PREFORMED LINE PRODUCTS
The connection you can count on.

Section 4 - Protection

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PREFORMED™ Armor Rods

PREFORMED™ Armor Rods are intended to protect against bending, compression, abrasion, arc-over whilst also being capable of providing a repair function. The degree of protection needed on a specific line depends upon a number of factors such as line design, temperature, tension, exposure to wind flow and vibration history on a similar construction in the same area. Armor Rods are recommended as a minimum protection for clamp type supports or suspension. Armor Rods may be used to restore full conductance and strength to AAC, AAAC and ACSR conductors, except high strength ACSR, where damage does not exceed 50% damage for 7 & 19 strand conductors or 25% damage for 37 & 61 strand conductors. PREFORMED™ Armor Rods are extremely effective in relieving or suppressing conductor strain and therefore extending conductor service life. PREFORMED™ Armor Rods are chamfered and above a certain size are ball ended to create a smooth uniformed finish to minimise corona.

Safety and Application Considerations

- This product is intended for a single (one-time) use and for the specified application, although it may be re-applied twice for re-tensioning within 90 days from initial installation.
- Do not modify this product in any way.
- This product is intended for use by qualified linesmen only.
- When working in the area of energised line with this product, extra care should be taken to prevent accidental electrical contact.
- For proper performance and personal safety, be sure to select the proper size PREFORMED™ products before application.
- PREFORMED™ products are precision devices. To ensure proper performance, they should be stored in cartons under cover and handled carefully.

PREFORMED™ Armor Rods

AAR

For AAC, AAAC and ACSR Conductors

Part Number	Conductor Diameter Range (mm)	Standard Pack Quantity	Colour Code
AAR-075	7.00-7.59	75	Blue
AAR-090	8.85-9.39	70	Red
AAR-125	12.20-16.69	50	Blue
AAR-135	13.20-13.99	35	Green
AAR-143	14.00 - 14.89	30	Blue
AAR-157	14.90 - 15.89	30	Purple
AAR-163	15.90 - 16.64	25	Orange
AAR-169	16.65 - 17.39	25	Green
AAR-175	17.40 - 18.29	20	Blue
AAR-188	18.30 - 18.89	20	Black
AAR-192	18.90 - 19.49	20	Yellow
AAR-196-2200	19.50 - 19.89	15	Brown
AAR-201	19.90 - 21.40	15	Red
AAR-210	20.90 - 21.79	15	Red
AAR-220	21.80 - 22.59	10	Blue
AAR-230	22.60 - 23.59	10	Blue
AAR-240	23.60 - 24.79	10	Blue
AAR-250	24.80 - 26.49	10	Black
AAR-270	26.50 - 27.59	5	Red
AAR-286	27.90 - 28.59	5	Orange
AAR-293	28.60 - 29.49	5	Orange
AAR-301	29.50 - 30.10	5	Red
AAR-315	30.70 - 32.24	5	Purple
AAR-338	33.70 - 35.30	5	Yellow
AAR-495	48.20 - 50.50	3	White

AARS

For AAC, AAAC and ACSR Conductors - Subset

AARS Rods are subset for quick and easy installation by a linesman. Subsetting greatly reduces installation time and ensures that the correct number of rods are applied.

Part Number	Conductor Diameter Range (mm)	Standard Pack Quantity	Colour Code
AARS-075	7.00-7.59	35	Blue
AARS-084	8.00-8.49	50	White
AARS-090	8.85-9.39	20	Red
AARS-102	9.90-10.39	20	Purple
AARS-113	10.90-11.59	20	Black
AARS-135	13.20-13.99	20	Green
AARS-143	14.00 - 14.89	20	Blue
AARS-163	15.90 - 16.64	15	Orange
AARS-175	17.40 - 18.29	20	Blue
AARS-188	18.30 - 18.89	12	Black
AARS-196-2000	19.30 - 19.89	15	Brown

PREFORMED™ Armor Rods

GAR

For Galvanised Steel Conductors SC/GZ

Part Number	Conductor Stranding	Conductor Diameter (mm)	Standard Pack Quantity	Colour Code
GAR-055	3/2.75	5.93	50	White
GAR-083	7/2.75	8.25	30	White
GAR-098	7/3.25	9.75	30	Blue
GAR-100	19/2.00	10	30	Yellow Orange
GAR-113	7/3.75	11.3	20	Black

AWAR

For SC/AC Conductors

Part Number	Conductor Stranding	Conductor Diameter (mm)	Standard Pack Quantity	Colour Code
AWAR-K031	3/3.25	7	50	Orange
AWAR-K040	3/3.75	8	50	Black
AWAR-K050	7/2.75	8.25	50	White
AWAR-K106	7/4.25	12.8	15	Brown
GAR-113	7/3.75	11.3	20	Black

PREFORMED™ Line Guards

ALG

For AAAC, AAC and ACSR Conductors

PREFORMED™ Line Guards are commonly used in distribution networks has a minimum support protection. Line Guards may also be used in transmission network applications.

PREFORMED™ Line Guards are intended to protect against abrasion, arc-over and may be used as patch rods designed to restore full conductivity and strength to conductors where damage is located outside the support area and does not exceed 25% of the outer layer strands.

Both in initial installation cost and in long-term cost, PREFORMED™ Line Guards virtually eliminate the possibility of conductor mechanical failure at support points.

PREFORMED™ Line Guards may be used as tap armour to protect conductors from wear and flash-over damage under hot-line taps.

Safety and Application Considerations

- This product is intended for a single (one-time) use and for the specified application, although it may be re-applied twice for e-tensioning within 90 days from initial installation.
- Do not modify this product in any way.
- This product is intended for use by qualified linesmen only.
- When working in the area of energised line with this product, extra care should be taken to prevent accidental electrical contact.
- For proper performance and personal safety, be sure to select the proper size PREFORMED™ products before application.
- PREFORMED™ products are precision devices. To ensure proper performance, they should be stored in cartons under cover and handled carefully.

Part Number	Conductor Diameter Range (mm)	Standard Pack Quantity	Colour Code
ALG-135	13.20-13.99	50	Green
ALG-143	14.00 - 14.89	50	Blue
ALG-157	15.40 - 15.89	40	Yellow
ALG-163	15.90 - 16.64	40	Orange
ALG-169	16.65 - 17.39	25	Brown
ALG-175	17.40 - 18.29	25	Blue
ALG-188	18.30 - 18.89	25	Black
ALG-192	18.90 - 19.49	25	Yellow
ALG-210	20.90 - 21.79	25	Red
ALG-230	22.60 - 23.59	20	Orange
ALG-240-4	23.60 - 24.79	20	Blue
ALG-270	26.00 - 27.29	20	Red
ALG-293	28.60 - 29.49	10	Orange
ALG-315	30.70 - 32.24	10	Purple
ALG-338	33.50 - 35.34	6	Black

PREFORMED™ Repair Rods

ARR

For Aluminium Conductors AAC, AAAC, ACSR

PREFORMED™ Aluminium Repair Rods are designed to repair damage to aluminium conductor mid-span in a quick and efficient manner. They are ideal for emergency and breakdown situations. Also for repair of mid-span damage in some instances where the outer stranding of the conductor does not exceed 50% damage for 7 & 19 strand conductors or 25% damage for 37 & 61 strand conductors. Aluminium Repair Rods are not suitable as an alternative to Armor Rods. They are not designed as an under-clamp protection device.

Repair Rods are also available for copper conductors, please contact PLP for more information.

Safety and Application Considerations

- This product is intended for a single (one-time) use and for the specified application, although it may be re-applied twice for re tensioning within 90 days from initial installation.
- Do not modify this product in any way.
- This product is intended for use by qualified linesmen only.
- When working in the area of energised line with this product, extra care should be taken to prevent accidental electrical contact.
- For proper performance and personal safety, be sure to select the proper size PREFORMED™ products before application.
- PREFORMED™ products are precision devices. To ensure proper performance, they should be stored in cartons under cover and handled carefully.

Part Number	Conductor Stranding	Standard Pack Quantity	Colour Code
ARR-135	7/4.50	15	Green
ARR-163	19/3.25	15	Orange
ARR-175	30/7/2.50	35	Blue
ARR-188	19/3.75	15	Black
ARR-210	37/3.00	15	Red
ARR-245	37/3.50	10	Purple
ARR-260	30/7/3.71	10	Black
ARR-270	54/7/3.00	10	Red/Black/Blue
ARR-286-8	54/7/3.18	10	Orange
ARR-293	61/3.25	10	Orange
ARR-315	54/7/3.50	10	Purple
ARR-338	61/3.75	4	Black/Blue
ARR-449	91/4.09	1	Orange

Aircraft Warning Sphere

AWS

300 or 600 Diameter

Part Number	Conductor Range (mm)
AWS*-300	6.00 - 25.00
AWS*-600	6.00 - 25.00

Note: UV stabilised fibreglass

D-UFO3

300 Diameter

Part Number	Conductor Range (mm)
D-UFO3060*	6.00 - 7.99
D-UFO3080*	8.00 - 9.99
D-UFO3100*	10.00 - 11.99
D-UFO3120*	12.00 - 13.99
D-UFO3140*	14.00 - 15.99
D-UFO3160*	16.00 - 18.99
D-UFO3190*	19.00 - 22.49
D-UFO3225*	22.50 - 26.49

Note: UV stabilised MD polyethylene

D-UFO6

600 Diameter

Part Number	Conductor Range (mm)
D-UFO6060*	6.00 - 7.99
D-UFO6080*	8.00 - 9.99
D-UFO6100*	10.00 - 11.99
D-UFO6120*	12.00 - 13.99
D-UFO6140*	14.00 - 15.99
D-UFO6160*	16.00 - 17.99
D-UFO6180*	18.00 - 19.99
D-UFO6200*	20.00 - 21.99
D-UFO6220*	22.00 - 23.99
D-UFO6240*	24.00 - 25.99
D-UFO6260*	26.00 - 27.99
D-UFO6280*	28.00 - 29.99
D-UFO6300*	30.00 - 31.99
D-UFO6320*	32.00 - 33.99

Note: UV stabilised MD polyethylene

*** Add suffix for colour:**
W = White
Y = Yellow
R = Red
O = Orange

Spiral Vibration Dampers

SVD

Spiral Vibration Dampers

Made from high impact, UV resistant, polyvinyl chloride (PVC), they are non- corrosive and do not abrade the conductor or require engineering calculations for positioning. Spiral Vibration Dampers are designed to reduce cable vibration at tangent supports and Dead-end positions. The degree of protection needed on a specific line depends upon a number of factors such as line design, temperature, tension and exposure to the wind flow.

Part Number	Conductor Diameter Range (mm)	Standard Pack Quantity	Colour Code
SVD-0102	4.42 - 6.34	30	Red
SVD-0103	6.35 - 8.29	60	Blue
SVD-0104	8.30 - 11.74	60	Black
SVD-0105	11.75 - 14.30	60	Yellow
SVD-0106	14.31 - 19.30	25	Green

Spiral Vibration Damper placement guide:

Span Length (m)	Standard SVD Quantities
0 - 244	2
245 - 488	4
489 - 732	6
733 - 976	8
977 - 1220	10

1. SVD's may be subset together in sets of up to 3 a piece; do not place more than 3 SVD's together in a subset as this can cause them to bind and reduce their overall effectiveness.

2. SVD's have the advantage of being placement independent and may be placed at either end of the span, or on both ends if so desired. However, please note that SVD's are designed to be placed directly on to the conductor or shield wire and not on to rods or attachment hardware. A general recommendation, place SVD's on the bare conductor or shield wire approximately one hand's width away from Suspension Rods, Dead-end Rods, ties, etc.

3. Please consult PLP for recommendations when;
- Flat open Terrain, river or gully crossings
- Tensions are greater than 20% UTS
- Aerial warning spheres are installed

VORTX™ Stockbridge Damper

Aeolian Vibration is a high frequency low amplitude motion caused by smooth laminar winds passing across the line. When conductors or cables are exposed to this wind a phenomenon known as eddy shedding occurs. Eddy or Vortex shedding creates an alternating pressure imbalance inducing the conductor to move up and down at right angles to the direction of air flow. These vibrations take the form of discrete standing waves that can cause support hardware breakdown, conductor fatigue, abrasion and eventually conductor failure.

The VORTX™ Damper exceeds the two response performance with a multi-response design that effectively reduces vibration over a wider range of imposing frequencies. This is accomplished by a design that has unequal messenger strand lengths enhanced in most cases with unequal weights. The weight sizes and messenger strand lengths are matched to specific conductor/cable impedance and line operating conditions that achieve optimum performance.

Features:

- Contoured Clamp - Aluminium alloy extrusions offer a more “precision” fit to evenly capture the conductor. As a result, tightening the bolt brings the clamp components together with evenly distributed pressure along the conductor surface.
- Clamp Profile - The clamp profile is configured to hang from the conductor or cable during installation in accordance with IEC standards. Hands are free to wrench tighten and reach proper torque.
- Messenger Strand - Galvanised steel messenger strand absorbs the vibration energy efficiently with optimum manufacturing techniques.
- Weight - Galvanised modular iron weights hug the sides of the messenger strand, not enclosing it. The possibility of corrosion is reduced.
- Weight Attachment: - PLP offers a collet type or crimped attachment to secure the weights to the messenger. Both meet pull-off strength requirements in accordance with IEC and AS1154.1 standards without changing properties of the adjoining messenger.
- PLP uses a proprietary computer program to make product recommendations for maximising damper performance. The program input considers many variables specific to individual lines, their designs, construction, and local operating conditions. The output recommendations include; specific model VORTX™ Damper, quantity and their placement location on the span.

VORTX™ Stockbridge Damper

VSD - Selection Chart

For AAC, AAAC, ACSR and OPGW

Step 1: Choose conductor diameter from range below

Step 2: Choose clamp size from range below i.e. total diameter including armor rods if applicable

Step 3: Choose corresponding part number

Conductor Selection		Clamp Range		Part Number
Min (mm)	Max (mm)	Min (mm)	Max (mm)	
9.7	11.9	9.7	12.3	VSD-1012
		15.5	20	VSD-1020*
12	18.2	12.3	15.5	VSD-2016
		15.5	20	VSD-2020
		20	25	VSD-2025*
		25	32	VSD-2032*
18.3	21.7	15.5	20	VSD-2520
		20	25	VSD-2525
		25	32	VSD-2532*
21.8	24.9	20	25	VSD-3525
		25	32	VSD-3532*
		32	40.1	VSD-3540*
		40.1	50	VSD-3550*
25	33.9	25	32	VSD-4032
		32	40.1	VSD-4040
		40.1	50	VSD-4050*
		50	61	VSD-4061*
32.1	44.7	32	40.1	VSD-5040
		40.1	50	VSD-5050
		50	61	VSD-5061*

VDSR

VORTX™ Damper Structural Rods

Part Number	Conductor Diameter Range (mm)	Rod Length (mm)	Standard Pack Quantity	Colour Code
VDSR-110	10.5 - 11.49	500	50	Green
VDSR-120	11.5 - 12.49	500	50	Purple
VDSR-130	12.5 - 13.79	500	50	Orange
VDSR-140	13.8 - 14.89	500	50	Blue
VDSR-150	14.9 - 15.49	500	30	Brown
VDSR-160	15.5 - 16.49	500	30	Yellow
VDSR-170	16.5 - 17.49	500	30	Red
VDSR-180	17.5 - 18.49	500	30	Yellow
VDSR-190	18.5 - 19.49	500	30	Yellow
VDSR-200	19.5 - 20.49	500	30	Yellow
VDSR-210	20.5 - 21.49	500	30	Blue
VDSR-320	31.5 - 32.49	700	30	Purple

DOGBONE® Vibration Damper

Dogbone® Vibration Dampers are designed to eliminate conductor fatigue damage and line maintenance costs by effectively diminishing aeolian vibration, thereby allowing increased line tensions. The messenger cable and unique Dogbone® shape of the masses are designed to achieve optimal energy dissipation for minimal clamp movement. The messenger cable and dogbone weights are matched to give additional resonant modes and wider effective frequency response. The mechanical impedance of the damper is matched to the conductor to optimise performance. The offset Dogbone® shaped masses introduces a torsional mode of vibration damping not present in conventional Stockbridge type dampers.

The range of Dogbone® Vibration Dampers is a development resulting from our extensive experience and research in the field of conductor vibration control. The Dogbone® concept is based on the known and proven principles of the Stockbridge Damper but embodies improvements which increase both power dissipation and range of frequency response beyond those of a Stockbridge Damper. The performance of the Dogbone® Vibration Damper has been further improved using the latest CIGRE and IEEE recommended methods including I.S.W.R. Power Dissipation and Mechanical Impedance Testing.

Materials:
- Clamp - cast of high strength aluminium alloy.
- Bolt - stainless steel bolt
- Flat Washer - stainless steel
- Spring Washer - stainless steel
- Messenger - exclusive 19 strand EHS - galvanised steel
- Masses - high grade zinc

Radio Interference Voltage (RIV):
- DOGBONE® Vibration Dampers are designed to be corona free at all operating voltages.

Placement:
- Due to the many parameters involved and the exhaustive tests conducted by DULMISON® for optimum damper placement and performance, it is recommended that PLP be consulted for exact damper requirements.

Part Number	Clamp Dia. Range (mm)	Conductor Type			
		AAC	AAAC	ACSR	SC/GZ
DB05B07SS	7.1-10.0				7/2.75 7/3.25
DB05B10SS	10.1-12.0			Banana	7/3.75 7/4.00
DB05B12SS	12.1-15.0	Mercury moon	Hydrogen Iodine Jade Jasper	Cherry	19/2.75
DB05B15SS	15.1-18.0	Neptune	Krypton Opal	Grape	19/3.25
DB05B18SS	18.1-21.0	Pluto	Neon Pearl		
DB05B21SS	21.1-24.0	Only used for OPGW			
DB05B24SS	24.1-27.0	Only used for OPGW			
DB1B18SS	18.1-21.0	Saturn	Nitrongen Ruby	Lemon	
DB1B21SS	21.1-24.0	Taurus	Oxygen Rutile		
DB2B21SS	21.1-24.0				
DB2B24SS	24.1-27.0	Triton	Phosphorus Sapphire	Lime Mango	
DB2B27SS	27.1-31.0	Uranus	Spinel Selenium	Orange	
DB3B31SS	31.1-34.0	Venus	Silicon Topaz	Olive Paw Paw	

Grading Rings

Corona forms when the voltage gradient at the surface of a conducting material exceeds a critical value and ionises the surrounding air. Corona becomes a great concern at extra high voltages where precautionary measures are necessary. Effects of corona include radio and television interference, voltage loss and audible noise on the line. PLP manufactures grading rings to suit EHV transmission lines for both suspension and tension configurations. Typical designs are shown below for demonstration of PLP's ability to manufacture to customer requirements. Please contact PLP for further information and design suited to your string configuration.

GRT

Grading Ring Tension

Part Number	Description
GRT-330-1	330kV Grading Ring
GRT-500-2	500kW Grading Ring

GRS

Grading Ring Suspension

Part Number	Description
GRS-330-1	330kV Suspension Grading Ring
GRS-500-2	500kV Suspension Grading Ring