



VOLUME 4 – Bill of Material
Watershed 132kV Line diversions
Project ID: CTXQ0827

NED
NWOU-AC
Rev 0

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Comments:

The following document contains the Bill of Material information needed to divert the Kingbird lines from Watershed substation to Sephaku, Klerksdorp North, Makokskraal and Zeerust substations. 16kA OPGW shall be installed on the watershed Sephaku line and Wolf on the other lines.

Please note: Do not order material specified on design bill of materials documents. Material to be ordered is specified on the Order bill of materials document The OPGW is a separate design to be submitted by NED: Control Plant.

Please Note: Contractor to ensure that all material is Eskom approved material according to Eskom's Buyer's Guide

Revision Details: Rev.0

Compiled By

| | | | | | |
|--------------|------------|-------------|--------------|--------------|------|
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|--------------|------------|-------------|--------------|--------------|------|

Watershed 132kV lines diversion

1.1 Structure - 132kV 3-pole intermediate structure

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
|--------------|---|-----------|-----------|------|-----|-------|
| Poles | | | | | | |
| 1 | 132kV 3 pole intermediate structure (18m,20m,18m) | D-DT-7617 | Non-stock | set | 1 | 2 |
| 2 | 132kV 3 pole intermediate structure (16m,18m,16m) | D-DT-7617 | Non-stock | set | 1 | |

Intermediate Insulator Assembly as per D-DT 7321

| | | | | | | |
|---|--|-----------|---------|----|---|----|
| 1 | Insul, Line Post 132kV 5.3kN T/C 31C D7013 | D-DT-7013 | 0180632 | ea | 3 | 6 |
| 2 | Damper,M/F Vibration 20.98-23.90 | D-DT-7005 | 0168893 | ea | 6 | 12 |
| 3 | Armour Rod, HF Cond 23.61/24.79 Al | D-DT 7034 | 0168763 | ea | 3 | 6 |
| 4 | Clamp, Trunnion L/Post Insul 25.5-38 D7010 | D-DT-7010 | 0165511 | ea | 3 | 6 |

Intermediate Earth Wire Assembly (Non-Insulated) as per D-DT-7331 (for Wolf)

| | | | | | | |
|---|--|-----------|---------|----|---|---|
| 1 | Clamp, S/Wire (similar to D-DT-7003,but for Wolf | McWade | H32413 | ea | 1 | 2 |
| 2 | Armour Rod, HF Cond, 18.81/19.86 Al | D-DT-7034 | 0168765 | ea | 1 | 2 |
| 3 | Damper,M/F Vibration 18.13-19.98 | D-DT-7005 | 0168960 | ea | 2 | 4 |

Intermediate Foundation Details as per D-DT-7850

| | | | | | | |
|---|---------------------------|--|-----------|-----|---|---|
| 1 | Foundation in Type 3 Soil | | Non-Stock | set | 3 | 6 |
|---|---------------------------|--|-----------|-----|---|---|

1.2 Structure - 132kV strain monopole self-support

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
|--------------|---|-------------------|-----------|------|-----|-------|
| Poles | | | | | | |
| 1 | 132kV 02 deg strain 18m monopole self-support | strsce0218kw110 | Non-stock | ea | 1 | 9 |
| 2 | 132kV 45 deg strain 18m monopole self-support | strsce4518kw110 | Non-stock | ea | 5 | |
| 3 | 132kV 90 deg strain 18m monopole self-support | strsce9018kw110 | Non-stock | ea | 2 | |
| 4 | 132kV 35 deg strain (16m,18m, 16m) 3pole self-support | str3psce3518kw158 | Non-stock | set | 1 | |

Strain Insulator Assembly as per D-DT 7311

| | | | | | | |
|---|---------------------------------------|-----------|---------|----|---|----|
| 1 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 6 | 54 |
| 2 | Turnbuckle, Eye Tongue 120kN | D-DT-7007 | 0164300 | ea | 6 | 54 |
| 3 | Clevis-Ball 16mm IEC 80x22 120kN | D-DT-6059 | 0222125 | ea | 3 | 27 |
| 4 | Insul, L/Rod 132kV 120kN B/S 31C Comp | D-DT-7014 | 0167607 | ea | 6 | 54 |
| 5 | Socket-Tongue 16mm 120kN | D-DT-6061 | 0010270 | ea | 6 | 54 |
| 6 | Clamp,C D/End Assy K/Bird 23.88 ACSR | D-DT-7000 | 0168747 | ea | 6 | 54 |
| 7 | Damper,M/F Vibration 20.98-23.90 | D-DT-7005 | 0168893 | ea | 6 | 54 |
| 8 | BALL-EYE OVAL 16mm 120kN | D-DT-7008 | 0010258 | ea | 6 | 54 |

Jumper Insulator Assembly as per D-DT 7321

| | | | | | | |
|---|--------------------------------------|-----------|---------|----|---|----|
| 1 | Insul, Line Post 132kV 5.3kN D/E 31C | D-DT-7013 | 0190380 | ea | 3 | 27 |
| 2 | Armour Rod, HF Cond 23.61/24.79 Al | D-DT 7034 | 0168763 | ea | 3 | 27 |
| 3 | Clamp,Susp Pivoted 25.0-40.0 | D-DT-7009 | 0402629 | ea | 3 | 27 |
| 4 | Shackle,Twisted Bolt Type 120kN | D-DT-7019 | 0163408 | ea | 3 | 27 |

Non-insulated Earth Wire Assemblies(strain) as per D-DT-7323/2-NT/697

| | | | | | | |
|---|------------------------------------|-----------|---------|----|---|----|
| 1 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 3 | 27 |
| 2 | Clamp,C D/End Assy Wolf 18.13 ACSR | D-DT-7000 | 0402499 | ea | 2 | 18 |
| 3 | Damper,M/F Vibration 18.13-19.98 | D-DT-7005 | 0168960 | ea | 2 | 18 |
| 4 | Turnbuckle, Eye Tongue 120kN | D-DT-7007 | 164300 | ea | 1 | 9 |

Strain Self Support Foundation Details

| | | | | | | |
|---|---|--------------------|-----------|-----|---|----|
| 1 | 132kV 02 deg strain 18m monopole self-support | D-WC-7602-07-07-02 | Non-Stock | ea | 1 | 9 |
| 2 | 132kV 45 deg strain 18m monopole self-support | D-WC-7602-07-11-03 | Non-Stock | ea | 5 | 45 |
| 3 | 132kV 90 deg strain 18m monopole self-support | D-WC-7602-07-11-03 | Non-Stock | ea | 1 | 9 |
| 4 | 132kV 35 deg strain 18m 3 pole self-support | D-WC-7602-07-07-02 | Non-Stock | set | 1 | 9 |

1.3 Structure - 132kV 3 pole stayed structure

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
|------|--|-----------|-----------|------|-----|-------|
| 1 | 132kV 3 pole stayed strain (16m,18m,16m) | D-DT-7618 | Non-Stock | set | 2 | 3 |
| 2 | 132kV 3 pole stayed strain (20m,22m,20m) | D-DT-7618 | Non-Stock | set | 1 | |

Strain Insulator Assembly as per D-DT 7311

| | | | | | | |
|---|---------------------------------------|-----------|---------|----|---|----|
| 1 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 6 | 18 |
| 2 | Turnbuckle, Eye Tongue 120kN | D-DT-7007 | 0164300 | ea | 3 | 9 |
| 3 | Clevis-Ball 16mm IEC 80x22 120kN | D-DT-6059 | 0222125 | ea | 6 | 18 |
| 4 | Insul, L/Rod 132kV 120kN B/S 31C Comp | D-DT-7014 | 0167607 | ea | 6 | 18 |
| 5 | Socket-Tongue 16mm 120kN | D-DT-6061 | 0010270 | ea | 6 | 18 |
| 6 | Clamp,C D/End Assy K/Bird 23.88 ACSR | D-DT-7000 | 0168747 | ea | 6 | 18 |
| 7 | Damper,M/F Vibration 20.98-23.90 | D-DT-7005 | 0168893 | ea | 6 | 18 |
| 8 | Ball-Eye Oval 16mm 120kN | D-DT-7008 | 0010258 | ea | 6 | 18 |

Please Note: A typical structure will have 6 vibration dampers per span, but the number of dampers depends on span lengths of specific project line design

Jumper Insulator Assembly as per D-DT 7321

| | | | | | | |
|---|--------------------------------------|-----------|---------|----|---|---|
| 1 | Insul, Line Post 132kV 5.3kN D/E 31C | D-DT-7013 | 0190380 | ea | 3 | 9 |
| 2 | Armour Rod, HF Cond 23.61/24.79 Al | D-DT 7034 | 0168763 | ea | 3 | 9 |
| 3 | Clamp,Susp Pivoted 25.0-40.0 | D-DT-7009 | 0402629 | ea | 3 | 9 |
| 4 | Shackle,Twisted Bolt Type 120kN | D-DT-7019 | 0163408 | ea | 3 | 9 |

Non-insulated Earth Wire Assemblies(strain) as per D-DT-7323/2-NT/697

| | | | | | | |
|---|------------------------------------|-----------|---------|----|---|---|
| 1 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 3 | 9 |
| 2 | Clamp,C D/End Assy Wolf 18.13 ACSR | D-DT-7000 | 0402499 | ea | 2 | 6 |
| 3 | Damper,M/F Vibration 18.13-19.98 | D-DT-7005 | 0168960 | ea | 2 | 6 |
| 4 | Turnbuckle, Eye Tongue 120kN | D-DT-7007 | 0164300 | ea | 1 | 3 |

Please Note: A typical structure will have 2 vibration dampers per span, but the number of dampers depends on span lengths of specific project line design

Adjustable M24 Stay Assembly (115kN) as per D-DT 7325

| | | | | | | |
|---|--|-----------|---------|----|-----|-----|
| 1 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 7 | 21 |
| 2 | Thimble,St To Fit 14mm Dia. Wire | D-DT 3026 | 163399 | ea | 7 | 21 |
| 3 | Guygrip D/E St To Fit 19/2.65 Steel Wire | D-DT 7035 | 402537 | ea | 14 | 42 |
| 4 | Wire Strand,St 3X4.00 1100MPa | D-DT-7036 | 0185944 | m | 180 | 540 |
| 5 | Stayrod 133kN 2400X24 Adjust | D-DT 7023 | 0163384 | ea | 17 | 51 |
| 6 | Stay Plate 600X600X6 | D-DT-3172 | 163420 | ea | 7 | 21 |

Strain Foundation Details as per D-DT-7851 Rev.1

| | | | | | | |
|---|----------------------------|-----------|-----------|-----|---|---|
| 1 | Foundation in Type 2 Soils | D-DT-7851 | Non-Stock | set | 3 | 9 |
|---|----------------------------|-----------|-----------|-----|---|---|

| 1.4 Miscellaneous Items | | | | | | |
|--|---|----------------|------------|-------------|------------|--------------|
| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
| 1 | Cond,Acsr Kingbird 23.90D Ungrs | D-DT-3136 | 0400662 | phm | 17940 | 17940 |
| 2 | Joint,M/Span Comp Kingbird 23.87 | D-DT-7001 | 0165770 | ea | 9 | 9 |
| 3 | Joint, M/Span Comp Wolf 18.13 | D-DT-7001 | 0401816 | ea | 3 | 3 |
| 4 | Cond, Acsr Wolf 18.13D Ungrs | D-DT-3136 | 0403037 | m | 5980 | 5980 |
| 5 | Insul, Shield Wire C+T 120kN | D-DT-7012 | 0167605 | ea | 1 | 2 |
| 1.5 Test Joints | | | | | | |
| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
| 1 | Cond,Acsr Kingbird 23.90D Ungrs | D-DT-3136 | 0400662 | m | 10 | 20 |
| 2 | Joint,M/Span Comp Kingbird 23.87 | D-DT-7001 | 0165770 | ea | 1 | 2 |
| 3 | Cond, Acsr Wolf 18.13D Ungrs | D-DT-3136 | 0403037 | m | 10 | 20 |
| 4 | Joint, M/Span Comp Wolf 18.13 | D-DT-7001 | 0401816 | ea | 1 | 2 |
| 5 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 1 | 2 |
| 6 | Clamp,C D/End Assy K/Bird 23.88 ACSR | D-DT-7000 | 0168747 | ea | 2 | 4 |
| 7 | Clamp, Comp D/End Assy Wolf 18.13 | D-DT-7000 | 0402499 | ea | 2 | 4 |
| 1.6 Material for 3 Point Star Earth Electrode as per 2-WT/763 (Structure Footing resistance results to be submitted to the Project Engineer/COW before earthing is done) | | | | | | |
| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY | TOTAL |
| 1 | Cond, Cu Bare Str 7/1.63 Annealed 16mm SQ | D-DT-3139 | 0171336 | m | 40 | 560 |
| 2 | Line Tap, TFR Brass/Tinned M12 | D-DT-3048 | 0165566 | ea | 1 | 14 |
| 3 | Lug, Crimp Cu 50 SQ x M14 fixing Hole (as per D-DT-3102 but with M14 fixing hole) | McWade | Non Stock | ea | 1 | 14 |
| 4 | Clamp, Earth Rod 16 RODPH/BRNZ | D-DT-3093 | 0165559 | ea | 4 | 56 |
| 5 | Earth Rod Cu 1500x16D Threadless | D-DT-3091 | 0168669 | ea | 4 | 56 |
| 6 | Set Screw, Hx Galv M12x40 Nut+Wash | D-DT-3082 | 0163642 | ea | 1 | 14 |
| The amount of the annealed copper conductor to be used for earthing will depend on the resistivity test at each pole: $0 \leq \rho \leq 300$, Cu = 20m. $300 \leq \rho \leq 600$, Cu = 40m. $600 \leq \rho \leq 900$, cu = 60m, $900 \leq \rho \leq 1500$, Cu = 80m | | | | | | |
| Rev.0 | | | | | | |

2.1 Structures Ordering Bill of Materials

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY |
|------|---|-------------------|-----------|------|-----|
| 1 | 132kV 3 pole intermediate structure (18m,20m,18m) | D-DT-7617 | Non-stock | set | 1 |
| 2 | 132kV 3 pole intermediate structure (16m,18m,16m) | D-DT-7617 | Non-stock | set | 1 |
| 3 | 132kV 02 deg strain 18m monopole self-support | strsce0218kw110 | Non-stock | ea | 1 |
| 4 | 132kV 45 deg strain 18m monopole self-support | strsce4518kw110 | Non-stock | ea | 5 |
| 5 | 132kV 90 deg strain 18m monopole self-support | strsce9018kw110 | Non-stock | ea | 2 |
| 6 | 132kV 35 deg strain (16m,18m, 16m) 3pole self-support | str3psce3518kw158 | Non-stock | ea | 1 |
| 7 | 132kV 3 pole stayed strain (16m,18m,16m) | D-DT-7618 | Non-stock | set | 2 |
| 8 | 132kV 3 pole stayed strain (20m,22m,20m) | D-DT-7618 | Non-stock | set | 1 |

2.2 Miscellaneous Equipment Ordering Bill of Materials

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY |
|------|---|-----------|--------------|------|--------|
| 1 | Armour Rod, Hf Cond, 18.81/19.86 Al | D-DT-7034 | 0168765 | ea | 2 |
| 2 | Armour Rod, HF Cond 23.61/24.79 Al | D-DT 7034 | 0168763 | ea | 42 |
| 3 | Insul, L/Rod 132kV 120kN B/S 31C Comp | D-DT-7014 | 0167607 | ea | 72 |
| 4 | BALL-EYE OVAL 16mm 120kN | D-DT-7008 | 0010258 | ea | 72 |
| 5 | Clamp,C D/End Assy Wolf 18.13 ACSR | D-DT-7000 | 0402499 | ea | 28 |
| 6 | Damper,M/F Vibration 20.98-23.90 | D-DT-7005 | 0168893 | ea | 84 |
| 7 | Clamp, S/Wire (similar to D-DT-7003,but for Wolf | McWade | H32413 | ea | 2 |
| 8 | Socket-Tongue 16mm 120kN | D-DT-6061 | 0010270 | ea | 72 |
| 9 | Cond,Acsr Kingbird 23.90D Ungrs | D-DT-3136 | 0400662 | phm | 17 960 |
| 10 | Cond, Acsr Wolf 18.13D Ungrs | D-DT-3136 | 0403037 | m | 6 000 |
| 11 | Cond, Cu Bare Str 7/1.63 Annealed 16mm SQ | D-DT-3139 | 0171336 | m | 560 |
| 12 | Insul, Line Post 132kV 5.3kN T/C 31C D7013 | D-DT-7013 | 0180632 | ea | 42 |
| 13 | Damper,M/F Vibration 18.13-19.98 | D-DT-7005 | 0168960 | ea | 28 |
| 14 | Clamp, Trunnion L/Post Insul 25.5-38 D7010 | D-DT-7010 | 0165511 | ea | 6 |
| 16 | Clamp, Earth Rod 16 RODPH/BRNZ | D-DT-3093 | 0165559 | ea | 56 |
| 17 | Earth Rod Cu 1500x16D Threadless | D-DT-3091 | 0168669 | ea | 56 |
| 18 | Set Screw, Hx Galv M12x40 Nut+Wash | D-DT-3082 | 0163642 | ea | 22 |
| 19 | Insul, Shield Wire C+T 120kN | D-DT-7012 | 0167605 | ea | 2 |
| 20 | Thimble,St To Fit 14mm Dia. Wire | D-DT 3026 | 163399 | ea | 21 |
| 21 | Guygrip D/E St To Fit 19/2.65 Steel Wire | D-DT 7035 | 402537 | ea | 42 |
| 22 | Wire Strand,St 3X4.00 1100MPa | D-DT-7036 | 0185944 | m | 540 |
| 23 | Stayrod 133kN 2400X24 Adjust | D-DT 7023 | 0163384 | ea | 51 |
| 24 | Stay Plate 600X600X6 | D-DT-3172 | 163420 | ea | 21 |
| 25 | Joint,M/Span Comp Kingbird 23.87 | D-DT-7001 | 0165770 | ea | 11 |
| 26 | Joint, M/Span Comp Wolf 18.13 | D-DT-7001 | 0401816 | ea | 5 |
| 27 | Line Tap, TFR Brass/Tinned M12 | D-DT-3048 | 0165566 | ea | 14 |
| 29 | Turnbuckle, Eye Tongue 120kN | D-DT-7007 | 0164300 | ea | 75 |
| 30 | Shackle, Straight Bolt Type 120kN | D-DT-7017 | 0163406 | ea | 131 |
| 31 | Clamp,Susp Pivoted 25.0-40.0 | D-DT-7009 | 0402629 | ea | 36 |
| 32 | Clamp,C D/End Assy K/Bird 23.88 ACSR | D-DT-7000 | 0168747 | ea | 76 |
| 33 | Lug, Crimp Cu 50 SQ x M14 fixing Hole (as per D-DT-3102 but with M14 fixing hole) | McWade | Non Stock 26 | ea | 14 |
| 34 | Shackle, Twisted Bolt Type 120kN | D-DT-7019 | 0163408 | ea | 36 |
| 35 | Clevis-Ball 16mm IEC 80x22 120kN | D-DT-6059 | 0222125 | ea | 45 |

2.3 Labels Ordering Bill of Materials

All labels shall be manufactured in strict accordance with the following Eskom standards, specifications and drawings :

- SCSSCAAP5 LATEST REVISION
- D-DT-5050 LATEST REVISION

| ITEM | DESCRIPTION | DRW. NO | SAP | UNIT | QTY |
|------|----------------------------|-------------|---------|------|-----|
| 1 | Tower Identification Label | D-DT-5050s1 | 1 below | ea | 14 |
| 2 | Line Crossing Label | D-DT-5050s2 | 2 below | ea | 0 |
| 3 | PLATE, PH MKR blu w/blk B | D-DT-6114 | 0172375 | ea | 4 |
| 4 | PLATE, PH MKR red w/blk R | D-DT-6114 | 0172376 | ea | 4 |
| 5 | PLATE, PH MKR wht w/blk W | D-DT-6114 | 0172377 | ea | 4 |

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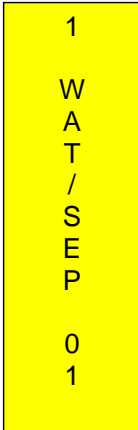
2.3.1 Tower Identification Labels (D-DT-5050 s1)

Notes:

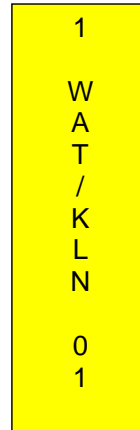
- Approved Viterous Enamel Labels shall be used
- The labels are to be positioned on alternating faces of the structures so that every second label will be visible when viewed from any in-line direction.
- The label shall be installed not less than 5m above ground, measured from the bottom of the label to ground level.

Total of 14 labels

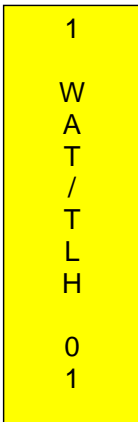
WATERSHED-SEPHAKU



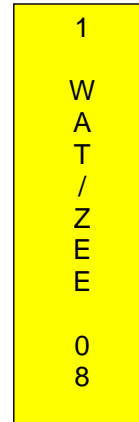
WATERSHED-KLERKSDORP NORTH



WATERSHED-TLHABOLOGANG



WATERSHED-ZEERUST

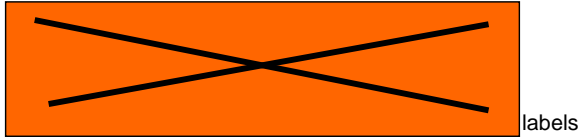


2.3.2 Line Crossing Labels (D-DT-5050 s2)

Notes:

- a) Approved Viterous Enamel Labels shall be used
- b) Line crossing labels shall be installed on three structures on either side of the crossing, facing away from the crossing.
- c) Line crossing labels shall be installed on three structures on either side of a bend larger than 60°, facing away from the bend.

N/A



2.3.3 Phase Disk Labels (D-DT-5047 s3)

Notes:

- a) Approved Viterous Enamel Labels shall be used
- b) Each terminal tower shall be fitted with phase disk labels

Total of 12 labels:

4xR, 4xB & 4xW to be fitted on Watershed Substation Terminal Structures

