### Bollard Pole Manufacturing Details

<table>
<thead>
<tr>
<th>Description</th>
<th>DWG No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100kN Capacity Bollard</strong></td>
<td></td>
</tr>
<tr>
<td>CB101SN/CB102SN 10m x 100kN Bollard Pole</td>
<td>5-19-2-1</td>
</tr>
<tr>
<td>CB121SN/CB122SN 12m x 100kN Bollard Pole</td>
<td>5-19-2-2</td>
</tr>
<tr>
<td>CB141SN/CB142SN 14m x 100kN Bollard Pole</td>
<td>5-19-2-3</td>
</tr>
<tr>
<td>CB161SN/CB162SN 16m x 100kN Bollard Pole</td>
<td>5-19-2-4</td>
</tr>
<tr>
<td><strong>Unstayed Bollard</strong></td>
<td></td>
</tr>
<tr>
<td>CB101UN 10m x 100kN Bollard Pole</td>
<td>5-19-2-5</td>
</tr>
<tr>
<td>CB121UN 12m x 100kN Bollard Pole</td>
<td>5-19-2-6</td>
</tr>
<tr>
<td>CB141UN 14m x 100kN Bollard Pole</td>
<td>5-19-2-7</td>
</tr>
<tr>
<td>CB161UN 16m x 100kN Bollard Pole</td>
<td>5-19-2-8</td>
</tr>
</tbody>
</table>

### 100kN Capacity Bollard
- CB101SN/CB102SN 10m x 100kN Bollard Pole
- CB121SN/CB122SN 12m x 100kN Bollard Pole
- CB141SN/CB142SN 14m x 100kN Bollard Pole
- CB161SN/CB162SN 16m x 100kN Bollard Pole

### Unstayed Bollard
- CB101UN 10m x 100kN Bollard Pole
- CB121UN 12m x 100kN Bollard Pole
- CB141UN 14m x 100kN Bollard Pole
- CB161UN 16m x 100kN Bollard Pole
**NAME PLATE INFORMATION**

- **MANUFACTURER'S NAME/TRADE MARK:**
- **MONTH AND YEAR OF MANUFACTURE:**
- **LENGTH OF POLE (m):**
- **LIMIT STATE DESIGN LOAD (kN):**
- **STOCK CODE:**

**OVERHEAD SUB-TRANSMISSION**

**STAYED MANUFACTURING DETAILS**

- **STAYED**
- **STOCK CODE:**

**LENGTH (m):** 10

**LIMIT STATE DESIGN LOAD (kN):** 30

**TP DIA. (mm):** 315

**STAY FINISH:** 2/S/3

**STRUCTURE TYPE:** CB101SN/CB102SN

**STAY CODE:** 2441145

**A**

**ORIENTATION**

<table>
<thead>
<tr>
<th>ORIENTATION</th>
<th>FITTING DESCRIPTION</th>
<th>TUBE LENGTH</th>
<th>FITTING PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>Tip ring &amp; pole cap</td>
<td>313</td>
<td></td>
</tr>
<tr>
<td>90°</td>
<td>Stay bracket top</td>
<td>317</td>
<td></td>
</tr>
<tr>
<td>180°</td>
<td>Stay bracket bottom</td>
<td>317</td>
<td></td>
</tr>
</tbody>
</table>

**SETTING DEPTH (m):**

- **M12 earth ferrule (30mm thread length)**
- **Name plate**
- **32 OD S/S tube for M24 bolt**
- **32 OD S/S tube**
- **38 OD S/S tube**
- **32 OD S/S tube**

**TRANSVERSE AND TIP LOADS**

- **Transverse Face**
  - \( M^* = 30\,\text{kN} \text{m} \) (in any direction)
  - \( H^* = 30\,\text{kN} \)
  - \( T^* = 15\,\text{kN} \) (in any direction)

- Torsional Loads
  - \( M^* = 20\,\text{kN} \text{m} \)

**NOTES**

1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require \( \pm 2\,\text{mm} \) tolerance between them and \( \pm 2\,\text{mm} \) orientation tolerance.
3. Refer to contract No 2009/0565/T Section 2 for limit state load capacities.
4. Bollard general arrangement drawing 5-11-3-2 (100kN) & 5-11-5-2 (200kN).
5. Stayed bollard is tip of C6S0L.

**POLE DESIGN LOADS**

- Pole is to be designed for:
  1. A strength limit state tip transverse load of \( H^* = 30\,\text{kN} \)
  2. A torsional strength limit state load of \( T^* = 20\,\text{kN} \text{m} \) which can be applied at the top or lower crossarms concurrently.
  3. A strength limit state moment capacity of \( M^* = 30\,\text{kN} \text{m} \)
  4. A strength limit state shear capacity in the lower 3.0m of each pole - \( V^* = (M^*/2.4) \)
  5. Limit state loads at through tubes:
    - M16 Bolt \( V = 50\,\text{kN} \)
    - M20 Bolt \( V = 80\,\text{kN} \) and for a
    - M16 Step Bolt Ferrule \( V = 21\,\text{kN} \)

**200kN Stayed Bollard**

**100kN Stayed Bollard**
<table>
<thead>
<tr>
<th>DISTANCE FROM TIP (mm)</th>
<th>ORIENTATION</th>
<th>FITTING DESCRIPTION</th>
<th>TUBE LENGTH</th>
<th>FITTING PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>T</td>
<td>Tip ring &amp; pole cap</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>270</td>
<td>J</td>
<td>Depth indication mark</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>370</td>
<td>G</td>
<td>M12 earth ferrule (30mm thread length)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>420</td>
<td>J</td>
<td>Depth indication mark</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>500</td>
<td>F</td>
<td>32 OD S/S tube for M24 bolt</td>
<td>1</td>
<td>T</td>
</tr>
<tr>
<td>660</td>
<td>K</td>
<td>5mm galv. cross wires (access barrier)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1100</td>
<td>K</td>
<td>Access barrier</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Notes:
1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance.
3. Refer to contract No 2009/056/5/T Section 2 for limit state load capacities.
4. Bollard general arrangement drawing 5-11-3-2 (100kN) & 5-11-5-2 (200kN).
5. Stayed bollard is tip of CSS0L.

**Transverse and Tip Loads**

**Torsional Loads**

**Pole Design Loads**

Pole is to be designed for:-
1. A strength limit state tip transverse load of $H^* = 30$ kN
2. A torsional strength limit state load of $T^* = 20$ kNm which can be applied at the top or lower crossarms concurrently with 50% of $M^* Max$. 
3. A strength limit state tip moment capacity of $M_x = 30$ kNm
4. A strength limit state shear capacity in the lower 3.0m of each pole - $V_x = (M_x / 2.4)$
5. Limit state loads at through tubes
   - M16 Bolt $V_x = 50$ kN
   - M20 Bolt $V_x = 60$ kN and for a
   - M16 Step Bolt Ferrule $V_x = 21$ kN

**Transverse Face**

$M^* = 30$ kNm

$H^* = 30$ kN

$M_x = 15$ kNm

$T^* = 20$ kNm
**Transverse Face**

\[ M^* = 30kNm \]

\[ H^* = 30kN \]

\[ T^* = 15kNM \]

**Transverse and Tip Loads**

**Torsional Loads**

**Pole Design Loads**

Pole is to be designed for:

1. A strength limit state tip transverse load of \( H^* = 30kN \)
2. A torsional strength limit state load of \( T^* = 15kNM \) which can be applied at the top or lower crossarms concurrently with 50% of \( M^* \) Max.
3. A strength limit state tip moment capacity of \( Mx = 30kNm \)
4. A strength limit state shear capacity in the lower 3.0m of each pole - \( Vx = (Mx / 2.4) \)
5. Limit state loads at through tubes:
   - M16 Bolt Vx fn = 50kN
   - M20 Bolt Vx fn = 60kN and for a
   - M16 Step Bolt Ferrule Vx fn = 21kN

**NOTES**

1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance.
3. Refer to contract No 2009/0565/T Section 2 for limit state load capacities.
4. Bollard general arrangement drawing 5-11-3-2 (100kN) & 5-11-5-2 (200kN).
5. Stayed bollard is tip of C6S0L.
Pole Design Loads

Pole is to be designed for:

1. A strength limit state tip transverse load of $H^* = 30kN$
2. A torsional strength limit state load of $T^* = 20kNm$ which can be applied at the top or lower crossarms concurrently with 50% of $M^*$ Max.
3. A strength limit state tip moment capacity of $M^* = 30kNm$
4. A strength limit state shear capacity in the lower 3.0m of each pole - $Vx < (Mx / 2.4)$
5. Limit state loads at through tubes $M16$ Bolt $Vx$ fn = 50kN, $M20$ Bolt $Vx$ fn = 60kN and for a $M16$ Step Bolt Ferrule $Vx$ fn = 21kN

NOTES

1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance.
3. Refer to contract No 2009/0595/T Section 2 for limit state load capacities.
4. Bollard general arrangement drawing 5-11-3-2 (100kN) & 5-11-5-2 (200kN).
5. Stayed bollard is tip of CSSOL.

Transverse Face

$M^* = 30kNm$

$H^* = 30kN$

(in any direction)

$M^* = 15kNm$

$H^* = 15kNM$

$T^* = 20kNM$

Transverse and Tip Loads

Torsional Loads

200kN Stayed Bollard

100kN Stayed Bollard

Ergon Energy Corporation Ltd
ABN 50 087 646 062
Hard copy
UNCONTROLLED

NOTES
1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance
3. Bollard general arrangement drawing 5-1-1-4-2.
4. Fill tip with concrete to depth of 300mm in lieu of pole cap.
TIP DIA (mm) 465
LENGTH (m) 12
LIMIT STATE DESIGN LOAD (kN) 80
STAY Unstayed

ORIENTATION DISTANCE FROM TIP (mm) FITTING DESCRIPTION TUBE LENGTH FITTING PURPOSE
0° 180° 0° 180° 0° 180°
0 A A A Pole cap and tip ring
150 K K K Pole cap and tip ring
465 F F F 32 OD S/S tube 857 Stay keystone tip bolt (M24)
250 J J J Stay plate
440 J J J 32 OD S/S tube 827 Stay keystone bottom bolt (M24)
1200 J J J Depth indication mark
1200 J J J 38 OD S/S tube 824 Name plate

NOTES
1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance.
3. Bollard general arrangement drawing 5-11-4-2.
4. Fill tip with concrete to depth of 300mm in lieu of pole cap.

STRENGTH LIMIT STATE DESIGN LOAD

<table>
<thead>
<tr>
<th>POLE TIP DIAMETER (mm)</th>
<th>DISTANCE FROM POLE TIP (m)</th>
<th>BENDING MOMENT M (kNm)</th>
<th>SHEAR V (kN)</th>
<th>TORSION T (kNm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
<td>0</td>
<td>100</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>420</td>
<td>1</td>
<td>100</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>435</td>
<td>2</td>
<td>150</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>450</td>
<td>3</td>
<td>240</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>465</td>
<td>4</td>
<td>360</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>460</td>
<td>5</td>
<td>420</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>510</td>
<td>7</td>
<td>560</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>525</td>
<td>8</td>
<td>640</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>540</td>
<td>9</td>
<td>720</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>555</td>
<td>10</td>
<td>800</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>570</td>
<td>11</td>
<td>880</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>585</td>
<td>12</td>
<td>960</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>600</td>
<td>13</td>
<td>1040</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>615</td>
<td>14</td>
<td>1120</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>630</td>
<td>15</td>
<td>1200</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>545</td>
<td>16</td>
<td>1280</td>
<td>250</td>
<td>50</td>
</tr>
</tbody>
</table>

Unstayed bollard consists of the butt end of pole of length "16m".
**NOTES**

1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require ±2 mm tolerance between them and ±2 mm orientation tolerance.
3. Bollard general arrangement drawing 5-11-4-2.
4. Fill tip with concrete to depth of 300mm in lieu of pole cap.

### STRENGTH LIMIT STATE DESIGN LOAD

<table>
<thead>
<tr>
<th>POLE TIP DIAMETER (mm)</th>
<th>DISTANCE FROM TIP (m)</th>
<th>BENDING MOMENT (T·m)</th>
<th>SHEAR V (KN)</th>
<th>TORSION ± T (KN·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
<td>0</td>
<td>100</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>420</td>
<td>1</td>
<td>100</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>435</td>
<td>2</td>
<td>150</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>450</td>
<td>3</td>
<td>240</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>465</td>
<td>4</td>
<td>360</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>480</td>
<td>5</td>
<td>420</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>495</td>
<td>6</td>
<td>500</td>
<td>180</td>
<td>50</td>
</tr>
<tr>
<td>510</td>
<td>7</td>
<td>560</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>525</td>
<td>8</td>
<td>640</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>540</td>
<td>9</td>
<td>720</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>555</td>
<td>10</td>
<td>800</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>570</td>
<td>11</td>
<td>880</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>585</td>
<td>12</td>
<td>960</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>600</td>
<td>13</td>
<td>1040</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>615</td>
<td>14</td>
<td>1200</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>630</td>
<td>15</td>
<td>1200</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>645</td>
<td>16</td>
<td>1280</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>660</td>
<td>17</td>
<td>1350</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>675</td>
<td>18</td>
<td>1440</td>
<td>250</td>
<td>50</td>
</tr>
</tbody>
</table>

**UNSTAYED BOLLARD CONSISTS OF BUTT END OF POLE OF LENGTH 18M.**
### NAME PLATE INFORMATION

- **MANUFACTURER'S NAME/TRADE MARK**:
- **MONTH AND YEAR OF MANUFACTURE**:
- **STOCK NO.**:
- **STANDARD / MARINE GRADE**: ERGON ENERGY
- **STOCK CODE**: 2441210

### MANUFACTURING DETAILS

#### OVERHEAD SUB-TRANSMISSION

- **STOCK CODE**: ERGON ENERGY
- **STANDARD / MARINE GRADE**: BATCH NO.

#### DESCRIPTION

- **FITTING**: A
  - **DESCRIPTION**: Depth indication mark
- **FITTING**: J
  - **DESCRIPTION**: 5mm galv. cross wires (access barrier)
- **FITTING**: T
  - **DESCRIPTION**: Name plate
- **FITTING**: G
  - **DESCRIPTION**: M12 earth ferrule (30mm thread length)
- **FITTING**: F
  - **DESCRIPTION**: 32 OD S/S tube for M24 bolt
- **FITTING**: K
  - **DESCRIPTION**: 32 OD S/S tube

#### NOTES

1. Orientation is measured clockwise when looking down on pole tip.
2. Bracketed fittings require +/- 2 mm tolerance between them and +/- 2mm orientation tolerance.
3. Bollard general arrangement drawing 5-11-4-2.
4. Fill tip with concrete to depth of 300mm in lieu of pole cap.

### STRENGTH LIMIT STATE DESIGN LOAD

#### STRENGTH LIMIT STATE DESIGN LOAD

<table>
<thead>
<tr>
<th>POLE TIP DIAMETER (mm)</th>
<th>DISTANCE FROM POLE TIP (m)</th>
<th>BENDING MOMENT M (kN.m)</th>
<th>SHEAR V (kN)</th>
<th>TORSION T (kNm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
<td>0</td>
<td>100</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>420</td>
<td>1</td>
<td>100</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>435</td>
<td>2</td>
<td>150</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>450</td>
<td>3</td>
<td>240</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>465</td>
<td>4</td>
<td>360</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>480</td>
<td>5</td>
<td>420</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>495</td>
<td>6</td>
<td>500</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>510</td>
<td>7</td>
<td>640</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>525</td>
<td>8</td>
<td>720</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>540</td>
<td>9</td>
<td>800</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>555</td>
<td>10</td>
<td>900</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>570</td>
<td>11</td>
<td>1000</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>585</td>
<td>12</td>
<td>1120</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>600</td>
<td>13</td>
<td>1200</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>615</td>
<td>14</td>
<td>1320</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>630</td>
<td>15</td>
<td>1400</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>645</td>
<td>16</td>
<td>1520</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>660</td>
<td>17</td>
<td>1600</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>675</td>
<td>18</td>
<td>1720</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>690</td>
<td>19</td>
<td>1800</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>705</td>
<td>20</td>
<td>1920</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>720</td>
<td>21</td>
<td>2000</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>735</td>
<td>22</td>
<td>2080</td>
<td>250</td>
<td>50</td>
</tr>
</tbody>
</table>

- **Unstayed bollard consists of the butt end of pole of length '22m'.**

---

**Ergon Energy Corporation Ltd**

ABN 50 087 646 062

**DRAWING NUMBER:** 5-19-2-8

**SUPERSEDES:**

**DRAWING NUMBER:** 5-19-2-8

**DRAWN:** R MARGANI

**CHECKED:** P DE SOUSA ROQUE

**APPROVED:** K STOLZ

**DATE:** 7/08/2013

**OVERHEAD SUB-TRANSMISSION**

- **66kV CONCRETE POLE MANUFACTURING DETAILS**
- **10kN CAPACITY UNSTAYED BOLLARD - 16m**

---

**STAY**

- **Unstayed**

**STOCK CODE:** ERGON ENERGY

**STANDARD / MARINE GRADE**

**BATCH NO.**

**STOCK CODE:** 2441210