

Street Address: Cnr Wards Road & Cordia St., Hohola Postal Address: PO Box 1105, BOROKO 111, NCD.PNG

General Enquiries: Telephone: + (675) 325 3200

Documentation To Be Provided As Part Of Tender Submission

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- 2 Schedule of Offer (Part One)
- 3 Schedule of Offer (Part Two)
- 4 Company Credentials
 - Statement of Financial Capability
 - Statement of Relevant Technical Capability
 - Statement of PNG Experience
 - Statement of Previous PPL Dealings
- 5 Company Certifications (PNG Based Companies)
 - IPA Registration No
 - GST Registration No
 - COC Number
- 6 Company Certifications (Overseas Based Companies)
 - Certificate of Accreditation / Quality Assurance
- 7 Product Technical Credentials
 - Product Brand Name
 - Name / Location of Manufacturer
 - Quality Assurance Certification of Manufacturer
 - Technical Specification / Drawings/ Catalogues as available
 - Confirmation of Compliance with PPL Technical Specification
 - Advice of any variations to PPL Technical Specification
- 8 Other Supporting Documentation

Tenderers should provide any other documentation that supports the Authenticity/Capability of their Supplier / Manufacturer.



TENDER FORM

The Chairman - Tender Openi	ng Committee
PNG Power Ltd	
P. O. Box 1105	
BOROKO 111 NCD	
Papua New Guinea	
Phone: (675) 324 3381	
Fax: (675) 3250791	
Email: supplyhelpdesk@pngp	power.com.pg
Mo (*: Il name of company)	
we (an name or company)	

hereby tender for the undermer	ntioned goods and services subject to the
conditions of tendering and at	the prices quoted in the scheduled therein
TENDER No.	10/00/17
	13/2017
CLOSING AT	4.00 PM FRIDAY 19 TH MAY 2017
	4.00 WITHDAT 10 WAT 2017

FOR

SUPPLY AND DELIVERY OF PREFORMES LINE SPLICE PNG POWER LTD DEPOTS OF POM, RAB, GKA & LAE BY PERIOD CONTRACT FOR A THREE (3) YEAR TERM.



SCHEDULE OF FORECAST REQUIREMENTS AND OFFER

ANNEX A TO: CONDITONS OF TENDER

LOCATION: PORT MORESBY, LAE, RABAUL, GOROKA

PAGE:

PA	PART 1								
		REQUIREMENT					0	OFFER	
Item No.	Vocab No.	Description	Spec. App No.	Unit of Issue	Forecast Requirement	Unit Price	STD Pack	Comment	Reserved for internal use
(a)	(q)	0	(p)	(e)	(f)	(6)	(h)	(i)	0
-	132090	Splice, 7/1.75 Copper Preformed Full Tension	~	Each	300				
7	132091	Splice, 7/2.00 Copper Preformed Full Tension		Each	300				
က	132092	Splice, 7/2.75 Copper Preformed Full Tension		Each	200				
4	132093	Splice, 19/2.00 Copper Preformed Full Tension		Each	200				
5	132166	Splice, 3/2.75 Galvanised Steel, Preformed, Full Tension		Each	400				
စ	132167	Splice, 6/4.75-7/1.60 ACSR Cherry Galvanised Steel, Preformed, Full Tension		Each	1,500				
7	132168	Splice, 37/3.00 Saturn, Preformed, Full Tension		Each	250				
8	132169	Splice, 3/4/2.50 ACSR, Raisin, Preformed, Full Tension		Each	400				
တ	132170	Splice, 6/1/3.00 ACSR, Apple Preformed, Full Tension		Each	2,000				

10	132171	132171 Splice, 6/1/3.75 ACSR Banana, Preformed, Full Tension		Each	300		
7	132171A	132171A Splice, 7/3.75 AAC Mars, Preformed, Full Tension	2	Each	250		
	APPARATE .						
12	132173	132173 Splice, 30/7/2.50 Grape Preformed, Full Tension	3	Each	100	-	
13	132173A	132173A Splice, 37/2.50 AAC Preformed, Full Tension	4	Each	100	WHITE AND THE PARTY OF THE PART	



(FAILURE TO COMPLETE AND SIGN THIS PART WILL INVALIDATE THE TENDER) PAPUA NEW GUINEA POWER LIMITED

PART 2

THE WASHINGTON OF THE PROPERTY	-1	GOROKA	(3)		Ex Wks/FOB
en e	N DEPOTS	RABAUL	(e)		EX WKS/FOB EX WKS/FOB EX WKS/FOB EX WKS/FOB
TENNYA	DESTINATION DEPOTS	프 드	(5)		Ex Wks/F0B
A THE RESEARCH OF THE PROPERTY		100 d	0		Ex Wks/F0B
PRICING		-		A CONTRACTOR OF THE CONTRACTOR	
BASIS OF PRICING	Supplier	Catedony	(4)	In Country	Overseas
X X	Line	S		2 2	2.

EXPLANATORY NOTES:

The destination depot for this tender appears at columns c, d, e, or f. Please complete as follows:

OVERSEAS SUPPLIERS Cj.

on which your price has been based under the destination depot of this Tender. If no Your pricing options are already entered at line 2. Delete one option and leave that deletion has been made, the contract will be FOB costs.

PNG SUPPLIERS: ത്

Where your supply is sourced locally to the destination enter "FIS" on line 1 under that depot. Where your supply is sourced from another province to that of the destination depot, enter "FOB" under the destination depot with the Port of shipment.

your offer and failure to observe this conditon may result in your offer declared Please note last line of paragraph 7 of the "Conditions and specificiations for the supply of goods and materials" on "GST". This is a vital condition of informal and not included for consideration. <u>რ</u>

Country of Wanufacturer	(Q)	THE PROPERTY OF THE PROPERTY O
B PRODUCT ORIGIN Line Schedule Item No. Number	(g)	entrone et centralizzanos et composito en la seguina de la seguina de la seguina de la seguina de la seguina d
No. in a		2.

DECLARATION	In respect of the offer in Part 1 of the schedule, I make the	Illowing declaration.
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		Ç

- Supply will conform with the conditions of Tender as specified.
- The price basis of the offer has been clearly identified in Part 2 - A in accordance with explanatory notes. α i
- The country of manufacturer of the product is given at Part 2 - B. ത്
- GST of......% has been included. In accordance with paragraph 3.1 of the explanatory notes. <ĵ

Company Name	**************************************
& Address	
Fax NoPhone:	
ETTAIN TO THE PROPERTY OF THE	Herring Addition Protest Protest Company and Company a
U.	Signature

NAME:

VOCABI	NUMBER	ITEM DESCRIPTI	ON	
132	090	Splice, 7/1.75 Copper	Preformed Full Tensi	ion
		SPECIFICATION DE	ETAILS	
1. Helical 1746 –		mid-span jointing of 7,	/1.75 hard drawn copp	per conductor to AS
	ing shall comply ted breaking load	with AS 1154.3 - 2009 of the conductor.	and shall hold not le	ss than 85% of the
3. Each fit to be us		ly marked with the condu	uctor size and type for	which it is designed
4. Full tech tender.	nnical description,	test reports and installa	tion instructions shall l	oe included with the
 Rejection specificate Credit me 	ion and is not liable fo	serves all rights to reject wh or any cost or loss with the ret een the supplier and PNG Po	urn of rejects to the Suppli	er. Facilitation of Invoice
Drawing Reference	es:	Manu	ufacturer's Product Cod	'e:
Approval by A Cha		re:DATA REVIEW ENDOR	Date: ./	7, / 17
		DWIW VEATERS FLIDOL	SEMENT	
NAME		TITLE	SIGNATURE	DATE
NAME Grevasias Peni	Team Leader St	TITLE and Material	SIGNATURE	DATE 16(12/16

	VOCAB	NUMBER	ITEM DESCRIPTI	ON			
	132	091	SPLICE, 7/2.00 CU PR	EFORMED FULL TENSIO	N		
			SPECIFICATION DI	ETAILS			
1.	Helical 1746 –		for mid-span jointing of 7,	/2.00 hard drawn coppe	er conductor to AS		
2.			ly with AS 1154.3 - 2009 ad of the conductor.	and shall hold not less	s than 85% of the		
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.						
4.	Full tecl tender.	hnical descriptio	on, test reports and installa	tion instructions shall be	e included with the		
	Unit of N	/leasure: Each					
•	Rejectior specificat Credit m	n: PNG Power Ltd ion and is not liable	reserves all rights to reject whe for any cost or loss with the re- ween the supplier and PNG Po ns.	urn of rejects to the Supplier	. Facilitation of Invoice		
Drawin	g Referenc			ufacturer's Product Code:			
			STANDARDS COMMITTE	E APPROVAL			
App	oroval by A Cha	lex Oa Signa irman	nture:	Date:	7, 1, 17		
			DATA REVIEW ENDOR	SEMENT			
N	AME		TITLE	SIGNATURE	DATE		
Grevasi	as Peni	Team Leader	Standards and Material	Thu	16/12/16		
		†					

VOCAB N	UMBER	ITEM DESCRIPTION	N	
1320	92	SPLICE, 7/2.75 CU PRE	FORMED FULL TENSION	
		SPECIFICATION DE	TAILS	
1. Helical t 1746 – 1		or mid-span jointing of 7/	2.75 hard drawn copper co	onductor to AS
2. The fitti nominat	ng shall complyed breaking loa	y with AS 1154.3 - 2009 of the conductor.	and shall hold not less th	an 85% of the
3. Each fitt to be us		arly marked with the condu	ctor size and type for whic	h it is designed
4. Full tech tender.	nical descriptio	n, test reports and installat	ion instructions shall be in	cluded with the
 Rejection specification Credit me 	on and is not liable	e for any cost or loss with the ret ween the supplier and PNG Po	ole or part of the order not co curn of rejects to the Supplier. Fac ower Ltd through the process o	lillation of invoice
Drawing Reference			ufacturer's Product Code:	
Approval by A Ch a		ature:	E APPROVAL Date:	1,17
	/	DATA REVIEW ENDO	RSEMENT	
NAME		TITLE	SIGNATURE	DATE
Grevasias Peni	Team Leader	Standards and Material	They	16/12/4

VOCAB N	NUMBER	ITEM DESCRIPT	ION	
132	093	Splice, 19/2.00 Copp	er Preformed Full Tension	ı
		SPECIFICATION D	ETAILS	
1. Helical 1746 – 1	-	for mid-span jointing of 1	9/2.00 hard drawn copper	conductor to AS
	ng shall comply g load of the co		nd shall hold not less 85% c	of the nominated
3. Each fitt to be us		early marked with the cond	uctor size and type for whi	ch it is designed
4. Full tech tender.	nnical descriptio	on, test reports and installa	ntion instructions shall be in	ncluded with the
 Rejection specificati Credit mu 	on and is not liabl	e for any cost or loss with the re tween the supplier and PNG F	nole or part of the order not c eturn of rejects to the Supplier. Fa ower Ltd through the process	acilitation of Invoice
Drawing Reference	es:	Mar	ufacturer's Product Code:	
Approval by Al Ch a	lex Oa Signa Irman	STANDARDS COMMITTE		1,17
		DATA REVIEW ENDO	RSEMENT	
NAME		TITLE	SIGNATURE	DATE
Grevasias Peni	Team Leader	Standards and Material	They	16/12/16

VOCAB NUMBER		UMBER	ITEM DESCRIPTION				
	132166		SPLICE, 3/2.75 GALVANISED STEEL, PREFORMED, FULL TENSION				
			SPECIFICATION DETA	AILS			
1.	Helical te	Helical tension for mid-span jointing of 3/2.75 SC/GZ galvanised steel to AS 1222.1 - 1992.					
2.	The fittings shall comply with AS 1154.3-2009 and shall hold not less than 85% of the nominated breaking load of the conductor.						
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.						
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.						
		(NB:	FOR ATTACHMENTS REF VOCA	B. NO. 132090)			
•	Unit of Mea		eserves all rights to reject whole or part o	f the order not complying	with this specification		
	Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.						
Dra	wing Refere	ences:	Manufactu	ırer's Product Code:			
			STANDARDS COMMITTEE AI	PPROVAL			
Арр	roval by Ale Chair		nature:	Date:	<u></u>		
			DATA REVIEW ENDORSE	MENT			
	NAME		TITLE	SIGNATURE	DATE		
Grev	asias Peni	Team Lead	ler - Standards and Materials	Tree!	10/12/1t		



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 <u>Mechanical Performance</u>

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports</u>. Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The center of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 Mechanical Performance

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 Mechanical Performance

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions

3.3.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 Type Testing

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 Mechanical Performance

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions

3.4.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 Electrical Performance

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

All splices, including termination splices, shall be suitable to temperatures up to 72°C and at this operating temperature shall not be annealing, suffer a greater loss of strength than the conductor for which they are supplied.

	VOCAB NU	IMBER	ITEM DESCRIPTION			
	13216	57	SPLICE, 6/4.75-7/1.60 AC	SR CHERRY PREFORMED	, FULL TENSION	
			SPECIFICATION D	ETAILS		
1.	Helical tension for mid-span jointing of 6/4.75-7/1.60 ACSR to AS 3607-1989.					
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.					
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.					
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.					
		(NB:	FOR ATTACHMENTS REF VO	CAB. NO. 132090)		
0	Unit of Mea	sure: Fach				
0	Unit of Measure: Each Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.					
Drau	ving Refere	nces:	Manuf	acturer's Product Code:		
			STANDARDS COMMITTE	E APPROVAL		
Арр	roval by Alex Chair ı		nature:	Date:	11.7	
			DATA REVIEW ENDO	SEMENT		
	NAME		TITLE	SIGNATURE	DATE	
Grevasias Peni		Team Lead	ler - Standards and Materia	s They	(6/12/16	



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports</u>. Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The center of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 <u>Mechanical Performance</u>

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 Mechanical Performance

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions

3.3.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 Type Testing

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 <u>Mechanical Performance</u>

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions

3.4.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 <u>Electrical Performance</u>

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

All splices, including termination splices, shall be suitable to temperatures up to 72°C and at this operating temperature shall not be annealing, suffer a greater loss of strength than the conductor for which they are supplied.

VOCAB NUMBER		R ITEM DESCRIPTION				
	132168	SPLICE, 37/3.00 AAC, SAT	URN, PREFORMED, FULL T	ENSION		
		SPECIFICATION DI	TAILS			
1.	Helical tension for mid-span jointing of 37/3.00 AAC to AS 3607-1989.					
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.					
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.					
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.					
		(NB: FOR ATTACHMENTS REF VO	CAR NO 132090)			
		(NB. FOR ATTACHINENTS REF VO	CAB. NO. 132090)			
0	Unit of Massu	vo. Each				
0	Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.					
Dra	wing Reference	ces: Manuf	ncturer's Product Code:			
		STANDARDS COMMITTE	APPROVAL			
Арр	oroval by Alex (Chairm		Date:	1,17		
BI I		DATA REVIEW ENDO	SEMENT			
	NAME	TITLE	SIGNATURE	DATE		
Grev	asias Peni	Team Leader - Standards and Materia	s Francis	16/12/16		



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports</u>. Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The center of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 <u>Mechanical Performance</u>

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 <u>Mechanical Performance</u>

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions

3.3.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 Type Testing

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Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 <u>Type Testing</u>

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 <u>Mechanical Performance</u>

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions

3.4.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 Electrical Performance

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The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

All splices, including termination splices, shall be suitable to temperatures up to 72°C and at this operating temperature shall not be annealing, suffer a greater loss of strength than the conductor for which they are supplied.

	VOCAB NI	JMBER	ITEM DESCRIPTION			
	1321	69	SPLICE, 3/4/2.50 ACSR, RAIS	IN PREFORMED, FULI	. TENSION	
			SPECIFICATION DETA	AILS		
1.	Helical tension for mid-span jointing of 3/4/2.50 ACSR to AS 3607-1989.					
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.					
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.					
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.					
		(NB	: FOR ATTACHMENTS REF VOCA	B. NO. 132090)		
•	and is not lia	NG Power Ltd able for any c	reserves all rights to reject whole or part o ost or loss with the return of rejects to t upplier and PNG Power Ltd through the	he Supplier, Facilitation of	Invoice Credit must	
Drav	Prawing References: Manufacturer's Product Code:					
			STANDARDS COMMITTEE AF	PPROVAL		
Аррі	roval by Alex Chai rn		gnature:	Date:/	1,17	
			DATA REVIEW ENDORSEM	MENT		
	NAME		TITLE	SIGNATURE	DATE	
Greva	sias Peni	Team Lea	der - Standards and Materials 🤜	Fran	16/12/16	
					1	



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports.</u> Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 Mechanical Performance

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 Mechanical Performance

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 <u>Conditions</u>

3.3.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 <u>Type Testing</u>

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 Mechanical Performance

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions

3.4.3.1 If the fittings incorporate a suitable grit glued to those sections of the helics which grip the conductor or stay, the gluing shall be such that any loss of grit during transport or store and field handling shall not affect the effectiveness of the fittings.



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 <u>Electrical Performance</u>

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

All splices, including termination splices, shall be suitable to temperatures up to 72°C and at this operating temperature shall not be annealing, suffer a greater loss of strength than the conductor for which they are supplied.

VOCAB NI	JMBER	ITEM DESCRIPTION					
1321	70	SPLICE, 6/1/3.00 ACSR, API	CE, 6/1/3.00 ACSR, APPLE PREFORMED, FULL TENSION				
		SPECIFICATION DET	AILS				
1. Helical ter	Helical tension for mid-span jointing of 6/1/3.00 ACSR/GZ to AS 3607-1989.						
	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.						
3. Each fittin be used.	y with the served and type for infinite it is designed to						
	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.						
(NB: FOR ATTACHMENTS REF VOCAB. NO. 132090)							
 Unit of Mea 	sure: Each		•				
and is not li	and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report						
Drawing Refere	Drawing References: Manufacturer's Product Code:						
		STANDARDS COMMITTEE A	APPROVAL				
Approval by Ale Chair		ure: (a) f	Date: ./7/.	1,17			
	/	DATA REVIEW ENDORSE	MENT				
NAME		TITLE	SIGNATURE	DATE			
Grevasias Peni	Team Leader	- Standards and Materials	They	16/12/16			



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports</u>. Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The center of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 <u>Mechanical Performance</u>

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 <u>Mechanical Performance</u>

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 <u>Type Testing</u>

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 <u>Mechanical Performance</u>

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - Two or more concentric layers or helically-formed rods.

3.4.4 <u>Electrical Performance</u>

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

- Andrew	VOCAB NUMB	ER ITEM DESCRIPTION	ITEM DESCRIPTION				
	132171	SPLICE, 6/1/3.75 ACSR BA	ANANA, PREFORMED, FU	LL TENSION			
		SPECIFICATION DI	TAILS				
1.	Helical tension	for mid-span jointing of 6/1/275 ACS	D+0 AC 2607 1090				
	Helical tension for mid-span jointing of 6/1/3.75 ACSR to AS 3607-1989.						
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.						
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.						
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.						
	(NB: FOR ATTACHMENTS REF VOCAB. NO. 132090)						
0	Unit of Measure:	Each					
0	Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.						
Drav	ving References	Manuf	cturer's Product Code:				
		· wanure					
		STANDARDS COMMITTEE	APPROVAL				
Аррі	oval by Alex Oa Chairman	STANDARDS COMMITTEE		i. 1. 17.			
Аррі		STANDARDS COMMITTEE	Date:,	i. 1. 17			
		STANDARDS COMMITTEE	Date:,	DATE			
	Chairman	Signature: DATA REVIEW ENDOR	Date:				
	Chairman	Signature: DATA REVIEW ENDOR	Date:	DATE			



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. **GENERAL REQUIREMENTS**

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 <u>Mechanical Performance</u>

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistence to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports.</u> Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 Mechanical Performance

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 <u>Mechanical Performance</u>

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 <u>Type Testing</u>

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 <u>Mechanical Performance</u>

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 Electrical Performance

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

and is not liable for any cost or loss with the return of rejects to the Suppl	old not less than type for which it is are to which the fill with the tender.	85% of the designed to			
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Grevasias Peni Team Leader - Standards and Materials	Earl	16/12/1			



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



SPECIFICATION FOR PREFORMED LINE FITTINGS – 132171A

2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports.</u> Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 Mechanical Performance

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 Mechanical Performance

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions



SPECIFICATION FOR PREFORMED LINE FITTINGS – 132171A

- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 Type Testing

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 Mechanical Performance

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 <u>Conditions</u>



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 <u>Electrical Performance</u>

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.



	VOCAB NU	MBER	ITEM DESCRIPTION				
	13217	3	SPLICE, 30/7/2.50 GRAPE P	REFORMED, FULL TENS	SION		
			SPECIFICATION DET	AILS			
			,				
1.	Helical ten	Helical tension for mid-span jointing of 30/7/2.50 ACSR/GZ to AS 3607-1989.					
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.						
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.						
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.						
	(NB: FOR ATTACHMENTS REF VOCAB. NO. 132090)						
•	Unit of Meas	ure: Each					
0	Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.						
Drau	wing Referen	ices:	Manufac	turer's Product Code:			
			STANDARDS COMMITTEE A	APPROVAL			
Арр	roval by Alex Chairn		nature:	Date: /	117		
			DATA REVIEW ENDORS	EMENT			
	NAME		TITLE	SIGNATURE	DATE		
Greva	asias Peni	Team Lead	ler - Standards and Materials	Trey	16/12/16		



Tenders are invited for the Supply and Delivery to PNG Power Limited main PNG Ports of Helically – Formed Line Fittings as per attached schedule.

1. SCOPE AND DEFINITIONS

1.1 Scope

This specification applies to helically-formed Armour rods, dead ends insulator ties and tension splices (including termination splices) for overhead line conductors and stays.

1.2 Definitions

For the purposes of this specification, the following definitions shall apply.

"Conductor" means any overhead line component which is designed to carry current.

"Direction of Lay" may be "right hand" or "left hand". With right hand lay, the slope of the wires seen by the observers is in the direction for the central part of the letter **Z** when the conductor is held vertically. With left hand lay, the slope of the wires seen by an observer is the direction of the central part of the letter **S** when the conductor is held vertically.

"Fitting" means one complete appliance consisting of one or more helically formed rods. (Note: The enclosed schedule contains descriptions of the types of fittings to which this specification applies).

"Rods" means metallic or non-metallic helically-formed element of the fitting.

"Set" means a group of rods which together comprise one fitting.

"Sub-set" means a group of rods fastened together ready for application and comprising less than one complete set. Two or more sub-sets may comprise one set.

2. GENERAL REQUIREMENTS

The following requirements are applicable to all fittings covered by this specification.

2.1 Standard Specifications

Where reference is made to standard specifications, these shall be the specifications (including amendments) current at the date of Tender.

2.2 Material

The material from which the fittings are manufactured shall be suitable for use in the environment to be encountered in service and shall conform to the following requirements. The Tenderer may submit alternative offers of several materials.

- 2.2.1 Galvanised Steel shall be galvanised in accordance with the relevant portions of the current Australian Standard.
- 2.2.2 Aluminium coatings on steel shall comply with the minimum requirements specified in Appendix "C".
- 2.2.3 Aluminium alloy. The alloy shall be quoted by the tenderer (The copper content of the alloy shall be kept to a minimum consistent with manufacturing requirements and shall not exceed 0.04%).
- 2.2.4 Plastic and rubber-like materials shall satisfactorily withstand all relevant tests specified in the current Australian Standard.



2.2.5 Other material. Full details including standard specification applied (if any) shall be quoted by the tenderer.

2.3 Dimensions

The following details of the fittings shall be quoted by the tenderer. All dimensions apply to the finished fitting before application.

- a) Overall length
- b) Length of fittings gripping the conductor or stay
- c) Number and diameter of rods in each fittings
- d) Number of sub-sets (if any) and number to rods in each sub-set
- e) Direction of the lay of helix (as defined in Clause 1.2)
- f) Number and description of filler rods (if any).

2.4 Finish

Where the outside diameter of the conductor or stay exceeds 18mm, the ends of each rod of the fittings shall be substantially hemispherical with a smooth tangential transition between the end and the cylindrical rod surface, or the ends shall be otherwise treated by a method acceptable to the purchaser so that they cannot, during installation or in service, scratch the conductor, rendering it susceptible to fatigue failure.

Where the outside diameter of the conductor or stay does not exceed 18mm, the ends of each rod shall be free from burrs and sharp edges which could scratch the conductor, rendering it susceptible to fatigue failure.

2.5 Identification

All rods of each fitting shall be fastened together to form a separate bundle, the fastening being able to withstand normal handling. Each fittings or group of not more than six fittings or otherwise as required by the purchaser shall be securely banded with a weatherproof material on which is legibly and indelibly marked a full description of the conductor or stay for which the fitting is supplied.

2.6 Packing

Fittings shall be packed in durable packs labelled on the outside with the marker's name, the complete description of the contents and the full description including lay of the conductor or stay for which the fittings are intended.

2.7 Permanence

All fittings, when applied according to manufacturer's directions, shall remain effective under all conditions of service for which they are supplied.

3 SPECIFIC TYPES OF FITTINGS

The following requirements of particular types of fittings are additional to the general requirements set out in Section 2.

3.1 Armour Rods

3.1.1 Marking

The center of each rods or sub-set shall be marked with durable coloured band.

3.1.2 Mechanical Performance

Armour rods shall be capable of imparting to:



- a) Steel and hard drawn copper conductor at supports, not less than the same resistance to fatigue, from the Aeolian vibration to be expected when the conductor is tensioned in service at 30% of its Ultimate Tensile Strength (UTS) as the same conductor has when not protected by the fittings and tensioned to 25% of its UTS under otherwise similar conditions.
- b) Hard drawn cadmium copper, hard drawn aluminium conductor, aluminium alloy conductor and aluminium conductor, steel reinforced at supports not less than the same resistance to fatigue, from the Aeolian Vibration to be expected when the conductor is tensioned in service at 22% of its UTS as the same conductor has when not protected by the fittings and tensioned to 18% of its UTS under otherwise similar conditions.

<u>Submission of performance reports</u>. Tenders shall be supported by reports of field experience with the type of fitting offered as such reports giving comparative results for similar conductors not protected by such unprotected conductors. Alternatively, test reports from a qualified laboratory may be offered.

3.2 Line Guards

3.2.1 Marking

The center of each rod or sub-set shall be marked with a durable coloured band.

3.2.2 Mechanical Performance

Line guards shall over their full length completely envelop the conductor.

3.3 Deadends

3.3.1 Marking

Each fitting shall be marked at points where the wrapping on shall commence during installation with a durable coloured band.

3.3.2 Mechanical Performance

The completed termination shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test, the load shall be sustained for one minute. A new fitting may be used for each provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at that temperature for 30 minutes.
- c) At room temperature, after the fitting has been immersed in water at room temperature for 10 minutes and then immediately applied to clean conductor or stay, removed and reapplied to a new, clean portion of the conductor or stay. This process shall be continued until 10 successive applications of the fitting have been made, the load being applied after the tenth.

3.3.3 Conditions



- 3.3.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - a) Removal of core grease of greased core ACSR conductor
 - b) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - c) Two or more concentric layers or helically-formed rods.

3.3.4 Type Testing

Type tests shall be performed in a laboratory registered by the National Association of Testing Authorities and the fittings shall meet the requirements specified in Clauses 3.3.2

All test reports shall bear the National Association of Testing Authorities endorsement and if requested by the purchaser the tenderer shall arrange for a copy of each report to be forwarded to the purchaser as soon as possible after completion of tests.

3.3.5 Sample Testing

If required by the purchaser at the time of ordering the tenderer shall arrange for testing of sample fittings selected at random from each batch or production run. The fittings shall meet the requirements specified in Clause 3.3.2. Nominally 0.5% of each production run, but not more than 10 and not fewer than two from each production run shall be thus tested. The purchaser shall supply a suitable length of conductor or stay for the tests.

3.3.6 Type Testing

In the event of a fitting, failing to meet the requirements of clause 3.3.2, the whole of the production run may be rejected.

3.4 Tension Splices (including termination splices)

3.4.1 Marking

The centre of each rod or sub-set shall be marked with a durable coloured band.

3.4.2 Mechanical Performance

The completed joint shall be capable of withstanding under all of the following test conditions without slip or damage to the conductor or stay, the maximum withstand load specified by the purchaser. In each test the load shall be sustained for one minute. A new fitting may be used for each test provided that all fittings tested in any one test series are taken from the same production batch.

- a) Fitting as manufactured and at room temperature.
- b) At a temperature of 75°C after having been maintained at the temperature for 30 minutes.
- c) At room temperature after the fitting has been immersed in water at room temperature for 10 minuted and then immediately applied to clean conductor or stay, removed and reapplied to a new clean portion of the conductor or stay.

3.4.3 Conditions



- 3.4.3.2 The tenderer shall state which, if any of the following measures are necessary for the achievement of the mechanical performance specified in Clauses 3.3.2.
 - d) Removal of core grease of greased core ACSR conductor
 - e) Application of grip enhancing compound, grit or anti-oxidant compound to the conductor or stay.
 - f) Two or more concentric layers or helically-formed rods.

3.4.4 <u>Electrical Performance</u>

The jointed section of conductor shall have a conductance not less than that of an equal length of unjointed conductor, the conductance being measured between points on the conductor adjacent to the extremities of the joint before any tension has been applied to the jointed conductor and also with all tensions up to the tension specified in Clause 3.4.2.

If any fitting offered does not meet this requirement, the tenderer shall state in Schedule of Particulars, full details of such variation. Unless the purchaser specifies "Limited Fault" splices, the calculated conductance per unit length of the fittings across the butt joint of the conductors jointed shall not be less than that of the conductor.

"Limited Fault" splices may have a lower conductance per unit length across the butt joint than the conductor proved that the conductance of the whole joint is not less than that of a similar length of unjointed conductor.

The preceding requirements of this clause shall not apply to termination splices.

	VOCAB NU	IMBER ITEM DESCRIPTION					
	13217	3A	SPLICE, 37/2.50 AAC PREFO	RMED, FULL TENSIO	N		
			SPECIFICATION DETA	AILS			
1.	Helical tension for mid-span jointing of 37/2.50 AAC to AS 1531-1991.						
2.	The fittings shall comply with AS 1154.3 - 2009 and shall hold not less than 85% of the nominated breaking load of the conductor.						
3.	Each fitting shall be clearly marked with the conductor size and type for which it is designed to be used.						
4.	Full technical description including minimum diameter of hardware to which the fitting can be applied, test reports and installation instructions shall be included with the tender.						
	(NB: FOR ATTACHMENTS REF VOCAB. NO. 132090)						
	(NO. FOR ATTACHNESS RELEVOCAD. NO. 152050)						
۰	Unit of Mea	sure: Each					
0	Rejection: PNG Power Ltd reserves all rights to reject whole or part of the order not complying with this specification and is not liable for any cost or loss with the return of rejects to the Supplier. Facilitation of Invoice Credit must commence between the supplier and PNG Power Ltd through the process of PNG Power Ltd Discrepancy Report provisions.						
Dra	ving Refere	nces:	Manufacte	urer's Product Code:			
			STANDARDS COMMITTEE A	PPROVAL			
Арр	roval by Ale Chai r	-	nature:	Date: // 7			
			DATA REVIEW ENDORSE	MENT			
	NAME		TITLE	SIGNATURE	DATE		
Grev	asias Peni	Team Lead	der - Standards and Materials	Plan	16/12/16		