<table>
<thead>
<tr>
<th>Appendix M</th>
<th>CM Traction motors</th>
<th>1</th>
</tr>
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<tbody>
<tr>
<td><strong>M.1</strong></td>
<td>Load profile</td>
<td>2</td>
</tr>
<tr>
<td><strong>M.1.1</strong></td>
<td>Section 21</td>
<td>2</td>
</tr>
<tr>
<td><strong>M.1.1.1</strong></td>
<td>Morning shifts</td>
<td>2</td>
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<td><strong>M.1.1.2</strong></td>
<td>Afternoon shifts</td>
<td>15</td>
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<tr>
<td><strong>M.1.2</strong></td>
<td>Section 51</td>
<td>28</td>
</tr>
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<td><strong>M.1.2.1</strong></td>
<td>Morning shifts</td>
<td>28</td>
</tr>
<tr>
<td><strong>M.1.2.2</strong></td>
<td>Afternoon shifts</td>
<td>37</td>
</tr>
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<td><strong>M.2</strong></td>
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<td>46</td>
</tr>
<tr>
<td><strong>M.2.1</strong></td>
<td>Section 21</td>
<td>47</td>
</tr>
<tr>
<td><strong>M.2.1.1</strong></td>
<td>Morning shifts</td>
<td>47</td>
</tr>
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<td><strong>M.2.1.2</strong></td>
<td>Afternoon shifts</td>
<td>50</td>
</tr>
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<td><strong>M.2.2</strong></td>
<td>Section 51</td>
<td>53</td>
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<td><strong>M.2.2.1</strong></td>
<td>Morning shifts</td>
<td>53</td>
</tr>
<tr>
<td><strong>M.2.2.2</strong></td>
<td>Afternoon shifts</td>
<td>56</td>
</tr>
<tr>
<td><strong>M.2.3</strong></td>
<td>Flashcard recorder</td>
<td>59</td>
</tr>
<tr>
<td><strong>M.2.3.1</strong></td>
<td>Morning shifts</td>
<td>59</td>
</tr>
<tr>
<td><strong>M.2.3.2</strong></td>
<td>Afternoon shifts</td>
<td>62</td>
</tr>
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<td><strong>M.3</strong></td>
<td>Thermal capacity</td>
<td>65</td>
</tr>
<tr>
<td><strong>M.3.1</strong></td>
<td>Section 21</td>
<td>65</td>
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<tr>
<td><strong>M.3.1.1</strong></td>
<td>Morning shifts</td>
<td>65</td>
</tr>
<tr>
<td><strong>M.3.1.2</strong></td>
<td>Afternoon shifts</td>
<td>69</td>
</tr>
<tr>
<td><strong>M.3.2</strong></td>
<td>Section 51</td>
<td>73</td>
</tr>
<tr>
<td><strong>M.3.2.1</strong></td>
<td>Morning shifts</td>
<td>73</td>
</tr>
<tr>
<td><strong>M.3.2.2</strong></td>
<td>Afternoon shifts</td>
<td>76</td>
</tr>
</tbody>
</table>
APPENDIX M

CM TRACTION MOTORS

Typical nameplate data for the traction motors of a CM can be seen in Table M-1. The traction motors measured at section 21 was a 250 V, 37 kW DC motor with a full load current rating of 167 A. The traction motor at section 51 was a 250 V, 50 kW DC motor with a full load current rating of 226 A.

Table M-1: Nameplate data of traction motor on a CM.

<table>
<thead>
<tr>
<th>CM Traction Motors</th>
<th>Power</th>
<th>Voltage</th>
<th>Duty</th>
<th>Current</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37 / 50 kW</td>
<td>250 V</td>
<td>S2 - 60</td>
<td>167 A</td>
<td>1650 / 1500</td>
</tr>
<tr>
<td></td>
<td>50 kW</td>
<td></td>
<td></td>
<td>226 A</td>
<td></td>
</tr>
</tbody>
</table>

Table M-2: Production figures for shifts that the traction motors were investigated.

<table>
<thead>
<tr>
<th>Date</th>
<th>Sect 21 Morning</th>
<th>Afternoon</th>
<th>Sect 61 Morning</th>
<th>Afternoon</th>
<th>Sect 51 Morning</th>
<th>Afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-May-2005</td>
<td>858</td>
<td>2145</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18-May-2005</td>
<td>1320</td>
<td>2112</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19-May-2005</td>
<td>1716</td>
<td>2013</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>23-May-2005</td>
<td></td>
<td></td>
<td>1740</td>
<td>2030</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>24-May-2005</td>
<td></td>
<td></td>
<td>1450</td>
<td>2320</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>25-May-2005</td>
<td></td>
<td></td>
<td>1740</td>
<td></td>
<td>1305</td>
<td>2175</td>
</tr>
<tr>
<td>10-Jun-2005</td>
<td>1575</td>
<td>2695</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13-Jun-2005</td>
<td>2310</td>
<td>2520</td>
<td>-</td>
<td>-</td>
<td>1305</td>
<td>2175</td>
</tr>
<tr>
<td>14-Jun-2005</td>
<td>1610</td>
<td>1750</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>29-Jun-2005</td>
<td></td>
<td></td>
<td>1740</td>
<td></td>
<td>2175</td>
<td></td>
</tr>
<tr>
<td>30-Jun-2005</td>
<td></td>
<td></td>
<td>1740</td>
<td></td>
<td>2175</td>
<td></td>
</tr>
</tbody>
</table>
M.1 LOAD PROFILE

The next section focuses on the load profiles of the traction motors. Each graph shows the line voltage and the voltage limits, the load current and full load current capacity of the traction motors. The morning shifts and afternoon shifts are separated as well as the measurements made at the different sections.

M.1.1 SECTION 21

M.1.1.1 Morning shifts

Figure M.1-1: Load power for a LH traction motor – 10 June 2005.
Figure M.1-2: Load power for a LH traction motor – 10 June 2005 (30 minute period).

Figure M.1-3: Load current for a LH traction motor – 10 June 2005.
Figure M.1-4: Load current for a LH traction motor – 10 June 2005 (30 minute period).

Figure M.1-5: Load power for a RH traction motor – 10 June 2005.
Figure M.1-6: Load power for a RH traction motor – 10 June 2005 (30 minute period).

Figure M.1-7: Load current for a RH traction motor – 10 June 2005.
Figure M.1-8: Load current for a RH traction motor – 10 June 2005 (30 minute period).

Figure M.1-9: Load power for a LH traction motor – 13 June 2005.
Figure M.1-10: Load power for a LH traction motor
– 13 June 2005 (30 minute period).

Figure M.1-11: Load current for a LH traction motor – 13 June 2005.
Figure M.1-12: Load current for a LH traction motor – 13 June 2005 (30 minute period).

Figure M.1-13: Load power for a RH traction motor – 13 June 2005.
Figure M.1-14: Load power for a RH traction motor – 13 June 2005 (30 minute period).

Figure M.1-15: Load current for a RH traction motor – 13 June 2005.
Figure M.1-16: Load current for a RH traction motor
– 13 June 2005 (30 minute period).

Figure M.1-17: Load power for a LH traction motor – 14 June 2005.
Figure M.1-18: Load power for a LH traction motor – 14 June 2005 (30 minute period).

Figure M.1-19: Load current for a LH traction motor – 14 June 2005.
Figure M.1-20: Load current for a LH traction motor
– 14 June 2005 (30 minute period).

Figure M.1-21: Load power for a RH C traction motor – 14 June 2005.
Figure M.1-22: Load power for a RH traction motor
– 14 June 2005 (30 minute period).

Figure M.1-23: Load current for a RH traction motor – 14 June 2005.
Figure M.1-24: Load current for a RH traction motor
– 14 June 2005 (30 minute period).
M.1.1.2 Afternoon shifts

Figure M.1-25: Load power for a LH traction motor – 10 June 2005.
Figure M.1-26: Load power for a LH traction motor
– 10 June 2005 (30 minute period).

Figure M.1-27: Load current for a LH traction motor – 10 June 2005.
Figure M.1-28: Load current for a LH traction motor
– 10 June 2005 (30 minute period).

Figure M.1-29: Load power for a RH traction motor – 10 June 2005.
Figure M.1-30: Load power for a RH traction motor – 10 June 2005 (30 minute period).

Figure M.1-31: Load current for a RH traction motor – 10 June 2005.
Figure M.1-32: Load current for a RH traction motor
– 10 June 2005 (30 minute period).

Figure M.1-33: Load power for a LH traction motor – 13 June 2005.
Figure M.1-34: Load power for a LH traction motor – 13 June 2005 (30 minute period).

Figure M.1-35: Load current for a LH traction motor – 13 June 2005.
Figure M.1-36: Load current for a LH traction motor
– 13 June 2005 (30 minute period).

Figure M.1-37: Load power for a RH traction motor – 13 June 2005.
Figure M.1-38: Load power for a RH traction motor – 13 June 2005 (30 minute period).

Figure M.1-39: Load current for a RH traction motor – 13 June 2005.
**Figure M.1-40:** Load current for a RH traction motor – 13 June 2005 (30 minute period).

**Figure M.1-41:** Load power for a LH traction motor – 14 June 2005.
Figure M.1-42: Load power for a LH traction motor – 14 June 2005 (30 minute period).

Figure M.1-43: Load current for a LH traction motor – 14 June 2005.
Figure M.1-44: Load current for a LH traction motor
– 14 June 2005 (30 minute period).

Figure M.1-45: Load power for a RH traction motor – 14 June 2005.
Figure M.1-46: Load power for a RH traction motor
– 14 June 2005 (30 minute period).

Figure M.1-47: Load current for a RH traction motor – 14 June 2005.
Figure M.1-48: Load current for a RH traction motor
– 14 June 2005 (30 minute period).
Figure M.1-49: Load power for a LH C traction motor – 29 June 2005.
Figure M.1-50: Load power for a LH traction motor
– 29 June 2005 (30 minute period).

Figure M.1-51: Load current for a LH traction motor – 29 June 2005.
Figure M.1-52: Load current for a LH traction motor
– 29 June 2005 (30 minute period).

Figure M.1-53: Load power for a RH C traction motor – 29 June 2005.
Figure M.1-54: Load power for a RH traction motor – 29 June 2005 (30 minute period).

Figure M.1-55: Load current for a RH traction motor – 29 June 2005.
Figure M.1-56: Load current for a RH traction motor – 29 June 2005 (30 minute period).

Figure M.1-57: Load power for a LH traction motor – 30 June 2005.
Figure M.1-58: Load power for a LH traction motor – 30 June 2005 (30 minute period).

Figure M.1-59: Load current for a LH traction motor – 30 June 2005.
Figure M.1-60: Load current for a LH traction motor – 30 June 2005 (30 minute period).

Figure M.1-61: Load power for a RH traction motor – 30 June 2005.
Figure M.1-62: Load power for a RH traction motor – 30 June 2005 (30 minute period).

Figure M.1-63: Load current for a RH traction motor – 30 June 2005.
Figure M.1-64: Load current for a RH traction motor
– 30 June 2005 (30 minute period).
M.1.2.2  Afternoon shifts

Figure M.1-65: Load power for a LH traction motor – 29 June 2905.
Figure M.1-66: Load power for a LH traction motor – 29 June 2905 (30 minute period).

Figure M.1-67: Load current for a LH traction motor – 29 June 2905.
Figure M.1-68: Load current for a LH traction motor
– 29 June 2005 (30 minute period).

Figure M.1-69: Load power for a RH traction motor – 29 June 2005.
Figure M.1-70: Load power for a RH traction motor
– 29 June 2005 (30 minute period).

Figure M.1-71: Load current for a RH traction motor – 29 June 2005.
Figure M.1-72: Load current for a RH traction motor
– 29 June 2005 (30 minute period).

Figure M.1-73: Load power for a LH traction motor – 30 June 2005.
Figure M.1-74: Load power for a LH traction motor – 30 June 2005 (30 minute period).

Figure M.1-75: Load current for a LH traction motor – 30 June 2005.
Figure M.1-76: Load current for a LH traction motor – 30 June 2005 (30 minute period).

Figure M.1-77: Load power for a RH traction motor – 30 June 2005.
Figure M.1-78: Load power for a RH traction motor
– 30 June 2005 (30 minute period).

Figure M.1-79: Load current for a RH traction motor – 30 June 2005.
Figure M.1-80: Load current for a RH traction motor
– 30 June 2005 (30 minute period).
M.2 HISTOGRAM

The next section focuses on the frequency with which a CMs traction motors consumed a certain load power and current. The graphs show the number of times a certain power or current has been consumed. The tables give data about the tonnes produced during the shift and the percentage time of the shift that the motors were producing. The time that the motors have been over loaded or loaded within the full load rating of the motor is given as a percentage of the actual producing time. The morning shifts and afternoon shifts are separated as well as the measurements made at the different sections.
M.2.1 SECTION 21

M.2.1.1 Morning shifts

Table M-3: Data for the total consumption of a LH traction motor in section 21.

<table>
<thead>
<tr>
<th></th>
<th>10-Jun-05</th>
<th>13-Jun-05</th>
<th>14-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1575</td>
<td>2310</td>
<td>1610</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>34.81%</td>
<td>37.92%</td>
<td>32.42%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>60.00%</td>
<td>61.43%</td>
<td>64.45%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>40.00%</td>
<td>38.57%</td>
<td>35.55%</td>
</tr>
</tbody>
</table>

Figure M.2-1: Histogram for power consumed by a LH traction motor.
Figure M.2-2: Histogram for current consumed by a LH C traction motor.

Table M-4: Data for the total consumption of a RH traction motor in section 21.

<table>
<thead>
<tr>
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<th>10-Jun-05</th>
<th>13-Jun-05</th>
<th>14-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1575</td>
<td>2310</td>
<td>1610</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>34.63%</td>
<td>37.49%</td>
<td>31.98%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>60.46%</td>
<td>63.42%</td>
<td>66.94%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>39.54%</td>
<td>36.58%</td>
<td>33.06%</td>
</tr>
</tbody>
</table>
Figure M.2-3: Histogram for power consumed by a RH traction motor.

Figure M.2-4: Histogram for current consumed by a RH traction motor.
M.2.1.2 Afternoon shifts

Table M-5: Data for the total consumption of a LH traction motor in section 21.

<table>
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<th>13-Jun-05</th>
<th>14-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>2695</td>
<td>2520</td>
<td>1750</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>37.91%</td>
<td>49.04%</td>
<td>33.70%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>63.28%</td>
<td>55.50%</td>
<td>53.33%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>36.72%</td>
<td>44.50%</td>
<td>46.67%</td>
</tr>
</tbody>
</table>

Figure M.2-5: Histogram for power consumed by a LH traction motor.
Figure M.2-6: Histogram for current consumed by a LH traction motor.

Table M-6: Data for the total consumption of a RH traction motor in section 21.

<table>
<thead>
<tr>
<th></th>
<th>10-Jun-05</th>
<th>13-Jun-05</th>
<th>14-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>2695</td>
<td>2520</td>
<td>1750</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>37.56%</td>
<td>48.55%</td>
<td>33.31%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>64.63%</td>
<td>55.41%</td>
<td>54.14%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>35.37%</td>
<td>44.59%</td>
<td>45.86%</td>
</tr>
</tbody>
</table>
Figure M.2-7: Histogram for power consumed by a RH traction motor.

Figure M.2-8: Histogram for current consumed by a RH traction motor.
M.2.2 SECTION 51

M.2.2.1 Morning shifts

Table M-7: Data for the total consumption of a LH traction motor in section 51.

<table>
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<th></th>
<th>29-Jun-05</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1305</td>
<td>1740</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>26.48%</td>
<td>36.01%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>76.87%</td>
<td>74.22%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>23.13%</td>
<td>25.78%</td>
</tr>
</tbody>
</table>

Figure M.2-9: Histogram for power consumed by a LH traction motor.
Figure M.2-10: Histogram for current consumed by a LH traction motor.

Table M-8: Data for the total consumption of a RH traction motor in section 51.

<table>
<thead>
<tr>
<th></th>
<th>29-Jun-05</th>
<th>30-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1305</td>
<td>1740</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>26.17%</td>
<td>35.61%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>88.11%</td>
<td>82.94%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>11.89%</td>
<td>17.06%</td>
</tr>
</tbody>
</table>
Figure M.2-11: Histogram for power consumed by a RH traction motor.

Figure M.2-12: Histogram for current consumed by a RH C traction motor.
M.2.2.2 Afternoon shifts

Table M-9: Data for the total consumption of a LH traction motor in section 51.

<table>
<thead>
<tr>
<th></th>
<th>29-Jun-05</th>
<th>30-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>2175</td>
<td>2320</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>42.74%</td>
<td>44.51%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>73.74%</td>
<td>71.11%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>26.26%</td>
<td>28.89%</td>
</tr>
</tbody>
</table>

Figure M.2-13: Histogram for power consumed by a LH traction motor.
Figure M.2-14: Histogram for current consumed by a LH traction motor.

Table M-10: Data for the total consumption of a RH traction motor in section 51.

<table>
<thead>
<tr>
<th></th>
<th>29-Jun-05</th>
<th>30-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>2175</td>
<td>2320</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>41.95%</td>
<td>43.70%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>82.16%</td>
<td>81.67%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>17.84%</td>
<td>18.33%</td>
</tr>
</tbody>
</table>
Figure M.2-15: Histogram for power consumed by a RH traction motor.

Figure M.2-16: Histogram for current consumed by a RH traction motor.
M.2.3 FLASHCARD RECORDER

M.2.3.1 Morning shifts

Table M-11: Data for the total consumption of a LH traction motor in section 21 & 61.

<table>
<thead>
<tr>
<th></th>
<th>16-May-05</th>
<th>17-May-05</th>
<th>18-May-05</th>
<th>23-May-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1551</td>
<td>858</td>
<td>1320</td>
<td>1740</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>38.59%</td>
<td>23.11%</td>
<td>22.87%</td>
<td>42.92%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>58.78%</td>
<td>50.29%</td>
<td>53.86%</td>
<td>81.40%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>41.22%</td>
<td>49.71%</td>
<td>46.14%</td>
<td>18.60%</td>
</tr>
</tbody>
</table>

Figure M.2-17: Histogram for power consumed by a LH traction motor.
Figure M.2-18: Histogram for current consumed by a LH traction motor.

Table M-12: Data for the total consumption of a RH traction motor in section 21 & 61.

<table>
<thead>
<tr>
<th></th>
<th>16-May-05</th>
<th>17-May-05</th>
<th>18-May-05</th>
<th>23-May-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1551</td>
<td>858</td>
<td>1320</td>
<td>1740</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>38.68%</td>
<td>23.15%</td>
<td>22.40%</td>
<td>42.71%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>62.19%</td>
<td>51.17%</td>
<td>57.67%</td>
<td>77.75%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>37.81%</td>
<td>48.83%</td>
<td>42.33%</td>
<td>22.25%</td>
</tr>
</tbody>
</table>
Figure M.2-19: Histogram for power consumed by a RH traction motor.

Figure M.2-20: Histogram for current consumed by a RH traction motor.
M.2.3.2 Afternoon shifts

Table M-13: Data for the total consumption of a LH traction motor in section 21 & 61.

<table>
<thead>
<tr>
<th></th>
<th>16-May-05</th>
<th>17-May-05</th>
<th>18-May-05</th>
<th>23-May-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1485</td>
<td>2145</td>
<td>2112</td>
<td>2030</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>37.20%</td>
<td>34.24%</td>
<td>45.00%</td>
<td>44.99%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>52.93%</td>
<td>38.14%</td>
<td>44.81%</td>
<td>74.76%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>47.07%</td>
<td>61.86%</td>
<td>55.19%</td>
<td>25.24%</td>
</tr>
</tbody>
</table>

Figure M.2-21: Histogram for power consumed by a LH traction motor.
Figure M.2-22: Histogram for current consumed by a LH traction motor.

Table M-14: Data for the total consumption of a RH traction motor in section 21 & 61.

<table>
<thead>
<tr>
<th></th>
<th>16-May-05</th>
<th>17-May-05</th>
<th>18-May-05</th>
<th>23-May-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1485</td>
<td>2145</td>
<td>2112</td>
<td>2030</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>37.25%</td>
<td>34.29%</td>
<td>46.65%</td>
<td>44.84%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>49.62%</td>
<td>39.68%</td>
<td>43.42%</td>
<td>70.10%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>50.38%</td>
<td>60.32%</td>
<td>56.58%</td>
<td>29.90%</td>
</tr>
</tbody>
</table>
Figure M.2-23: Histogram for power consumed by a RH traction motor.

Figure M.2-24: Histogram for current consumed by a RH traction motor.
M.3 THERMAL CAPACITY

The next section focuses on the temperature of the windings of the traction motors. Each graph shows the temperature of the motor, the load current and rated full load current of the motor. The morning shifts and afternoon shifts are separated as well as the measurements made at the different sections. The thermal time constant is 40 minutes for the 37 kW motor and 45 minutes for the 50 kW motor.

M.3.1 SECTION 21

M.3.1.1 Morning shifts

Figure M.3-1: Load current and motor temperature for a LH traction motor – 10 June 2005.
Figure M.3-2: Load current and motor temperature for a RH traction motor
– 10 June 2005.

Figure M.3-3: Load current and motor temperature for a LH traction motor
Figure M.3-4: Load current and motor temperature for a RH traction motor

Figure M.3-5: Load current and motor temperature for a LH traction motor
Figure M.3-6: Load current and motor temperature for a RH traction motor
M.3.1.2 Afternoon shifts

Figure M.3-7: Load current and motor temperature for a LH traction motor – 10 June 2005.
Figure M.3-8: Load current and motor temperature for a RH traction motor – 10 June 2005.

Figure M.3-9: Load current and motor temperature for a LH traction motor – 13 June 2005.
Figure M.3-10: Load current and motor temperature for a RH traction motor

Figure M.3-11: Load current and motor temperature for a LH traction motor
Figure M.3-12: Load current and motor temperature for a RH traction motor – 14 June 2005.
M.3.2 SECTION 51

M.3.2.1 Morning shifts

Figure M.3-13: Load current and motor temperature for a LH traction motor
Figure M.3-14: Load current and motor temperature for a RH traction motor – 29 June 2005.

Figure M.3-15: Load current and motor temperature for a LH traction motor – 30 June 2005.
Figure M.3-16: Load current and motor temperature for a RH traction motor
M.3.2.2  Afternoon shifts

Figure M.3-17: Load current and motor temperature for a LH traction motor – 29 June 2005.
Figure M.3-18: Load current and motor temperature for a RH traction motor

Figure M.3-19: Load current and motor temperature for a LH traction motor
Figure M.3-20: Load current and motor temperature for a RH traction motor – 30 June 2005.