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APPENDIX R

FEEDER BREAKER CRUSHER MOTOR

Typical nameplate data for the crusher motors of a Feeder breaker can be seen in Table R-1. The crusher motors measured at both sections was a 55 kW induction motor with a full load current rating of 39 A.

Table R-1: Nameplate data of the cutter motor on a CM.

<table>
<thead>
<tr>
<th>Feeder breaker</th>
<th>Crusher Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>55 kW</td>
</tr>
<tr>
<td>Duty</td>
<td>S1</td>
</tr>
<tr>
<td>Ins class</td>
<td>H</td>
</tr>
<tr>
<td>Voltage</td>
<td>1000 V</td>
</tr>
<tr>
<td>Current</td>
<td>39 A</td>
</tr>
<tr>
<td>RPM</td>
<td>1475</td>
</tr>
<tr>
<td>pf</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Table R-2: Production figures for shifts that the crusher motors were investigated.

<table>
<thead>
<tr>
<th>Date</th>
<th>Sect 21</th>
<th>Sect 51</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morning</td>
<td>Afternoon</td>
</tr>
<tr>
<td>31-May-2005</td>
<td>1782</td>
<td>1716</td>
</tr>
<tr>
<td>1-Jun-2005</td>
<td>1254</td>
<td>1980</td>
</tr>
<tr>
<td>2-Jun-2005</td>
<td>1320</td>
<td>2145</td>
</tr>
</tbody>
</table>
R.1 LOAD PROFILE

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

R.1.1 SECTION 21

R.1.1.1 Morning shifts

Figure R.1-1: Load current and voltage for a LH crusher motor – 31 May 2005.
Figure R.1-2: Load current and voltage for a LH crusher motor – 31 May 2005 (30 minute period).

Figure R.1-3: Load current and voltage for a RH crusher motor – 31 May 2005.
Figure R.1-4: Load current and voltage for a RH crusher motor – 31 May 2005 (30 minute period).

Figure R.1-5: Load current and voltage for a LH crusher motor – 01 June 2005.
Figure R.1-6: Load current and voltage for a LH crusher motor – 01 June 2005 (30 minute period).

Figure R.1-7: Load current and voltage for a RH crusher motor – 01 June 2005.
Figure R.1-8: Load current and voltage for a RH crusher motor – 01 June 2005 (30 minute period).

Figure R.1-9: Load current and voltage for a LH crusher motor – 02 June 2005.
Figure R.1-10: Load current and voltage for a LH crusher motor – 02 June 2005 (30 minute period).

Figure R.1-11: Load current and voltage for a RH crusher motor – 02 June 2005.
Figure R.1-12: Load current and voltage for a RH crusher motor
– 02 June 2005 (30 minute period).
R.1.1.2 Afternoon shifts

Figure R.1-13: Load current and voltage for a LH crusher motor – 31 May 2005.
Figure R.1-14: Load current and voltage for a LH crusher motor – 31 May 2005 (30 minute period).

Figure R.1-15: Load current and voltage for a RH crusher motor – 31 May 2005.
Figure R.1-16: Load current and voltage for a RH crusher motor – 31 May 2005 (30 minute period).

Figure R.1-17: Load current and voltage for a LH crusher motor – 01 June 2005.
Figure R.1-18: Load current and voltage for a LH crusher motor
- 01 June 2005 (30 minute period).

Figure R.1-19: Load current and voltage for a RH crusher motor – 01 June 2005.
Figure R.1-20: Load current and voltage for a RH crusher motor
– 01 June 2005 (30 minute period).

Figure R.1-21: Load current and voltage for a LH crusher motor – 02 June 2005.
Figure R.1-22: Load current and voltage for a LH crusher motor – 02 June 2005 (30 minute period).

Figure R.1-23: Load current and voltage for a RH crusher motor – 02 June 2005.
Figure R.1-24: Load current and voltage for a RH crusher motor
– 02 June 2005 (30 minute period).
R.2 HISTOGRAM

The next section focuses on the frequency with which a Feeder breakers crusher 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.
R.2.1 SECTION 21

R.2.1.1 Morning shifts

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

<table>
<thead>
<tr>
<th></th>
<th>31-May-05</th>
<th>1-Jun-05</th>
<th>2-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1782</td>
<td>1254</td>
<td>1320</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>74.50%</td>
<td>50.27%</td>
<td>58.45%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Figure R.2-1: Histogram for power consumed by a LH crusher motor.
Figure R.2-2: Histogram for current consumed by a LH crusher motor.

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

<table>
<thead>
<tr>
<th></th>
<th>31-May-05</th>
<th>1-Jun-05</th>
<th>2-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1782</td>
<td>1254</td>
<td>1320</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>74.50%</td>
<td>50.29%</td>
<td>58.45%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Figure R.2-3: Histogram for power consumed by a RH crusher motor.

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

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

<table>
<thead>
<tr>
<th></th>
<th>31-May-05</th>
<th>1-Jun-05</th>
<th>2-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1716</td>
<td>1980</td>
<td>2145</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>74.44%</td>
<td>84.89%</td>
<td>64.34%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th></th>
<th>31-May-05</th>
<th>1-Jun-05</th>
<th>2-Jun-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes/CM/Shift</td>
<td>1716</td>
<td>1980</td>
<td>2145</td>
</tr>
<tr>
<td>% Time of shift producing</td>
<td>74.43%</td>
<td>84.89%</td>
<td>64.34%</td>
</tr>
<tr>
<td>% of Production time underloaded</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>% of Production time overloaded</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Figure R.2-7: Histogram for power consumed by a RH crusher motor.

Figure R.2-8: Histogram for current consumed by a RH crusher motor.
R.3 THERMAL CAPACITY

The next section focuses on the temperature of the windings of the crusher 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 45 minutes.

R.3.1 SECTION 21

R.3.1.1 Morning shifts

Figure R.3-1: Load current and motor temperature for a LH crusher motor
Figure R.3-2: Load current and motor temperature for a RH crusher motor

Figure R.3-3: Load current and motor temperature for a LH crusher motor
– 01 June 2005.
Figure R.3-4: Load current and motor temperature for a RH crusher motor
– 01 June 2005.

Figure R.3-5: Load current and motor temperature for a LH crusher motor
– 02 June 2005.
Figure R.3-6: Load current and motor temperature for a RH crusher motor  
– 02 June 2005
R.3.1.2 Afternoon shifts

Figure R.3-7: Load current and motor temperature for a LH crusher motor – 31 May 2005.
Figure R.3-8: Load current and motor temperature for a RH crusheur motor

Figure R.3-9: Load current and motor temperature for a LH crusheur motor
– 01 June 2005.
Figure R.3-10: Load current and motor temperature for a RH crusher motor
– 01 June 2005.

Figure R.3-11: Load current and motor temperature for a LH crusher motor
– 02 June 2005.
Figure R.3-12: Load current and motor temperature for a RH crusher motor
– 02 June 2005.