm INTERNAL	1
6	HEATSHRINK 1.6mm	4
8	SCREW-M2.5x3 SKT HD GRUB SS *F	1
11	CONNECTOR CLAMP RING	1
14	SCREW-M2.5x4 SKT HD GRUB SS	1

Common Material (to be sourced locally):-

Item 14 Quick-set epoxy resin (Scotch Weld DP100)
Item 15 Loctite 243



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