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APPENDIX L

CM CUTTER MOTORS

Typical nameplate data for the cutter motors of a CM can be seen in Table L-1. The cutter motors measured at all the sections was a 175 kW induction motor with a full load current rating of 133 A.

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

CM Cutter Motors					
Power	175	kW	Voltage	1000	V
Duty	S1		Current	133	A
Ins class	H		RPM	1475	
			pf	0.79	

Table L-2: Production figures for shifts that the cutter motors were investigated.

Date	Sect 21		Sect 61		Sect 51	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
17-May-2005	858	2145	-	-	-	-
18-May-2005	1320	2112	-	-	-	-
19-May-2005	1716	2013	-	-	-	-
23-May-2005	-	-	1740	2030	-	-
24-May-2005	-	-	1450	2320	-	-
25-May-2005	-	-	2320	1160	-	-
6-Jun-2005	2079	1485	-	-	-	-
7-Jun-2005	1925	1435	-	-	-	-
8-Jun-2005	1750	2240	-	-	-	-
23-Jun-2005	-	-	-	-	1856	1566
28-Jun-2005	-	-	-	-	2204	1740

L.1 LOAD PROFILE

The next section focuses on the load profiles of the cutter 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.

L.1.1 SECTION 21

L.1.1.1 Morning shifts

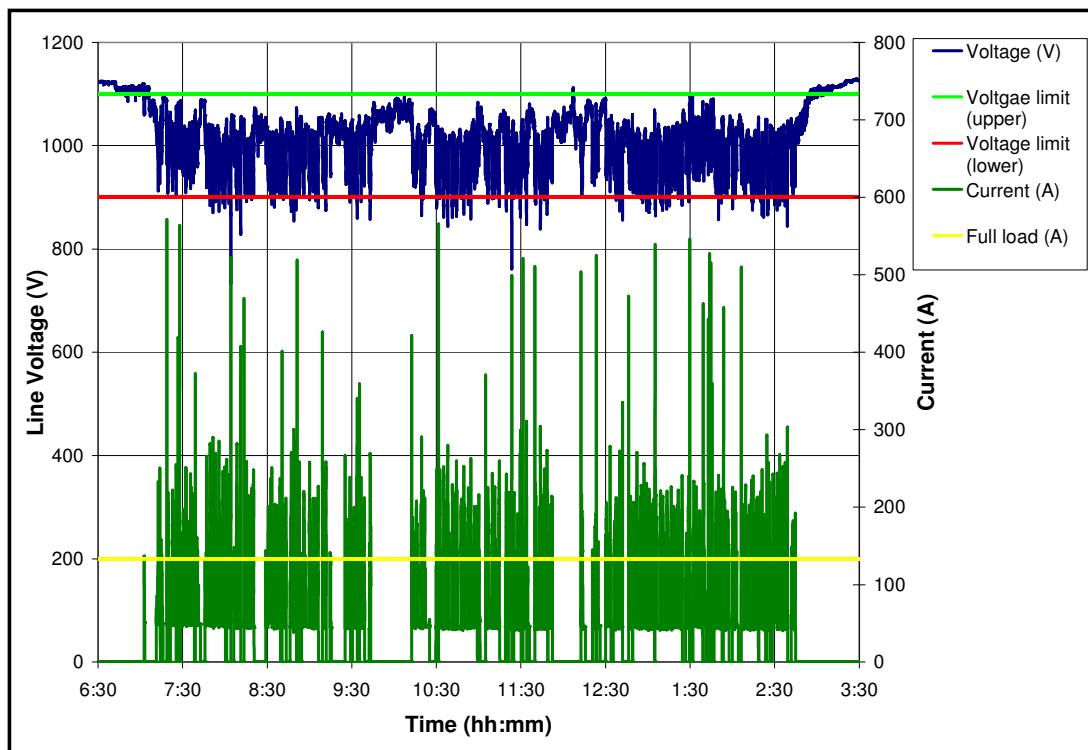
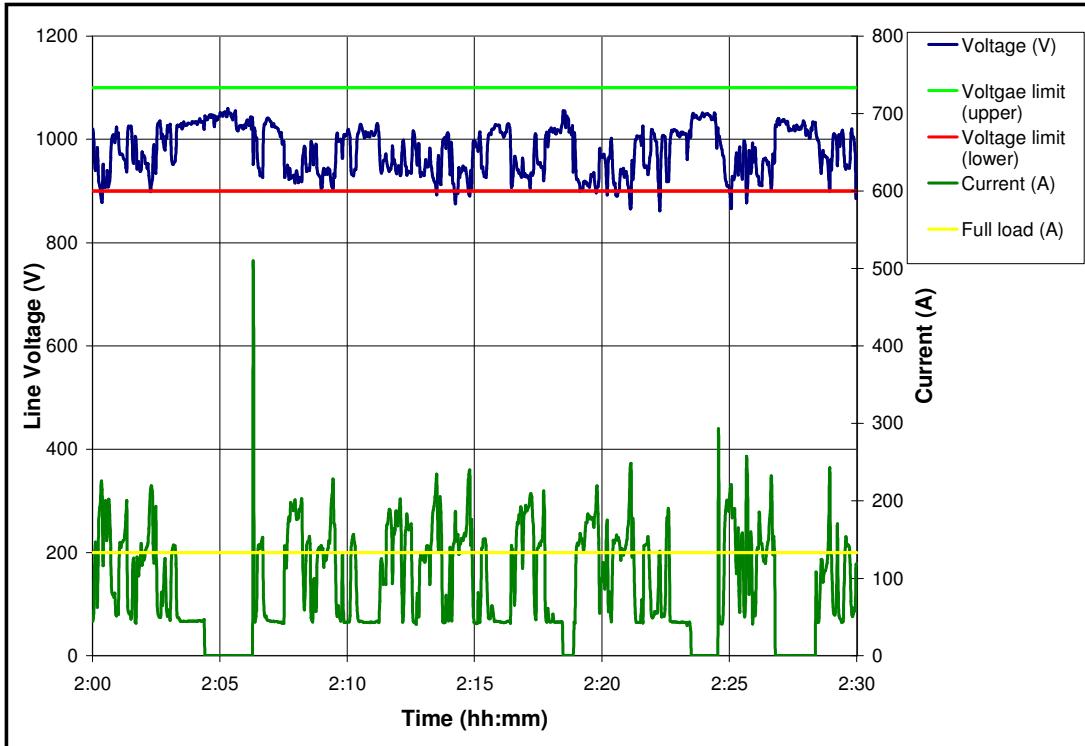


Figure L.1-1: Load current and voltage for a LH cutter motor – 6 June 2005.



**Figure L.1-2: Load current and voltage for a LH cutter motor – 6 June 2005
(30 minute period).**

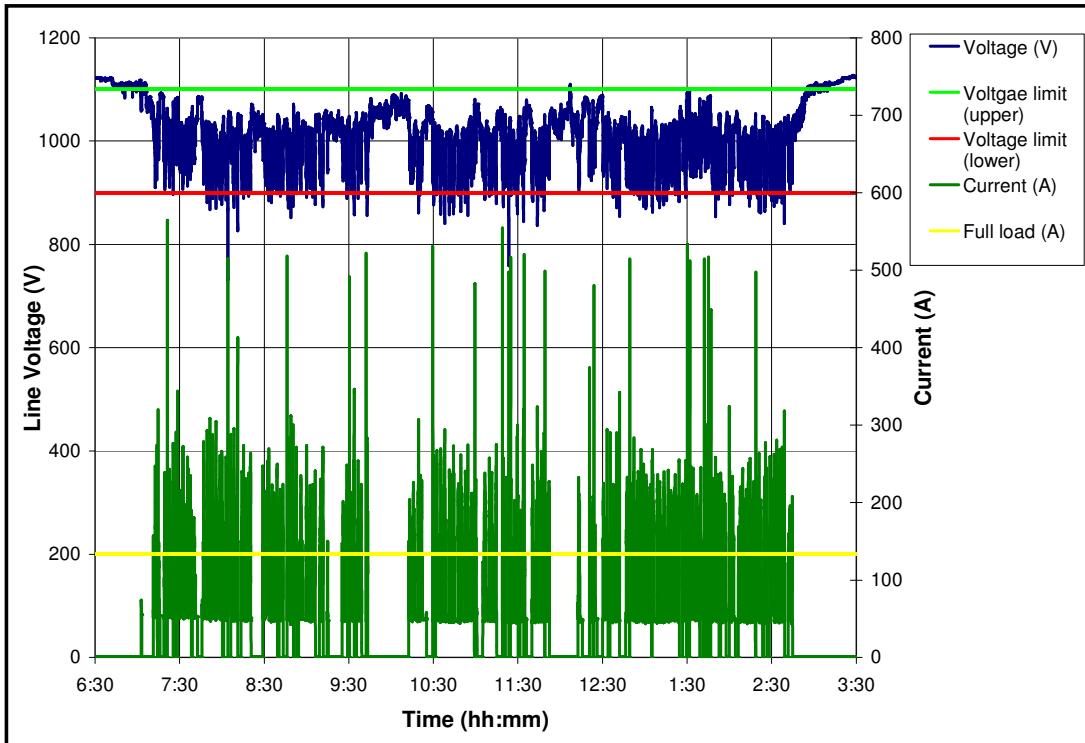
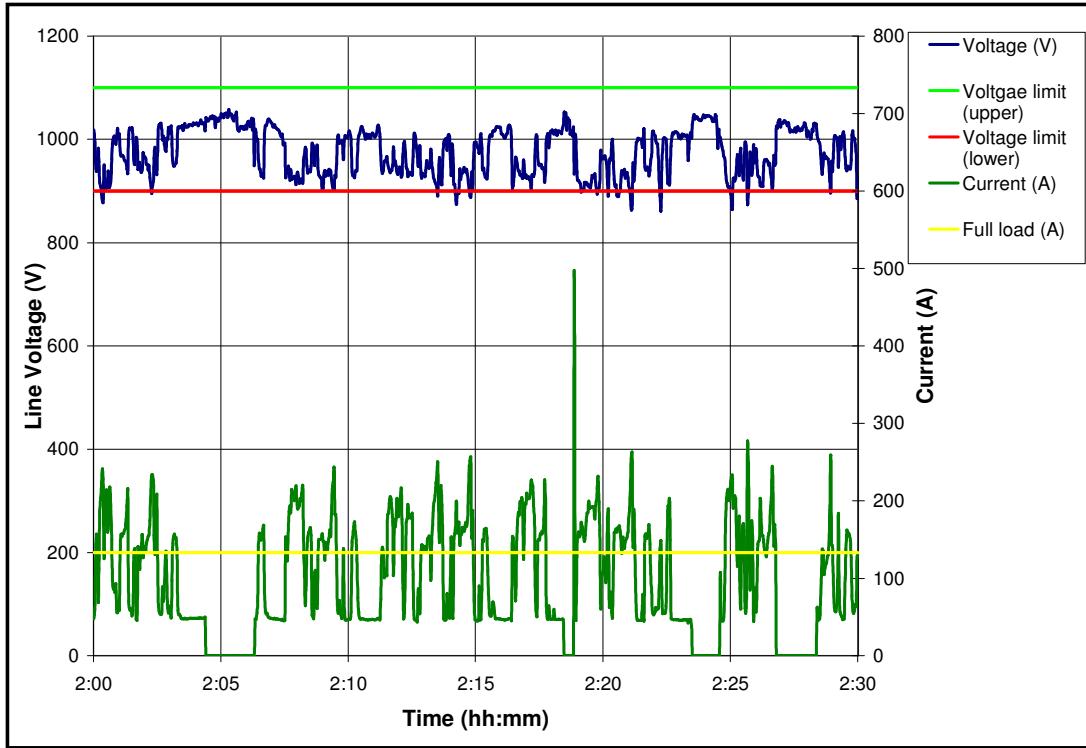


Figure L.1-3: Load current and voltage for a RH cutter motor – 6 June 2005.



**Figure L.1-4: Load current and voltage for a RH cutter motor – 6 June 2005
(30 minute period).**

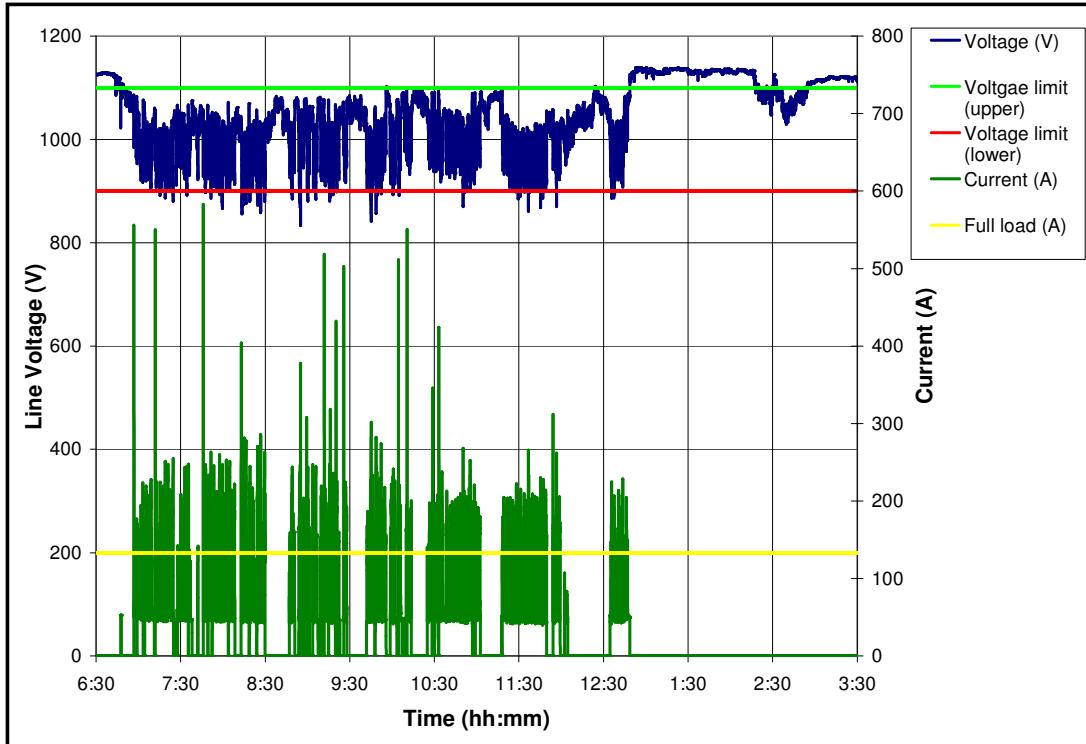
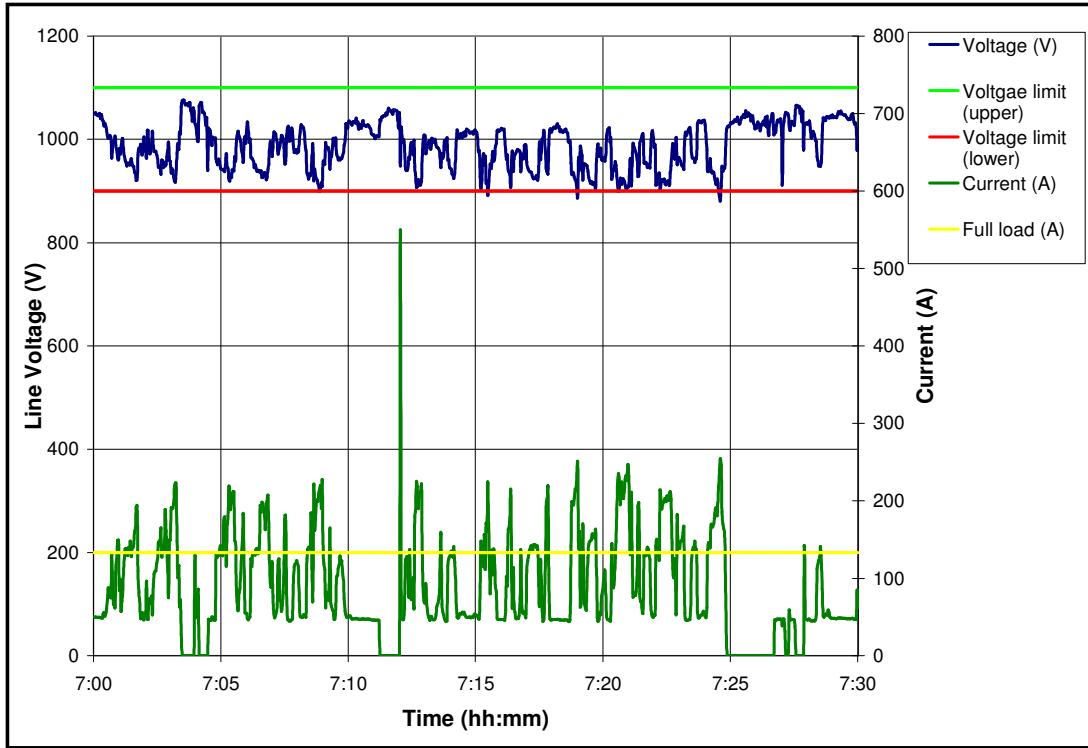


Figure L.1-5: Load current and voltage for a LH cutter motor – 7 June 2005.



**Figure L.1-6: Load current and voltage for a LH cutter motor – 7 June 2005
(30 minute period).**

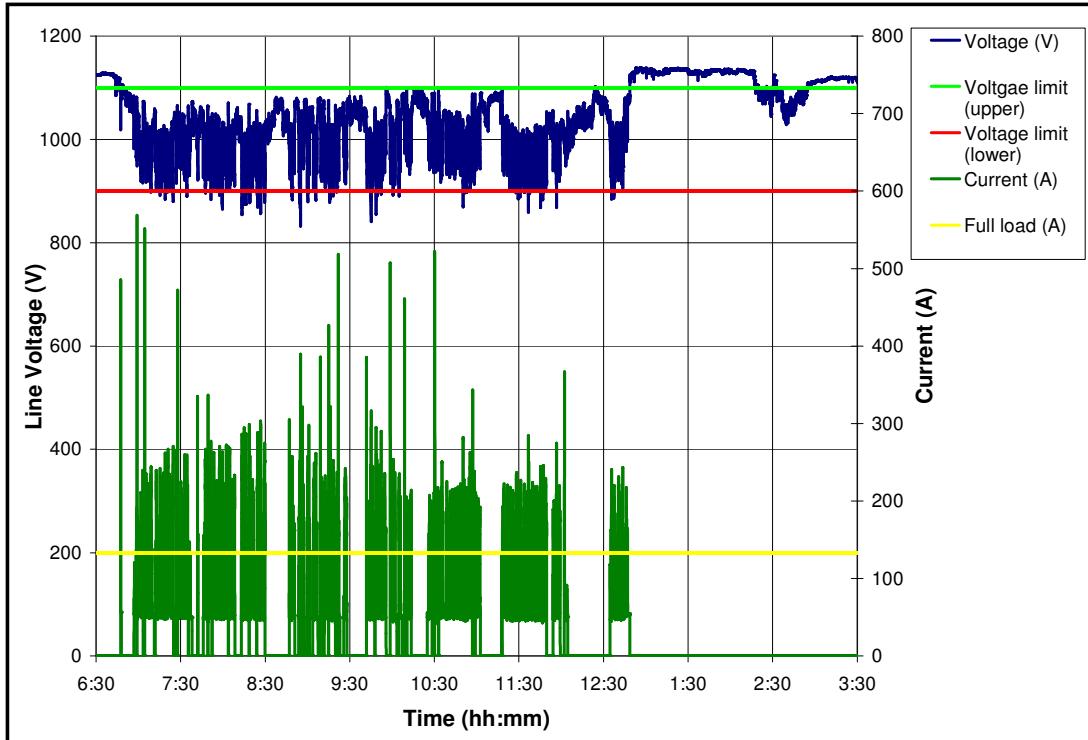
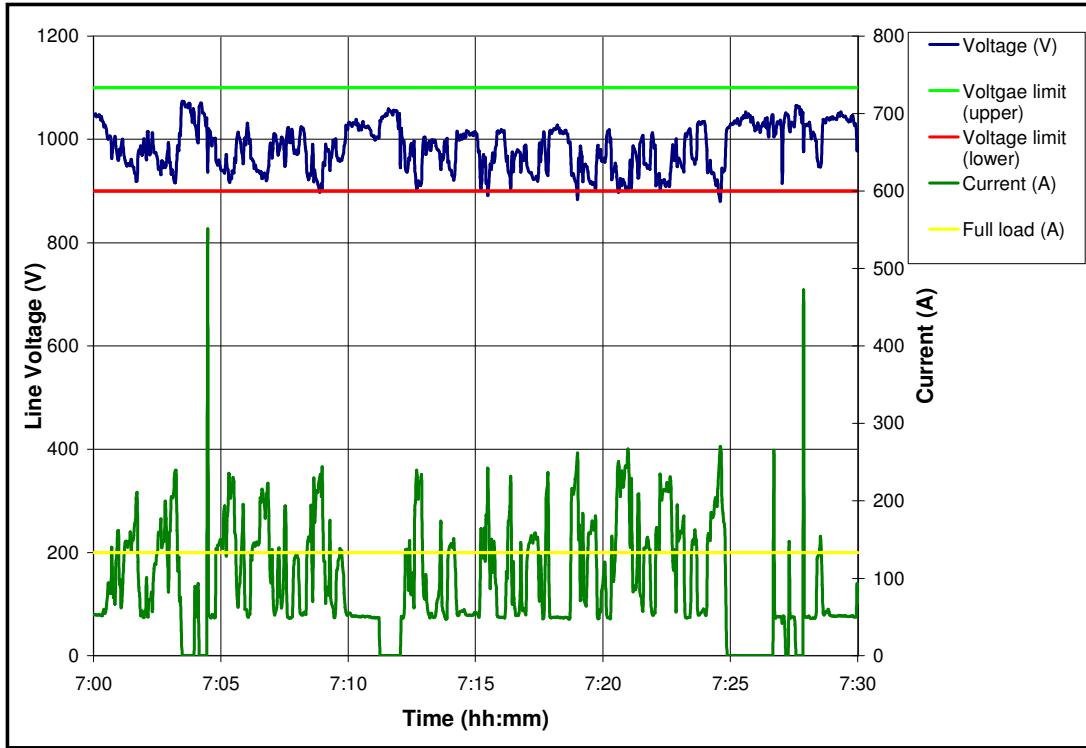


Figure L.1-7: Lo Load current and voltage for a RH cutter motor – 7 June 2005.



**Figure L.1-8: Load current and voltage for a RH cutter motor – 7 June 2005
(30 minute period).**

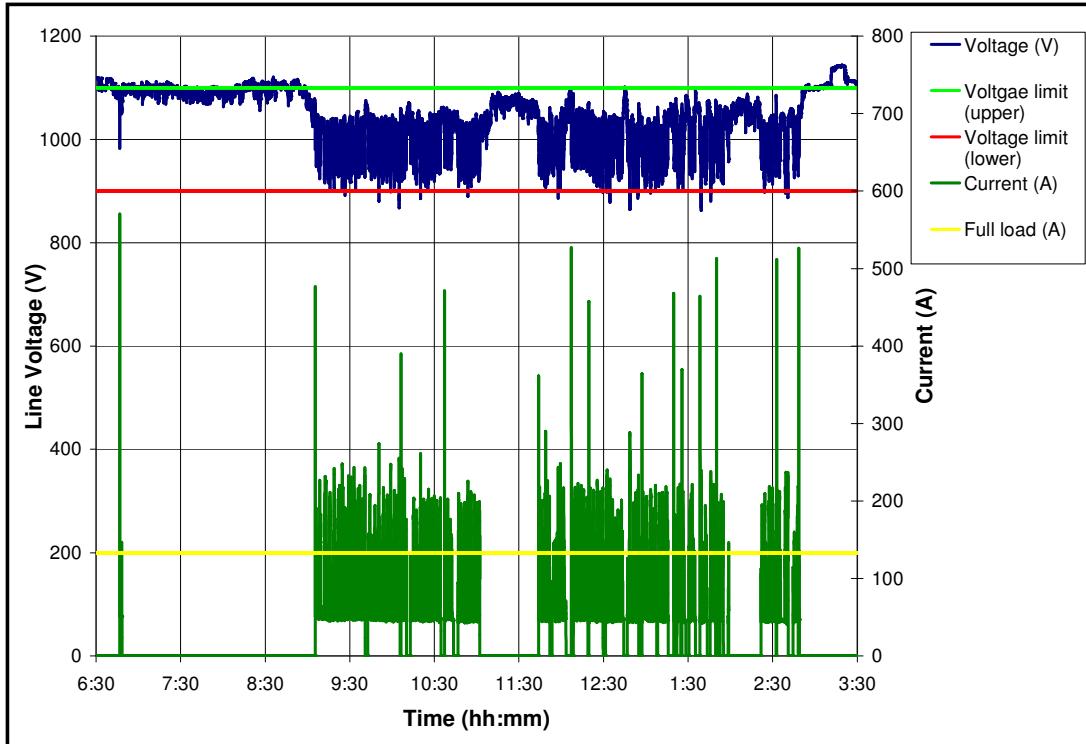
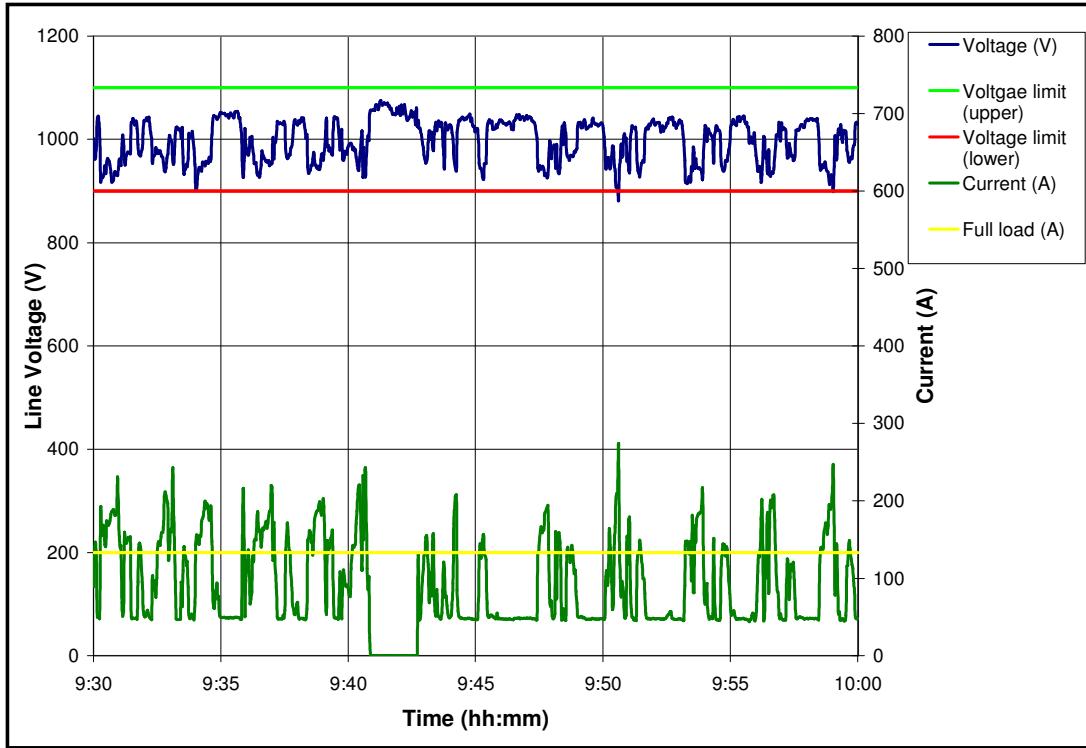


Figure L.1-9: Load current and voltage for a LH cutter motor – 8 June 2005.



**Figure L.1-10: Load current and voltage for a LH cutter motor – 8 June 2005
(30 minute period).**

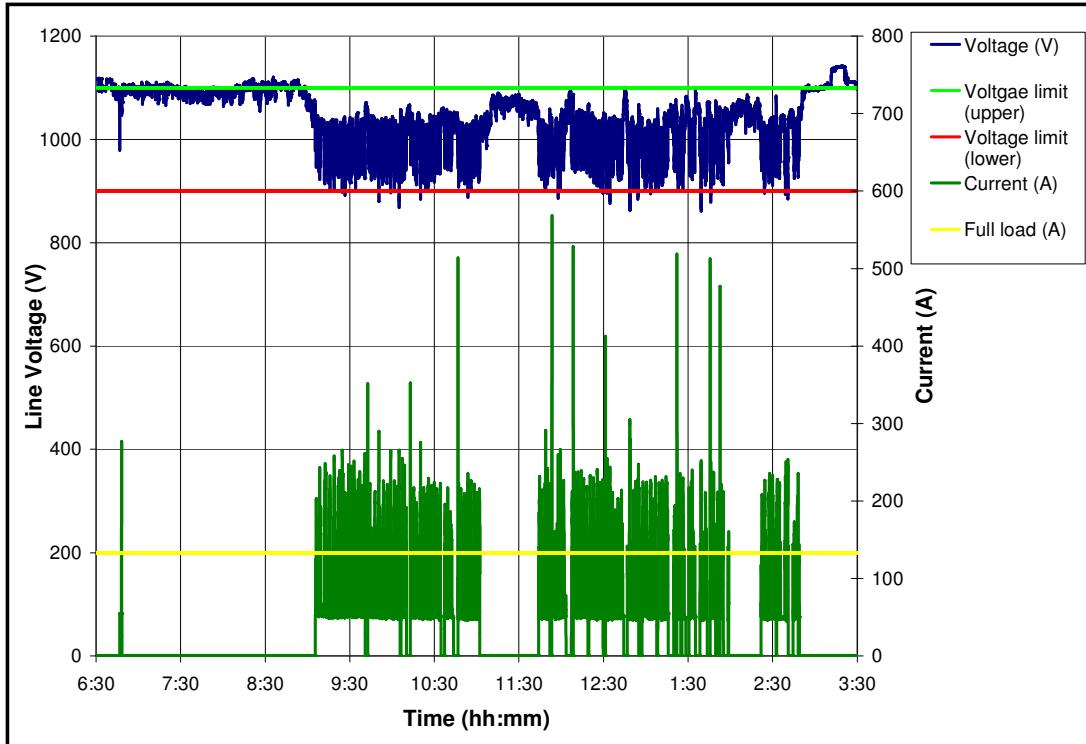
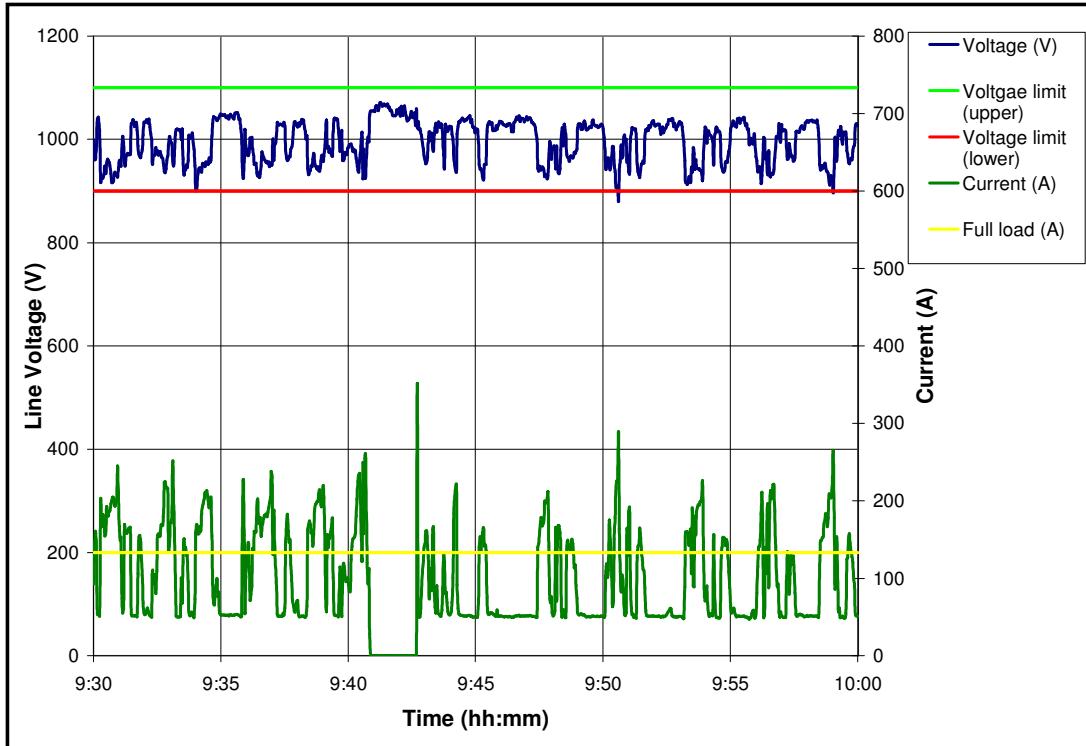


Figure L.1-11: Load current and voltage for a RH cutter motor – 8 June 2005.



**Figure L.1-12: Load current and voltage for a RH cutter motor – 8 June 2005
(30 minute period).**

L.1.1.2 Afternoon shifts

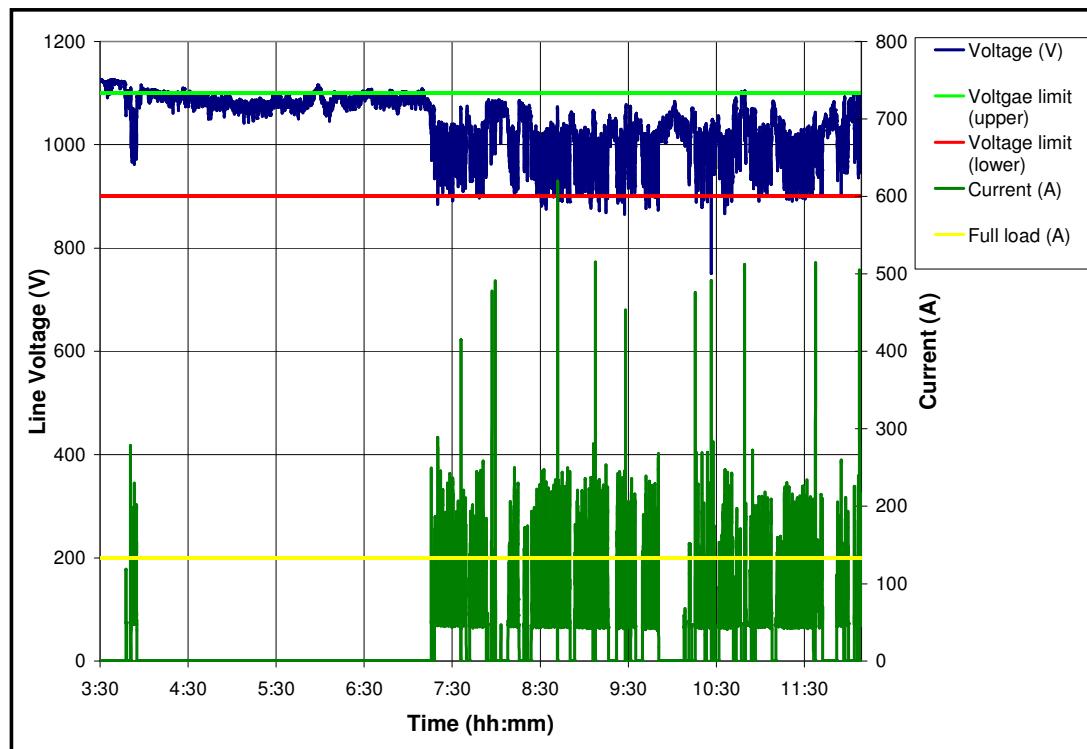
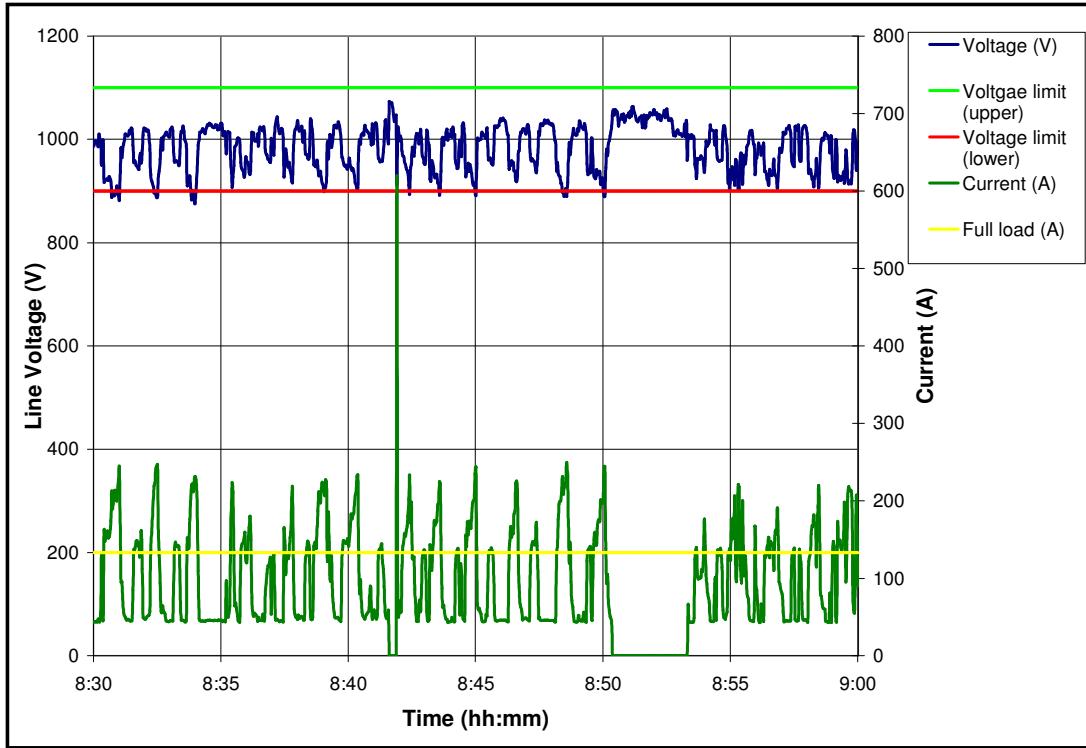


Figure L.1-13: Load current and voltage for a LH cutter motor – 6 June 2005.



**Figure L.1-14: Load current and voltage for a LH cutter motor – 6 June 2005
(30 minute period).**

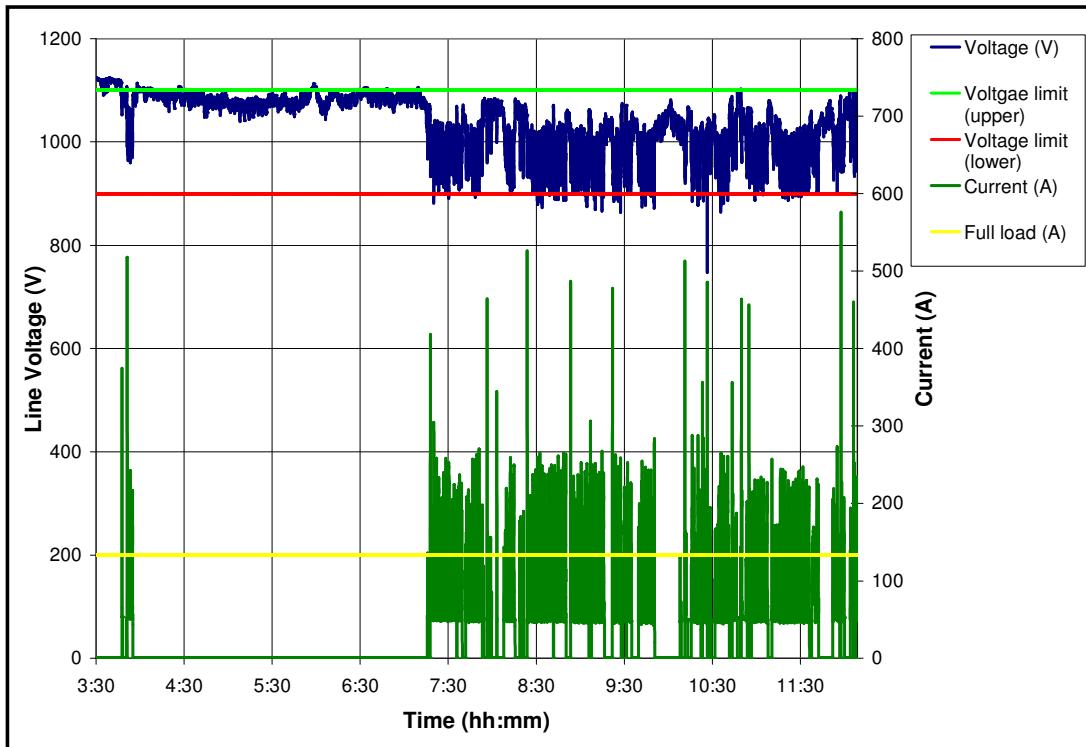
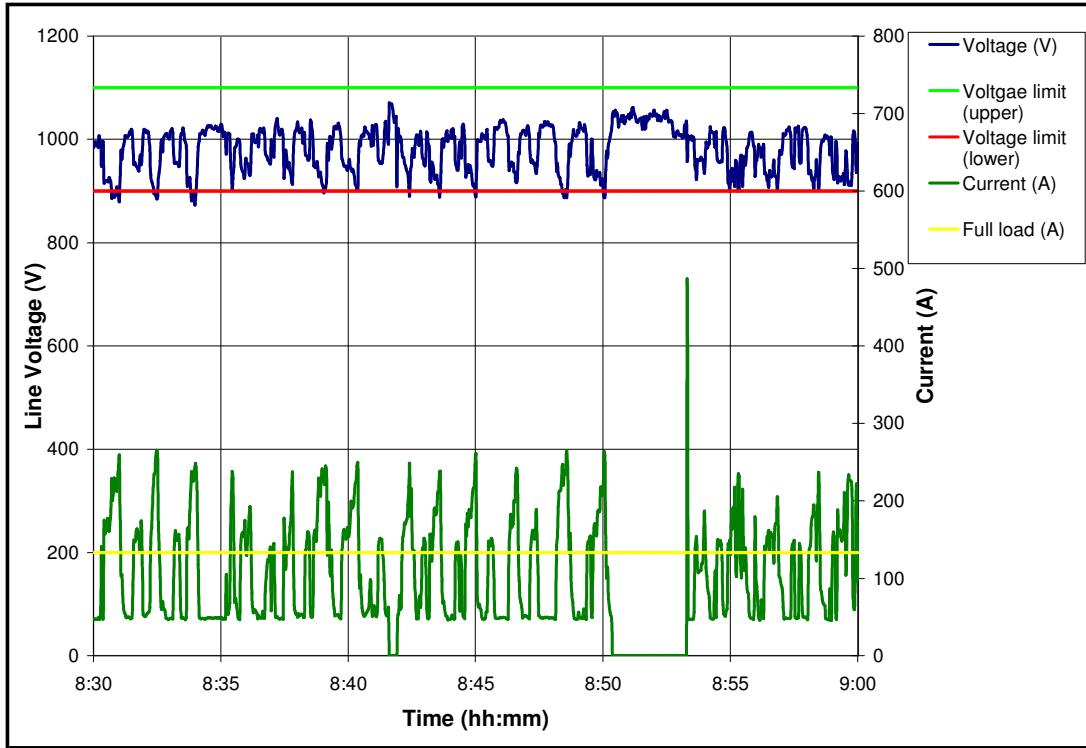


Figure L.1-15: Load current and voltage for a RH cutter motor – 6 June 2005.



**Figure L.1-16: Load current and voltage for a RH cutter motor – 6 June 2005
(30 minute period).**

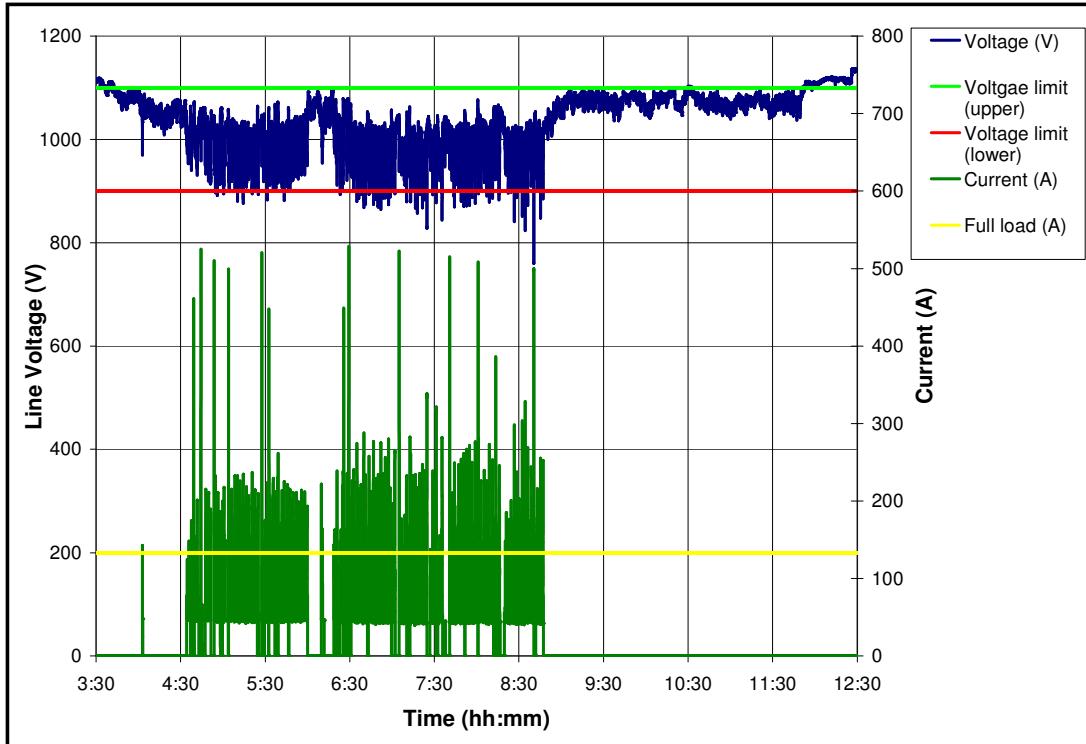
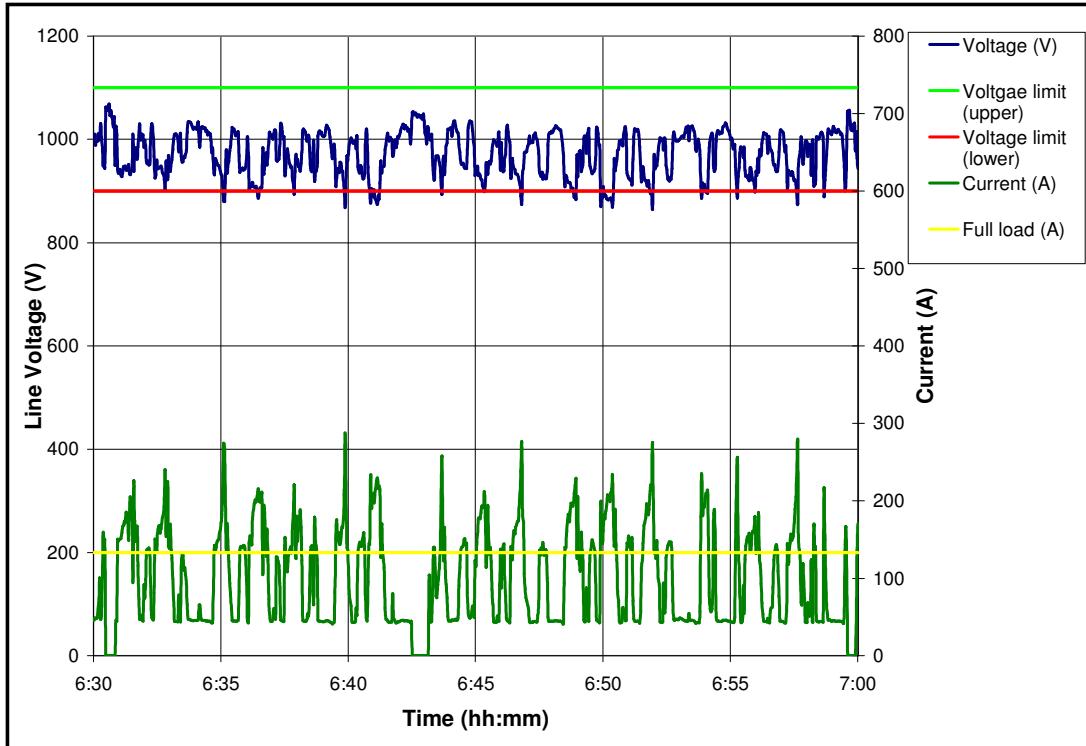


Figure L.1-17: Load current and voltage for a LH cutter motor – 7 June 2005.



**Figure L.1-18: L Load current and voltage for a LH cutter motor – 7 June 2005
(30 minute period).**

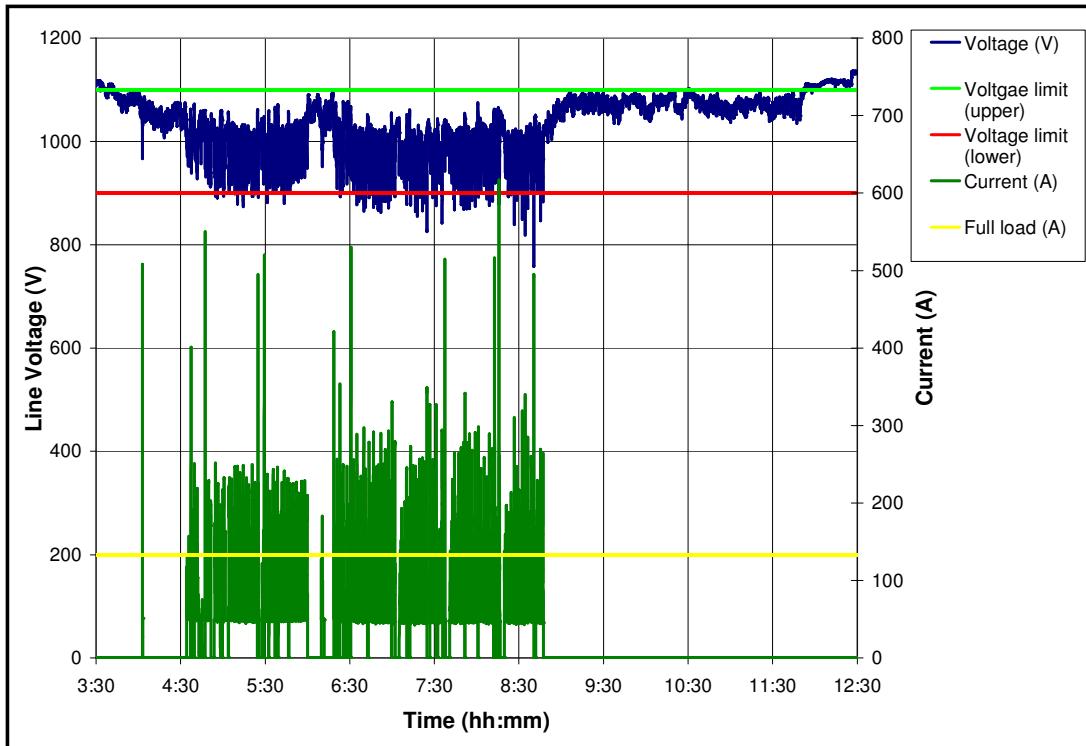
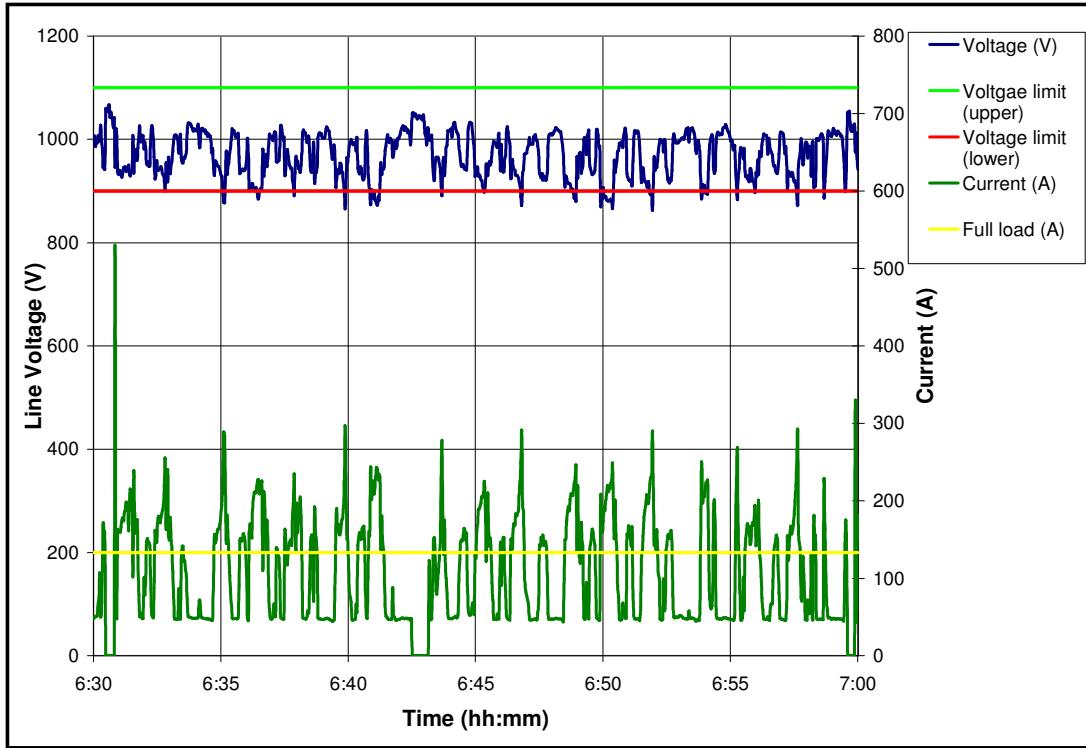


Figure L.1-19: Load current and voltage for a RH cutter motor – 7 June 2005.



**Figure L.1-20: Load current and voltage for a RH cutter motor – 7 June 2005
(30 minute period).**

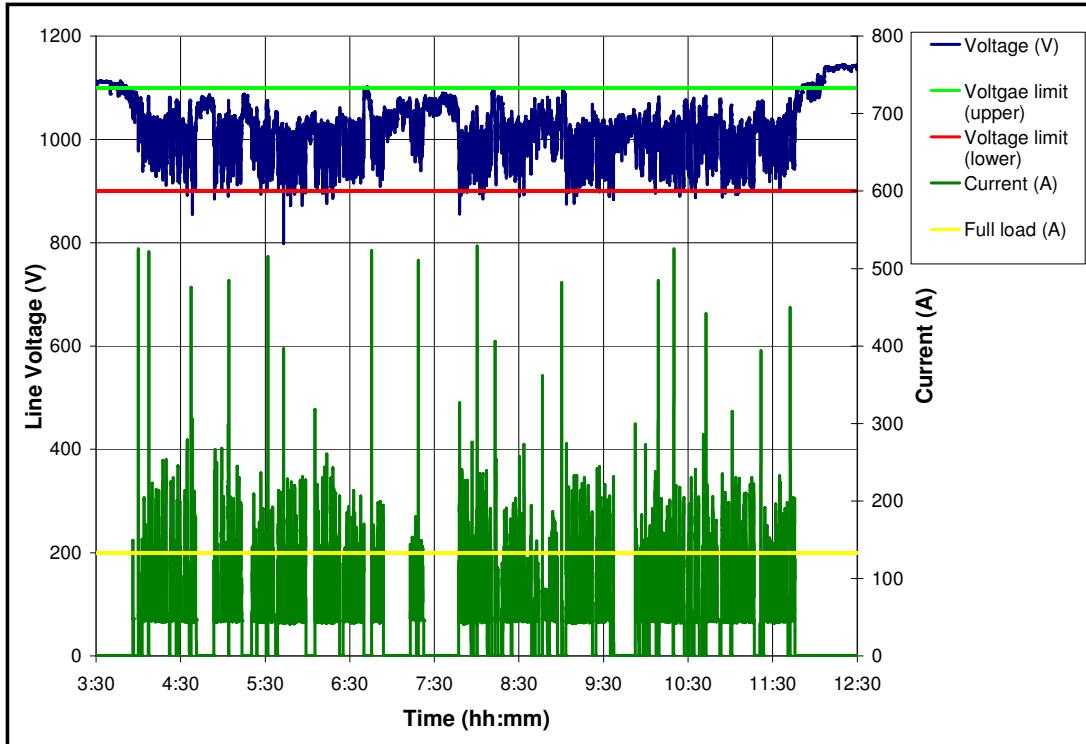
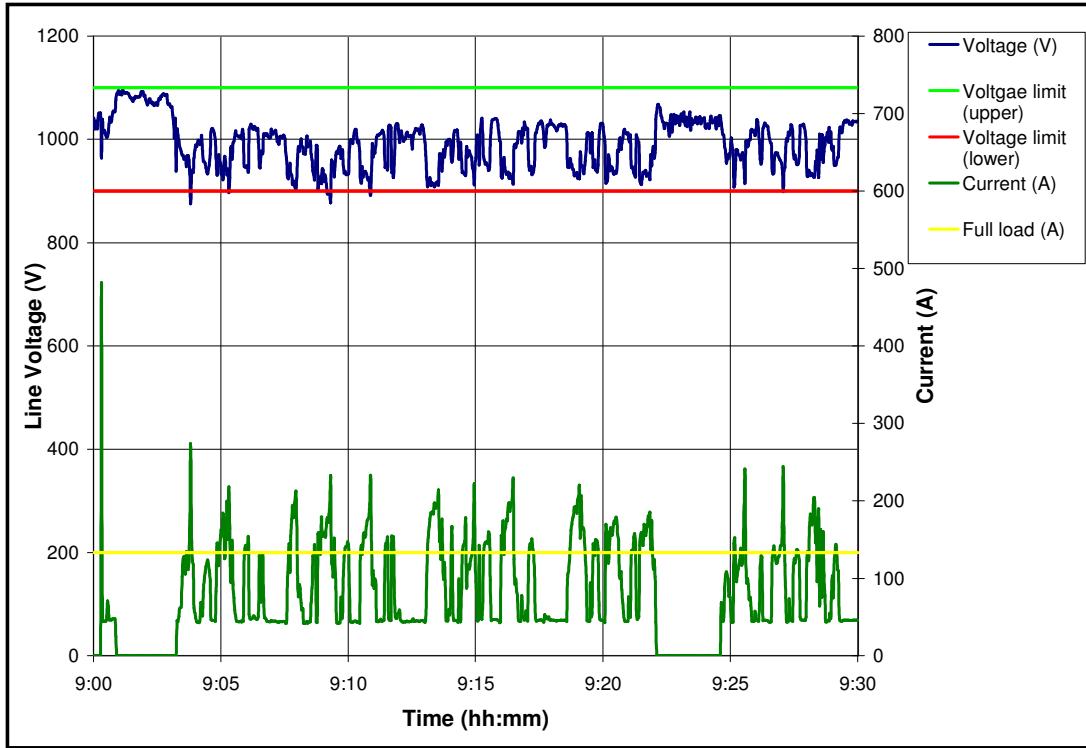


Figure L.1-21: Load current and voltage for a LH cutter motor – 8 June 2005.



**Figure L.1-22: Load current and voltage for a LH cutter motor – 8 June 2005
(30 minute period).**

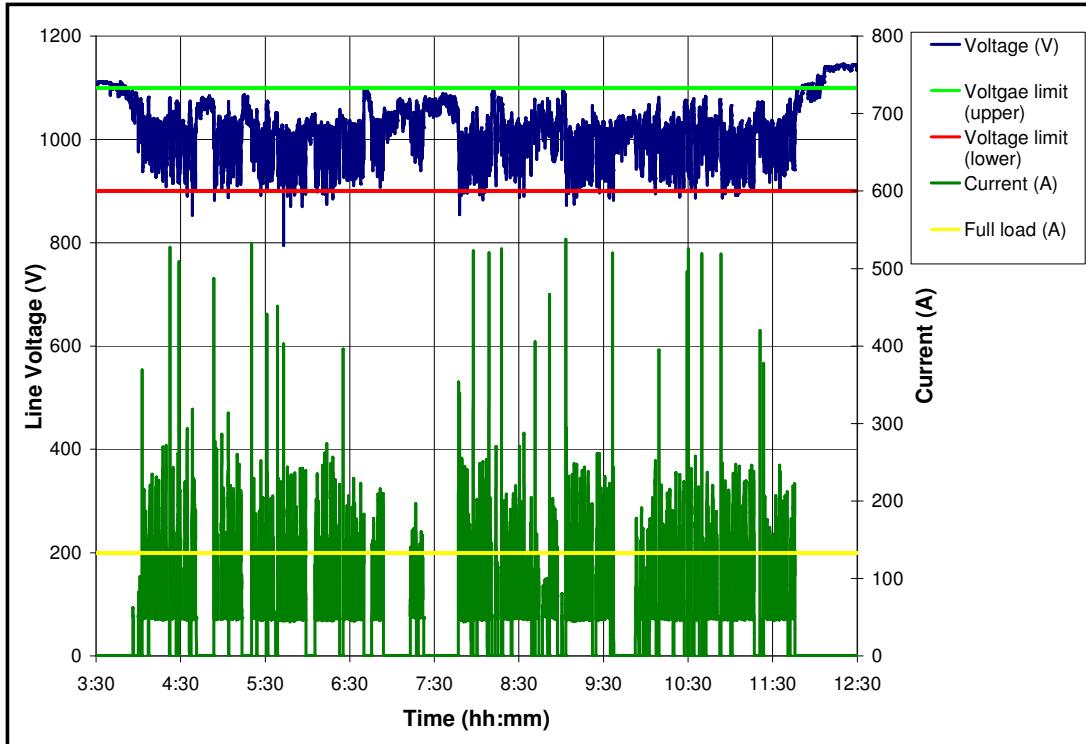
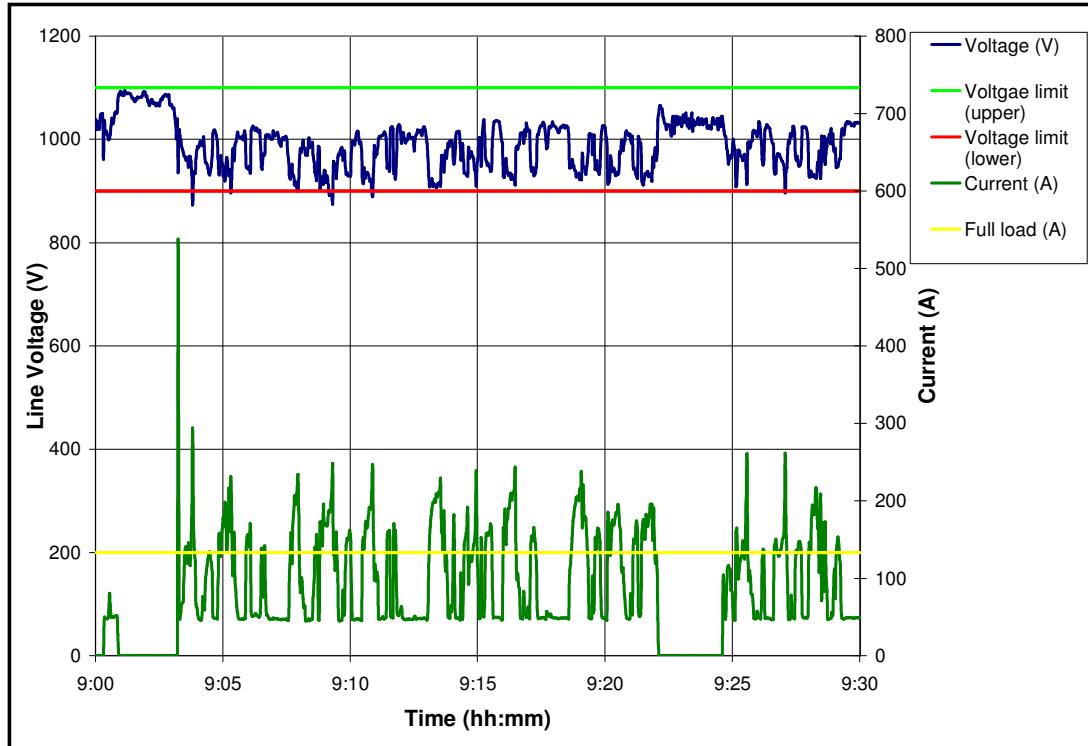


Figure L.1-23: Load current and voltage for a RH cutter motor – 8 June 2005.



**Figure L.1-24: Load current and voltage for a RH cutter motor – 8 June 2005
(30 minute period).**

L.1.2 SECTION 51

L.1.2.1 Morning shifts

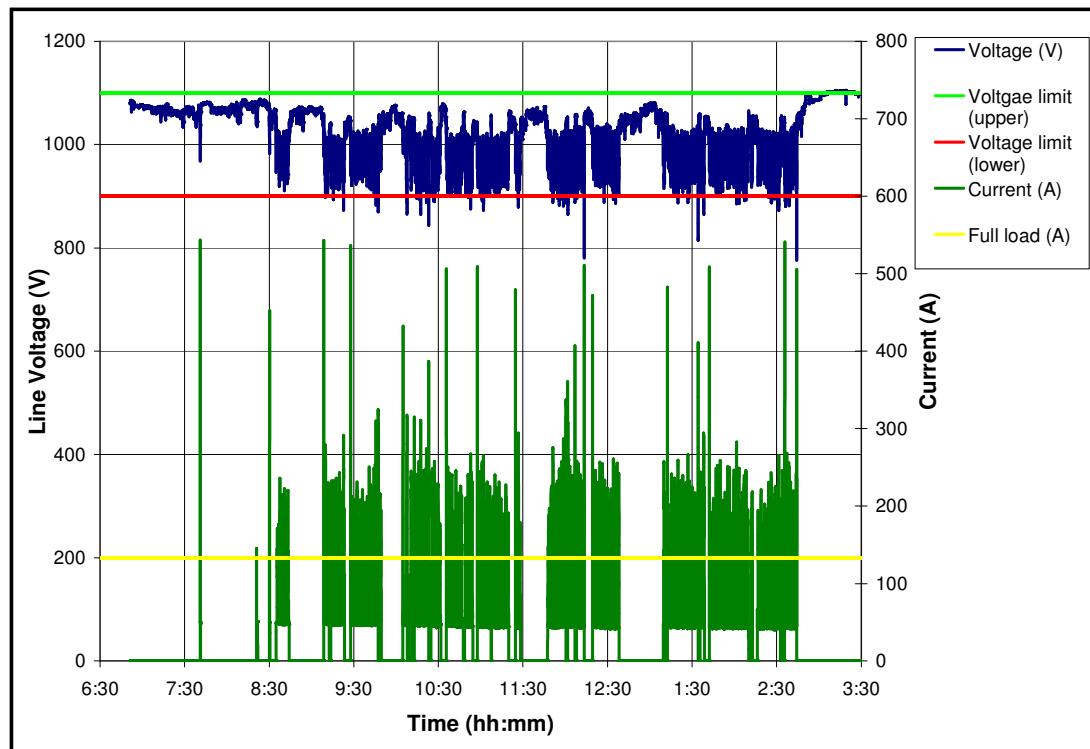
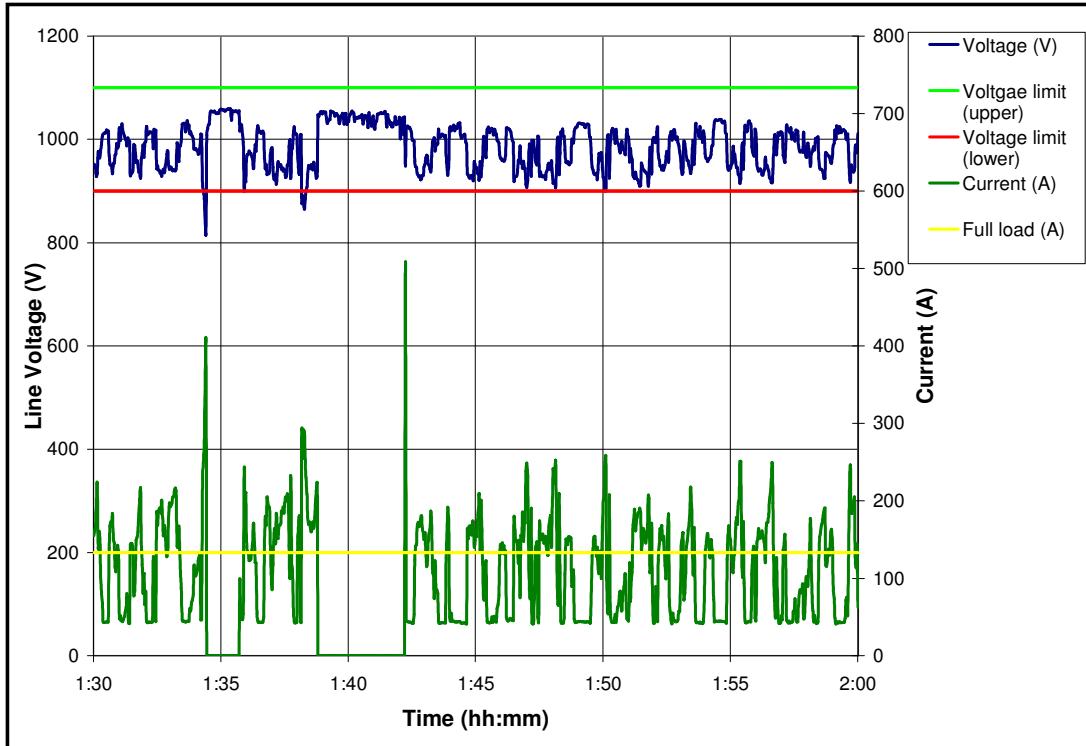


Figure L.1-25: Load current and voltage for a LH cutter motor – 23 June 2005.



**Figure L.1-26: Load current and voltage for a LH cutter motor – 23 June 2005
(30 minute period).**

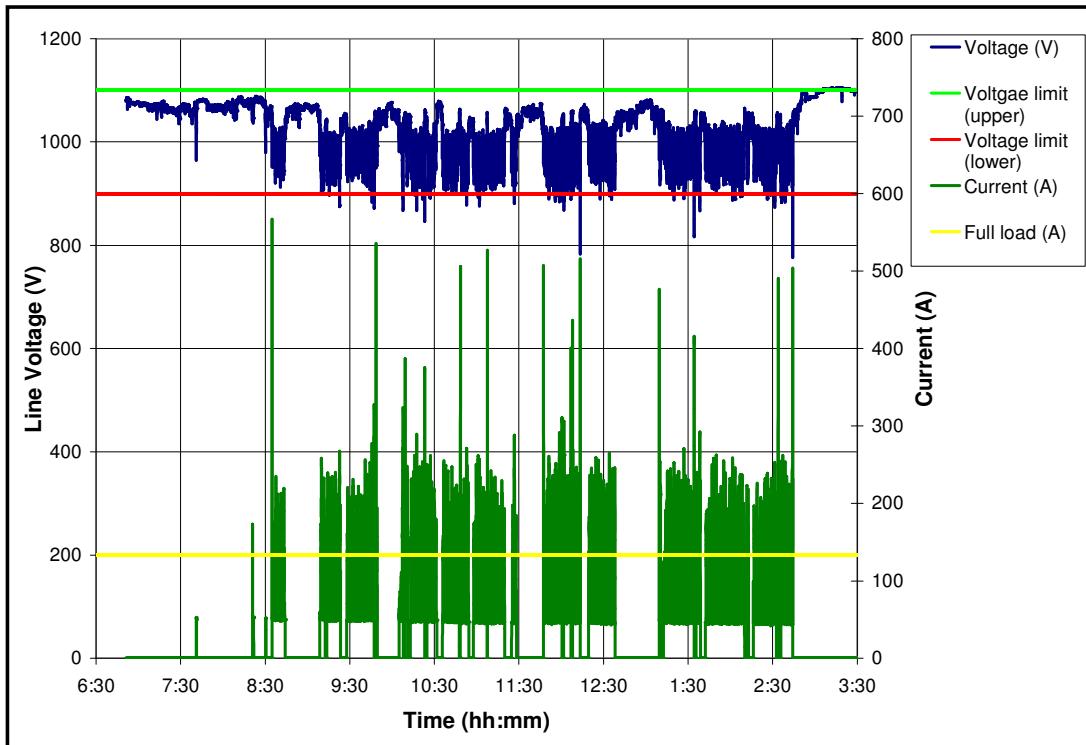
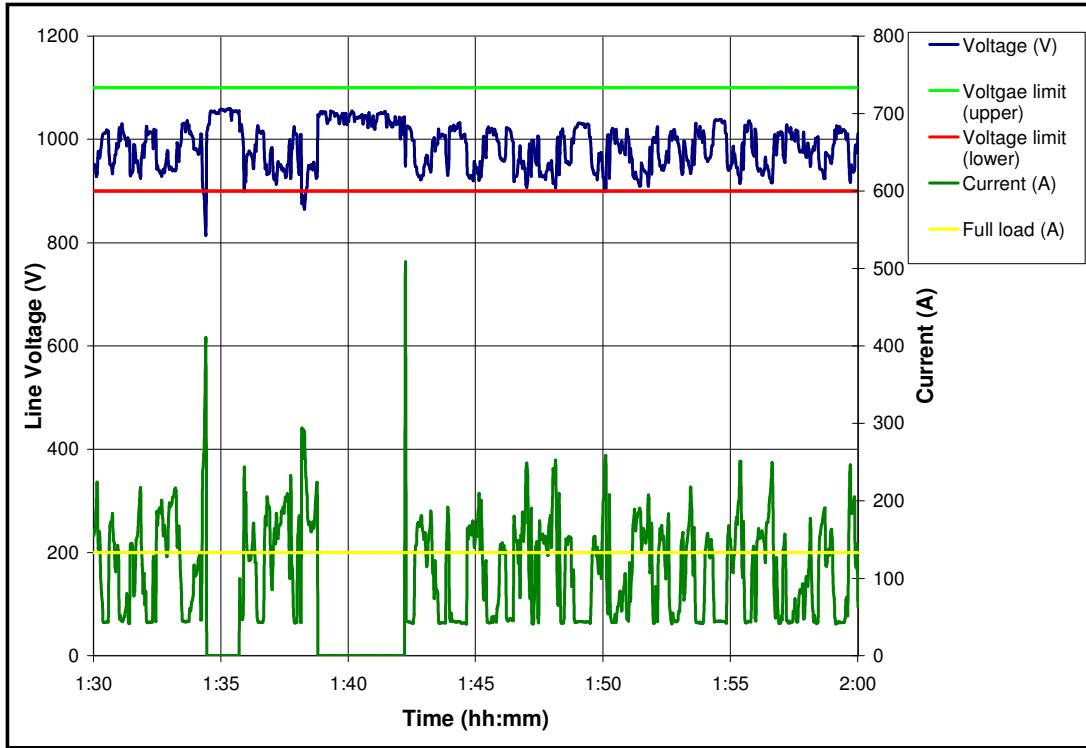


Figure L.1-27: Load current and voltage for a RH cutter motor – 23 June 2005.



**Figure L.1-28: Load current and voltage for a RH cutter motor – 23 June 2005
(30 minute period).**

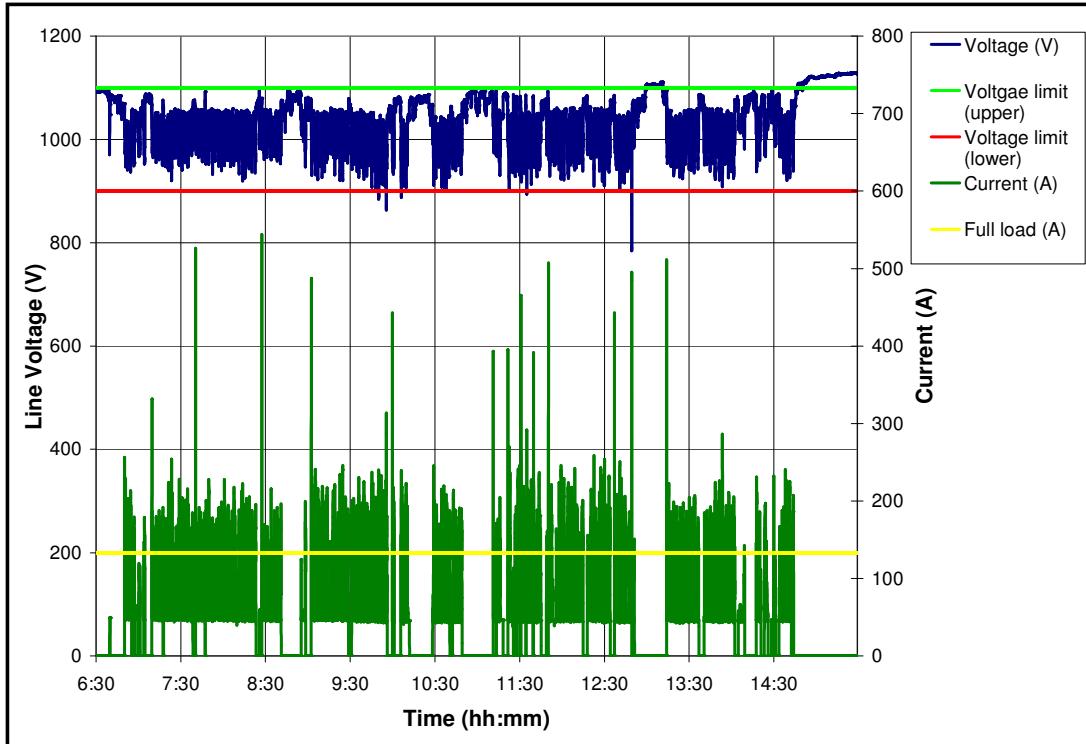
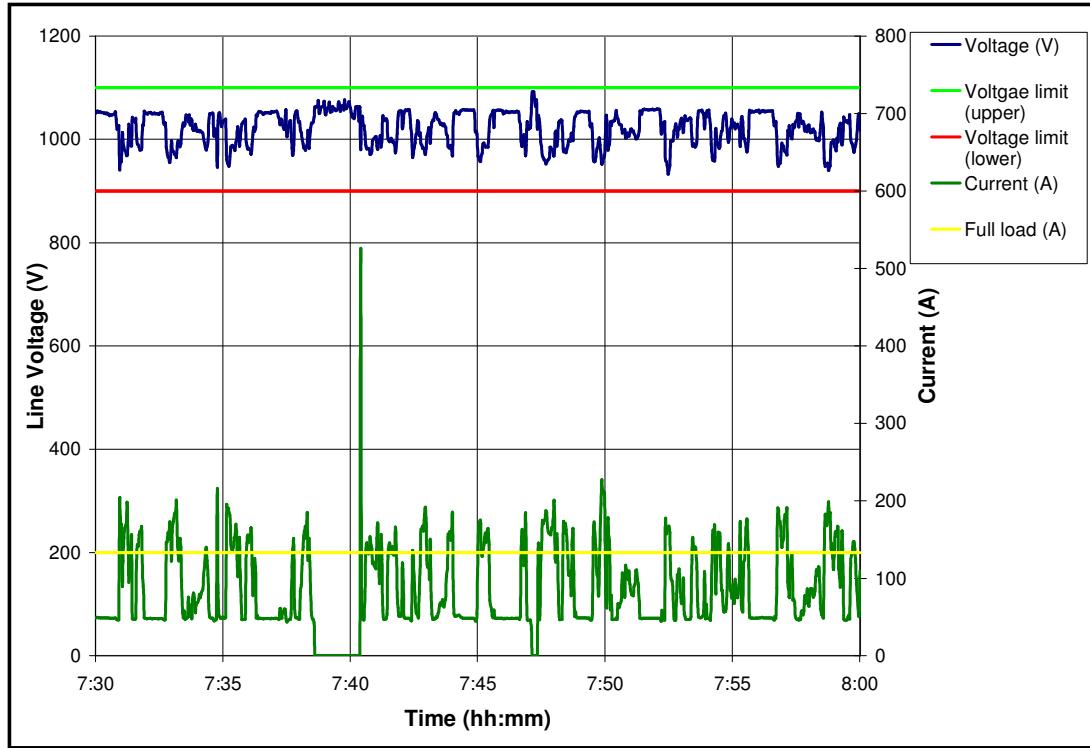


Figure L.1-29: Load current and voltage for a LH cutter motor – 28 June 2005.



**Figure L.1-30: Load current and voltage for a LH cutter motor – 28 June 2005
(30 minute period).**

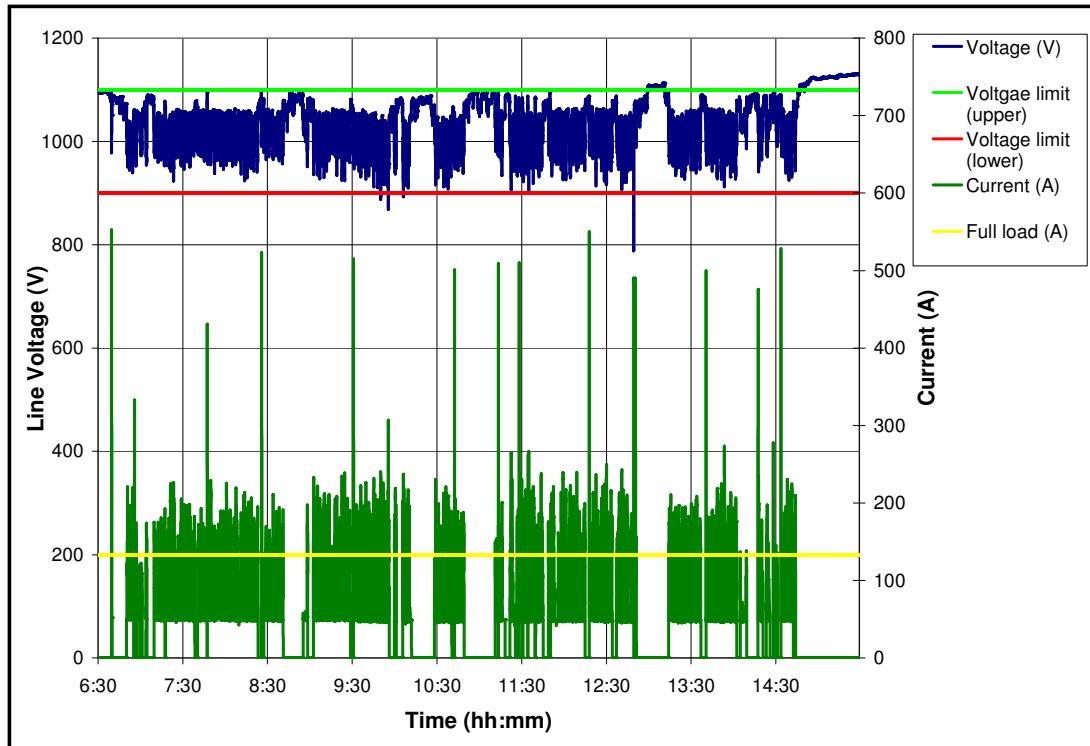
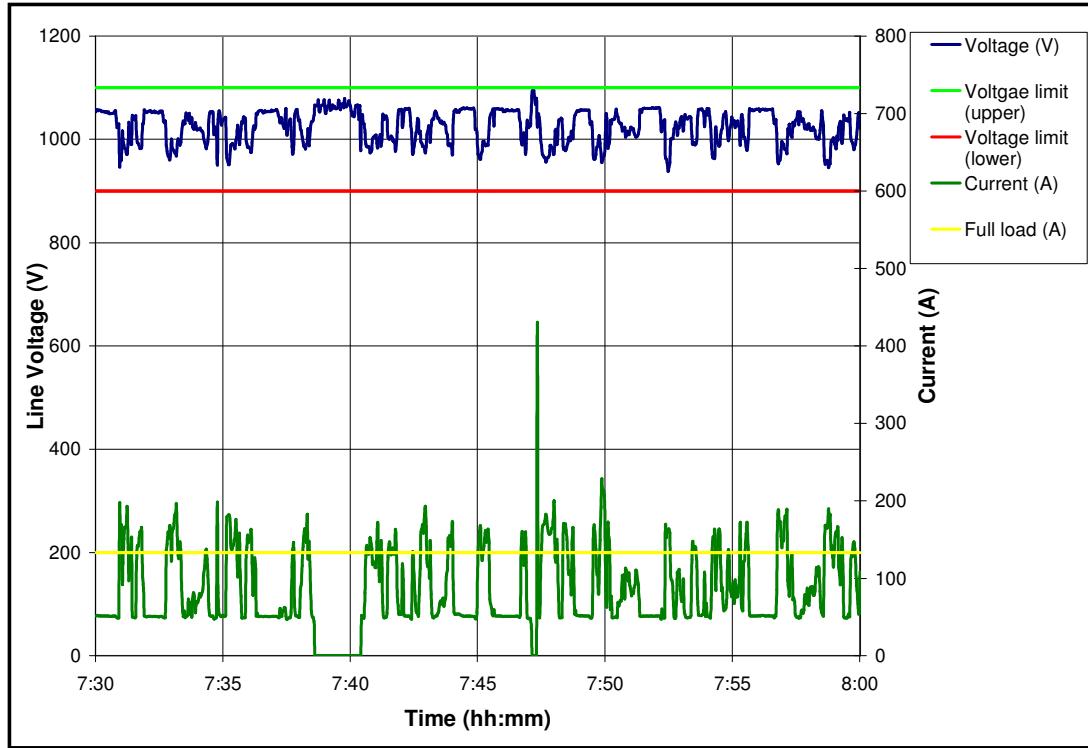


Figure L.1-31: Load current and voltage for a RH cutter motor – 28 June 2005.



**Figure L.1-32: Load current and voltage for a RH cutter motor – 28 June 2005
(30 minute period).**

L.1.2.2 Afternoon shifts

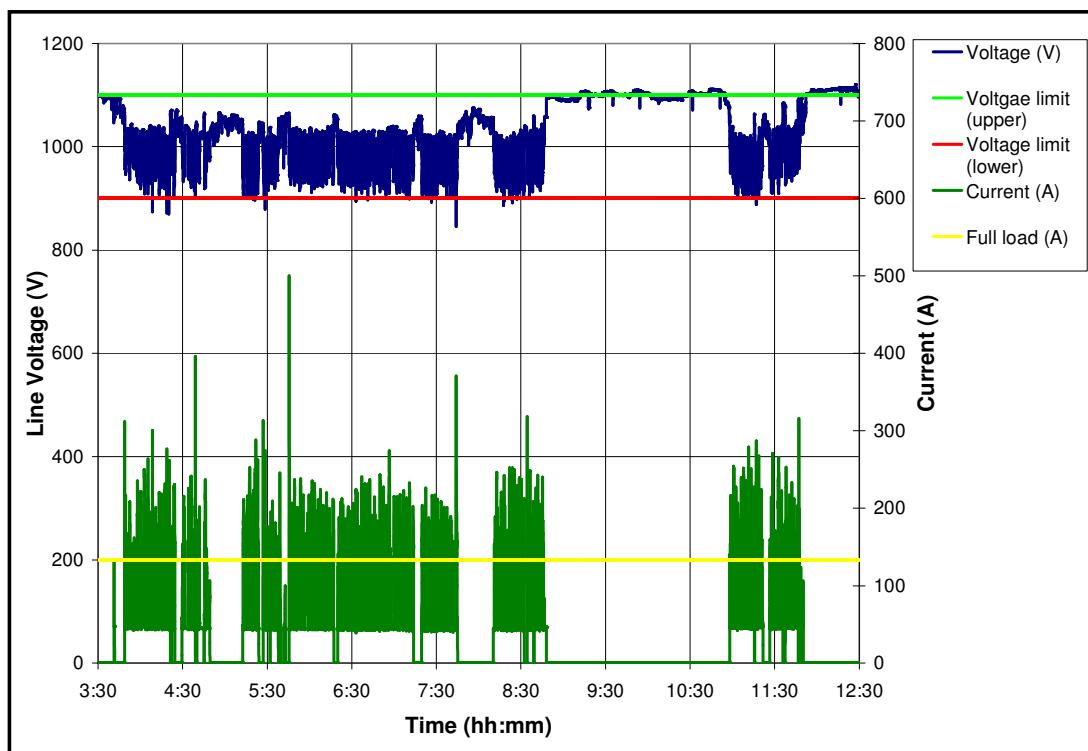
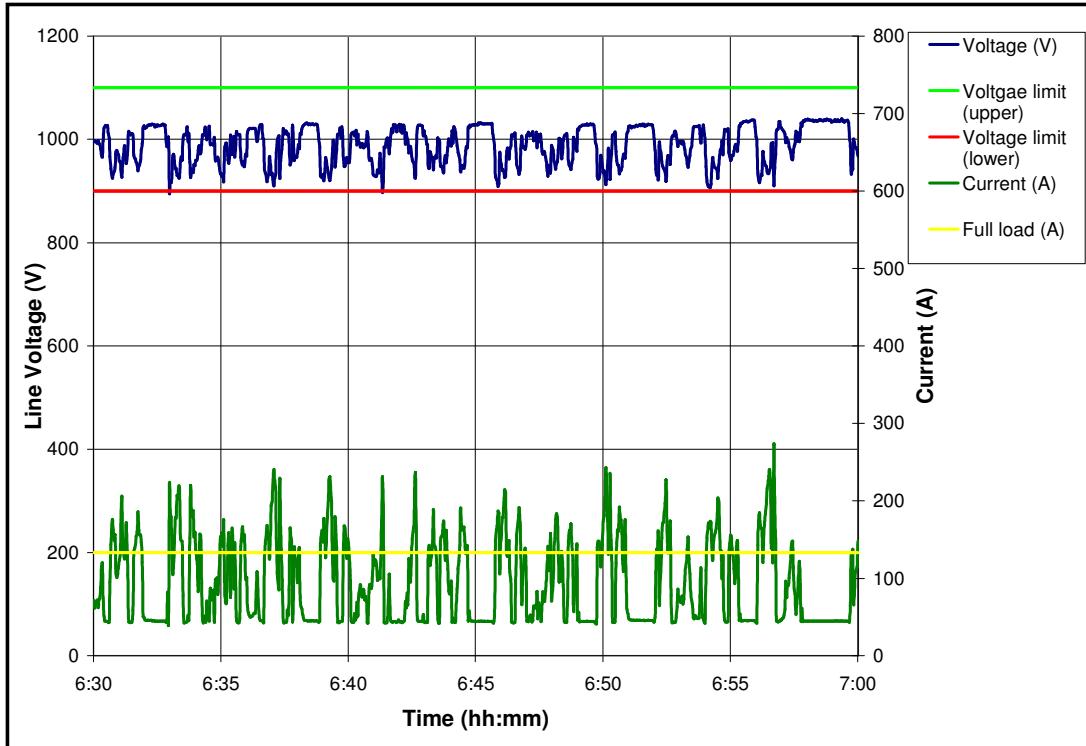


Figure L.1-33: Load current and voltage for a LH cutter motor – 23 June 2005.



**Figure L.1-34: Load current and voltage for a LH cutter motor – 23 June 2005
(30 minute period).**

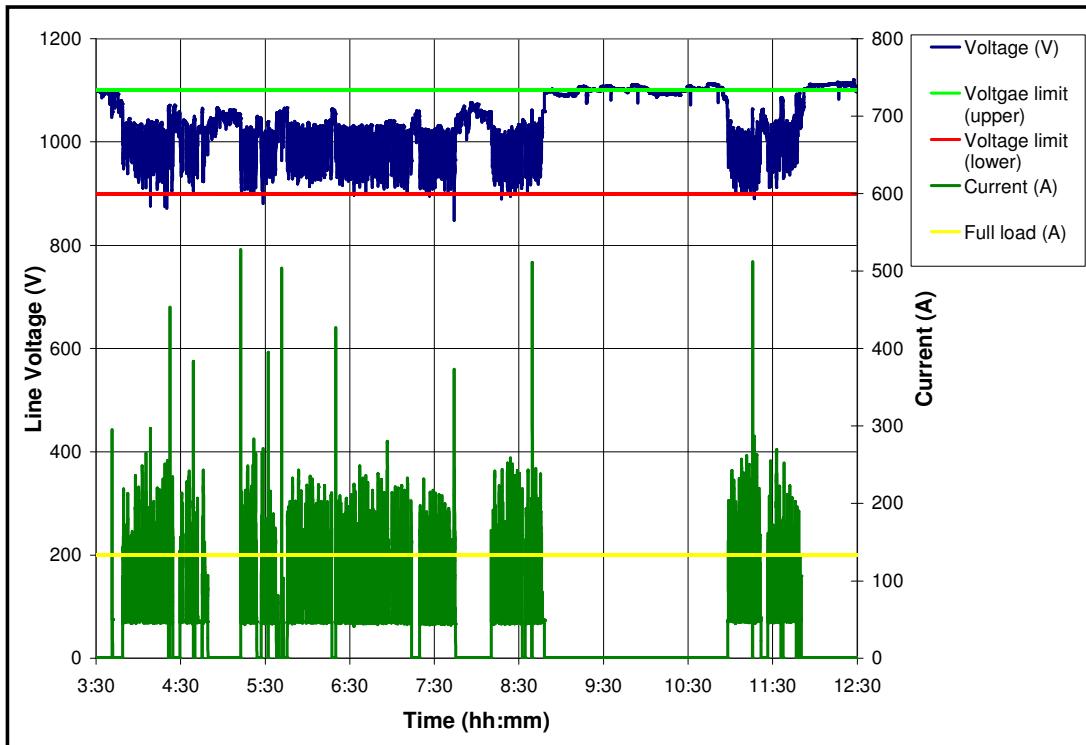
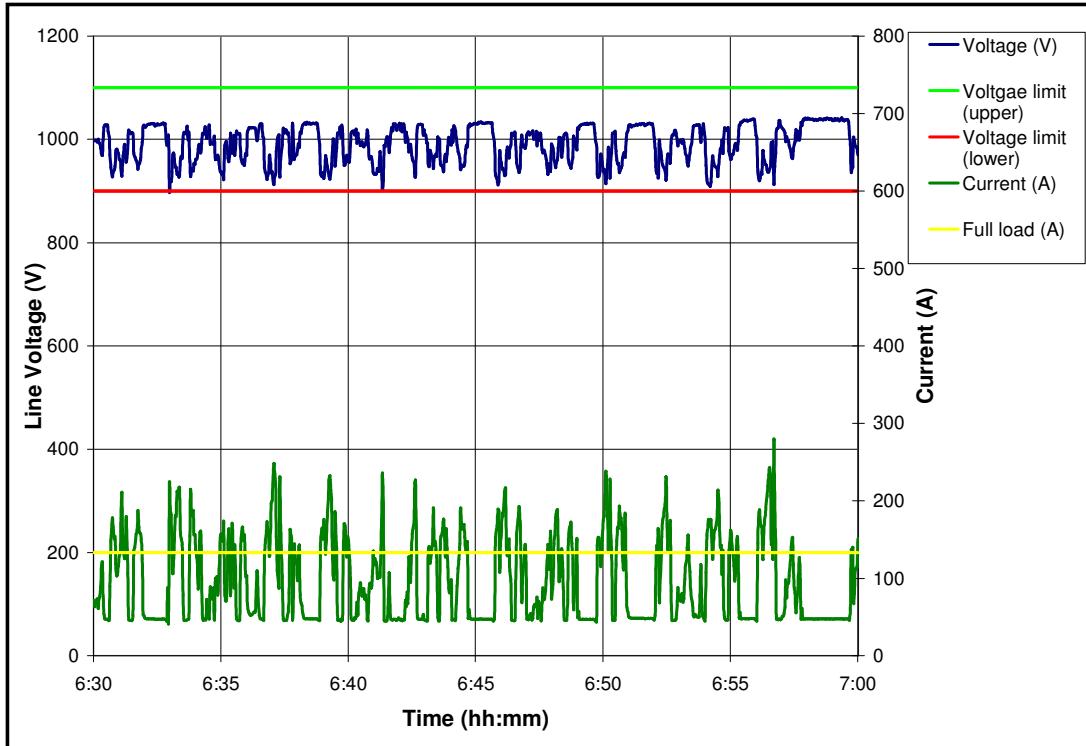


Figure L.1-35: Load current and voltage for a RH cutter motor – 23 June 2005.



**Figure L.1-36: Lo Load current and voltage for a RH cutter motor – 23 June 2005
(30 minute period).**

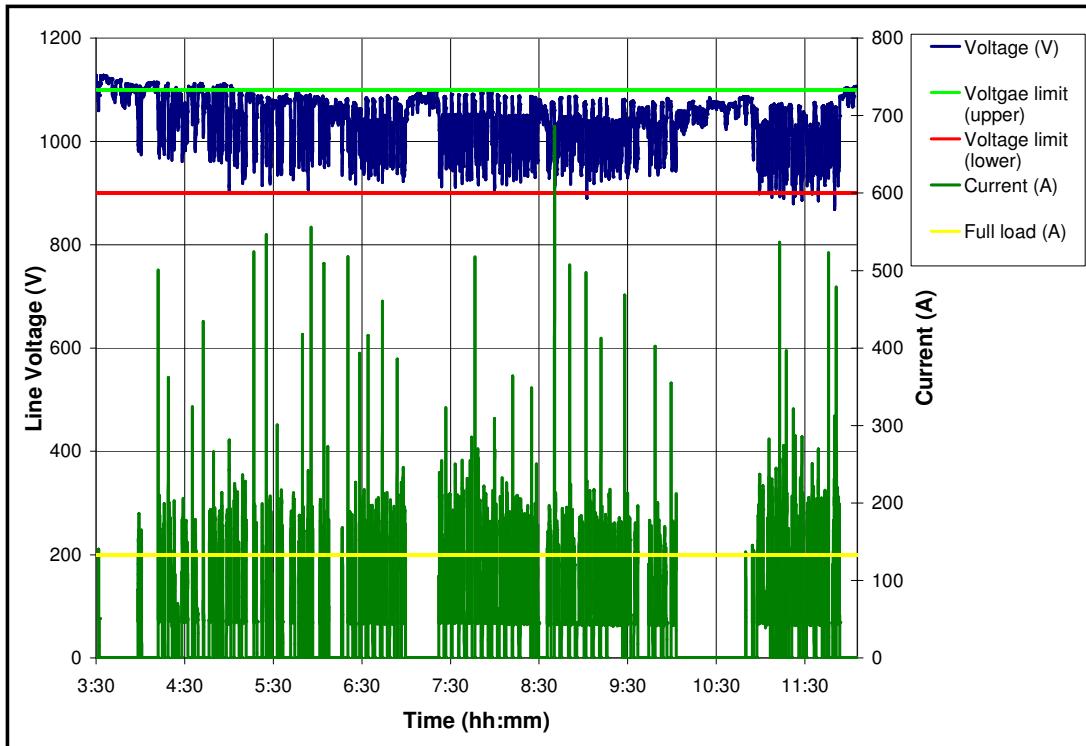
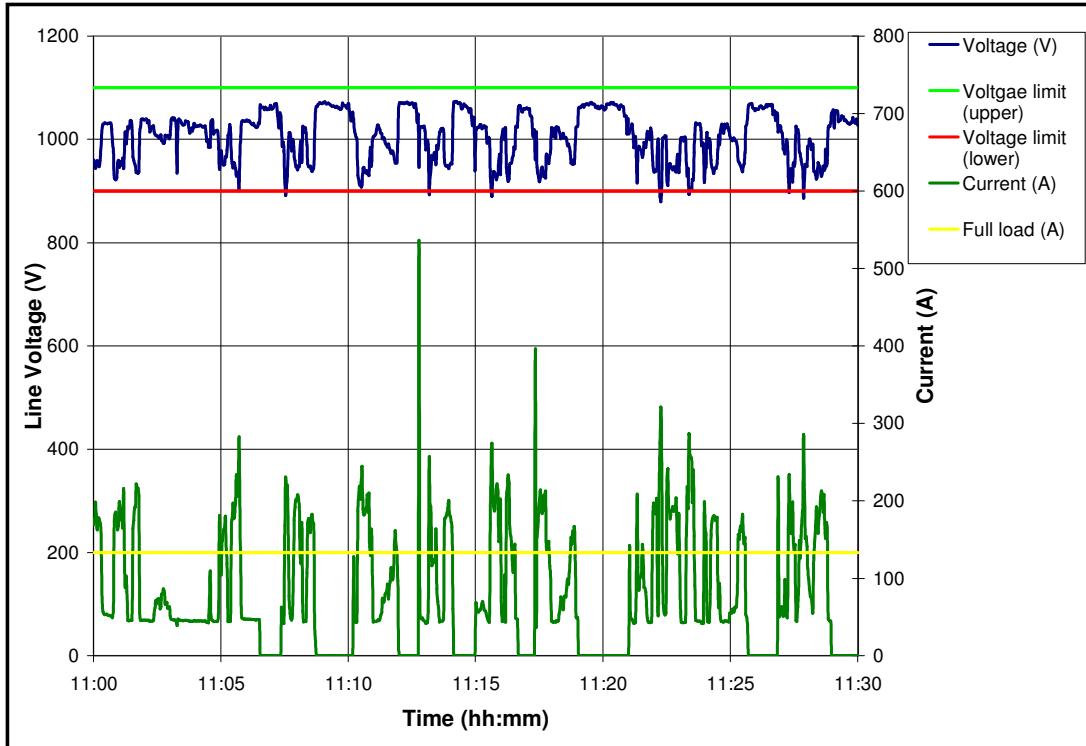


Figure L.1-37: Load current and voltage for a LH cutter motor – 28 June 2005.



**Figure L.1-38: Load current and voltage for a LH cutter motor – 28 June 2005
(30 minute period).**

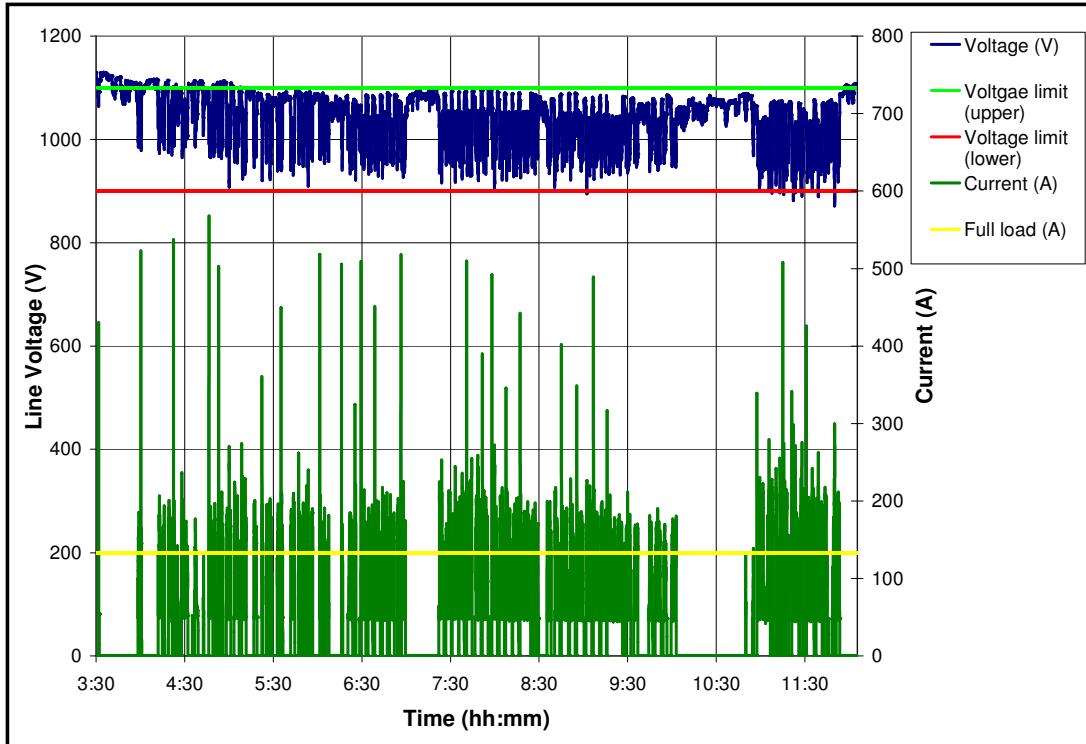
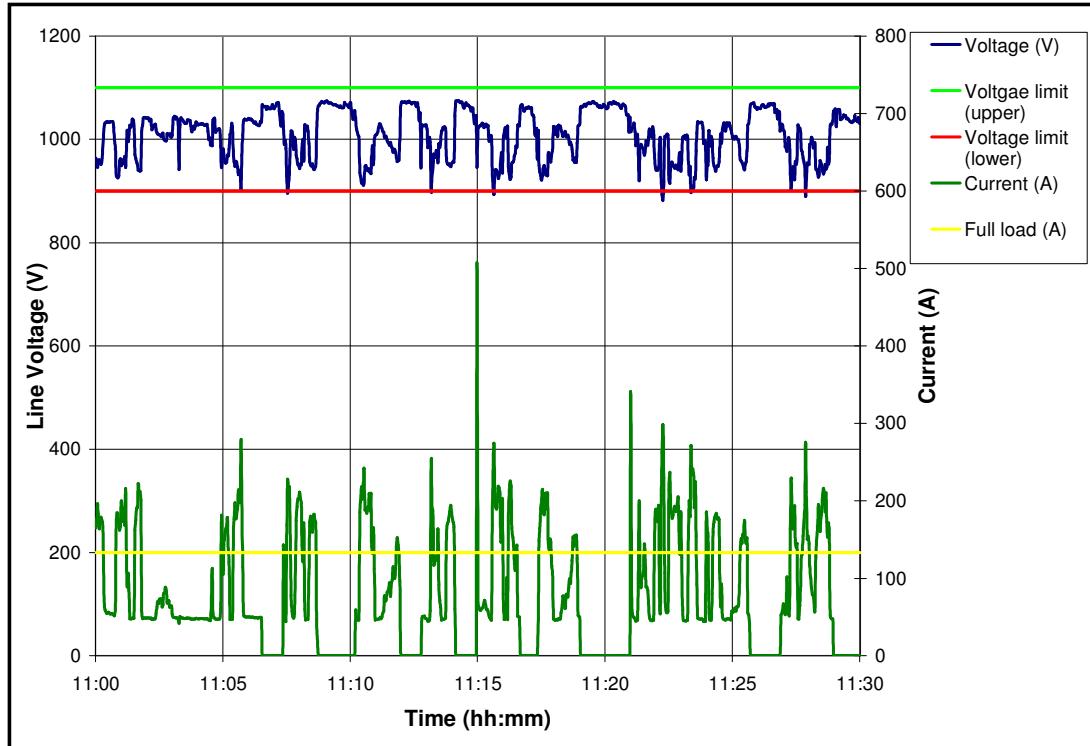


Figure L.1-39: Load current and voltage for a RH cutter motor – 28 June 2005.



**Figure L.1-40: Load current and voltage for a RH cutter motor – 28 June 2005
(30 minute period).**

L.2 HISTOGRAM

The next section focuses on the frequency with which a CMs cutter 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.

L.2.1 SECTION 21

L.2.1.1 Morning shifts

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

	6-Jun-05	7-Jun-05	8-Jun-05
Tonnes/CM/Shift	2079	1925	1750
% Time of shift producing	54.71%	39.81%	43.07%
% of Production time underloaded	72.82%	68.24%	73.87%
% of Production time overloaded	27.18%	31.76%	26.13%

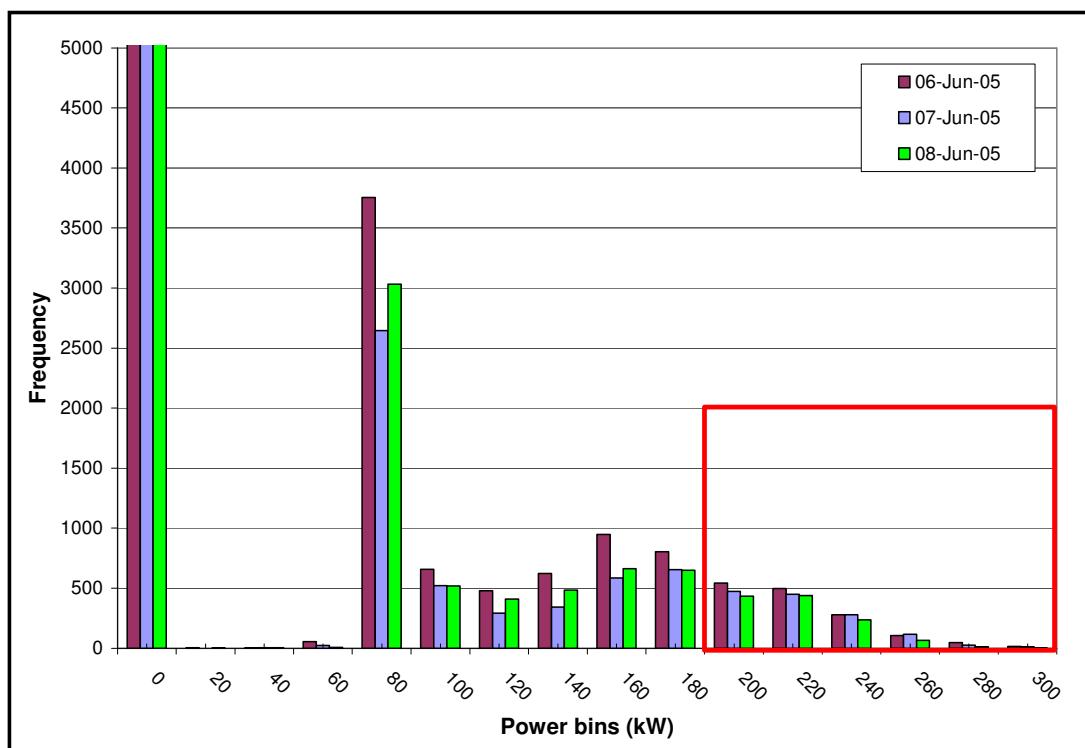


Figure L.2-1: Histogram for power consumed by a LH cutter motor.

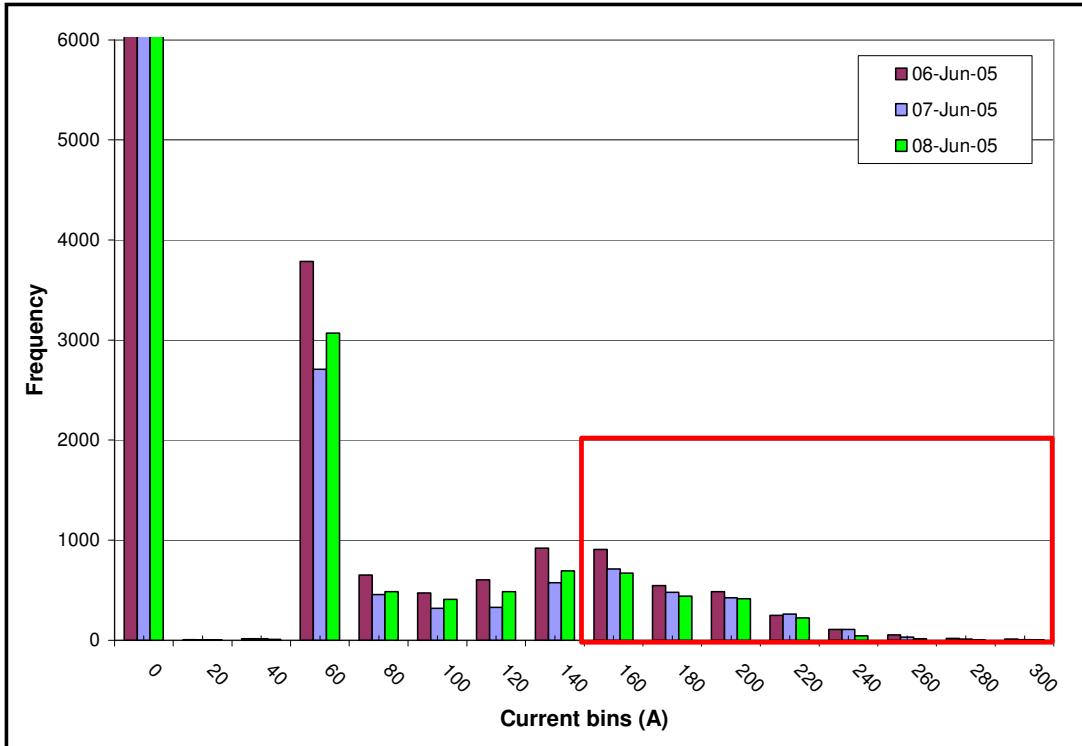


Figure L.2-2: Histogram for current consumed by a LH cutter motor.

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

	6-Jun-05	7-Jun-05	8-Jun-05
Tonnes/CM/Shift	2079	1925	1750
% Time of shift producing	54.73%	39.85%	43.05%
% of Production time underloaded	66.92%	63.23%	67.97%
% of Production time overloaded	33.08%	36.77%	32.03%

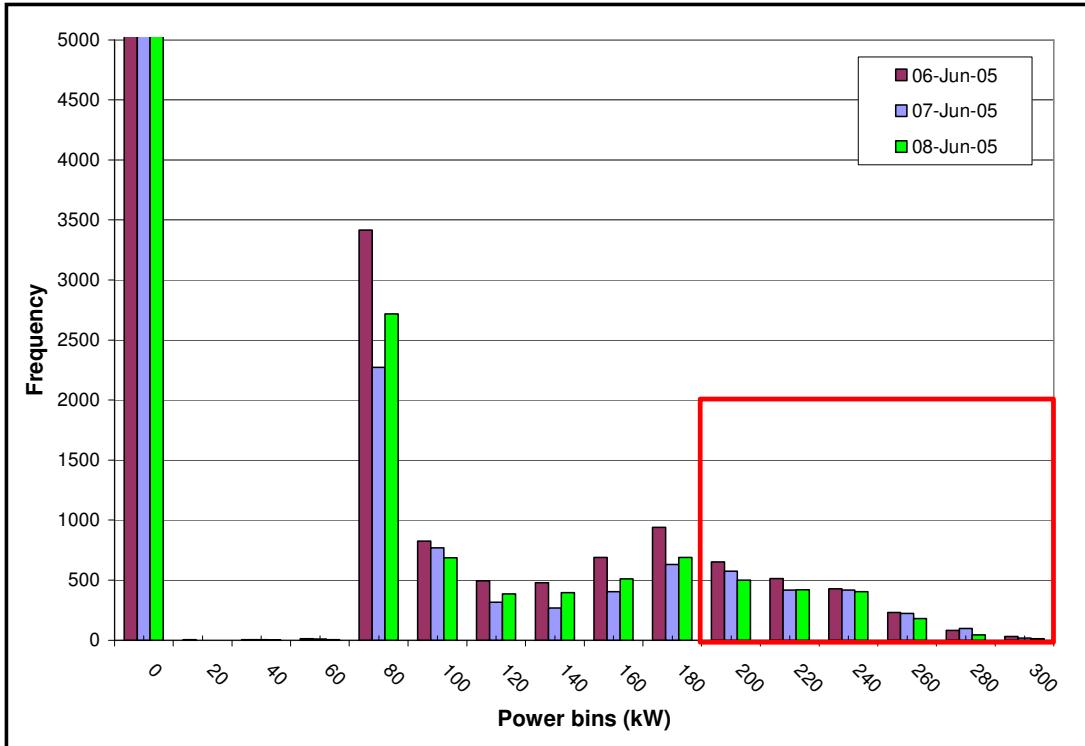


Figure L.2-3: Histogram for power consumed by a RH cutter motor.

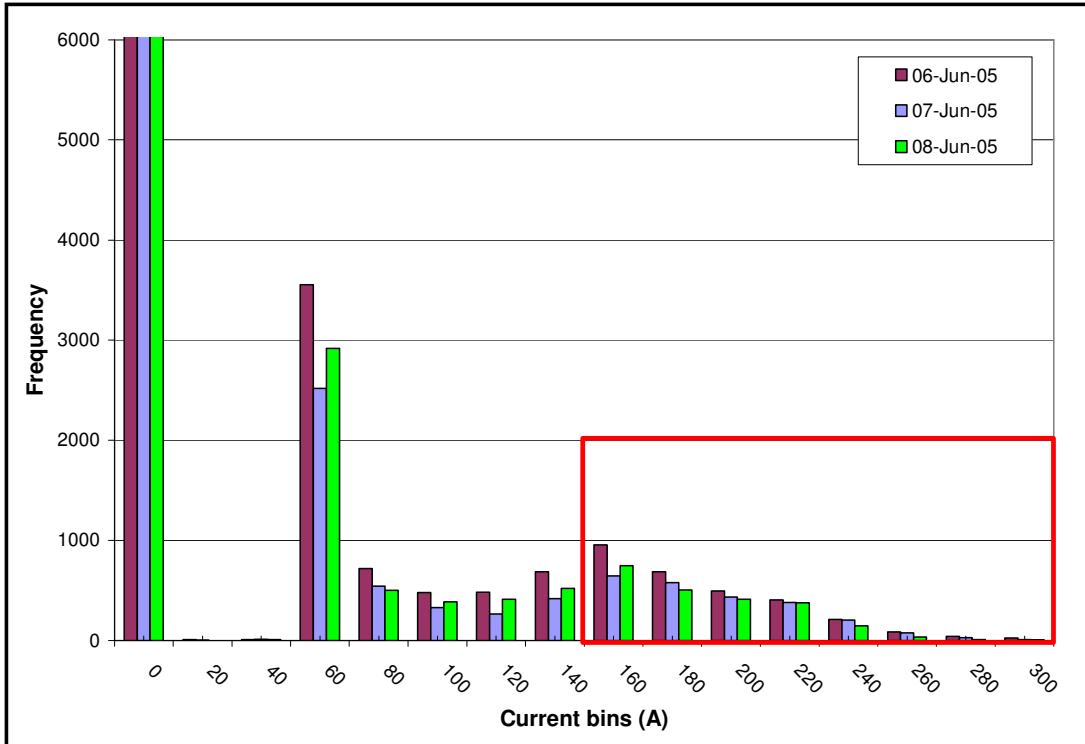


Figure L.2-4: Histogram for current consumed by a RH cutter motor.

L.2.1.2 Afternoon shifts

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

	6-Jun-05	7-Jun-05	8-Jun-05
Tonnes/CM/Shift	1485	1435	2240
% Time of shift producing	39.71%	37.16%	59.32%
% of Production time underloaded	73.19%	76.01%	80.81%
% of Production time overloaded	26.81%	23.99%	19.18%

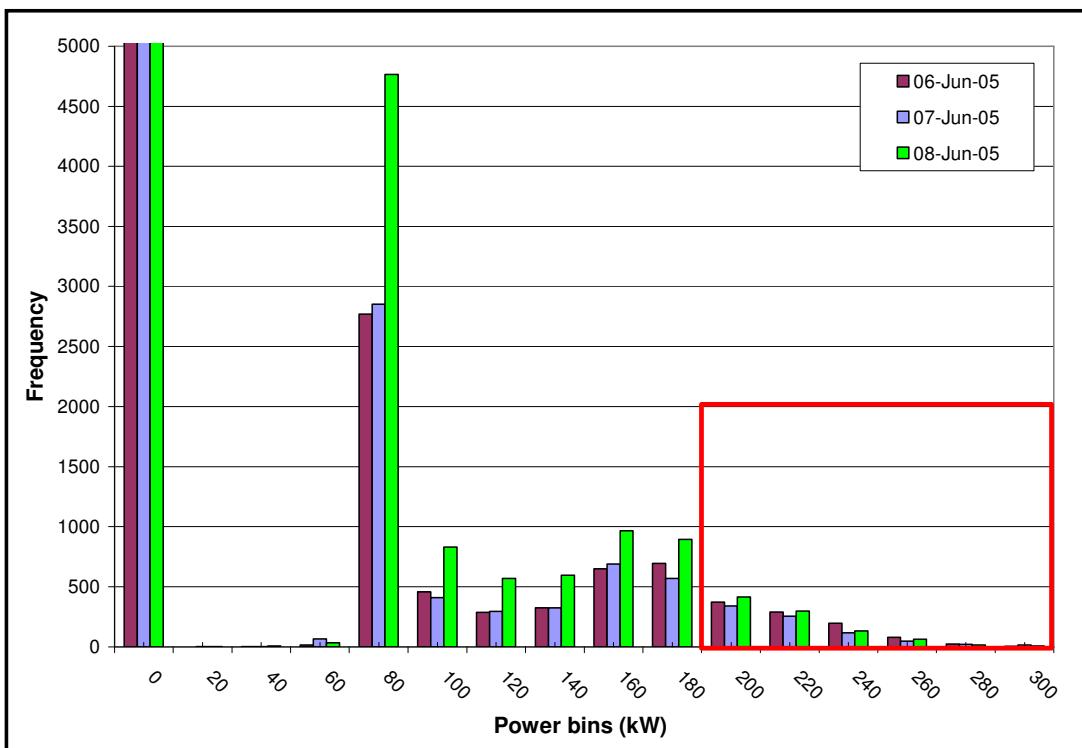


Figure L.2-5: Histogram for power consumed by a LH cutter motor.

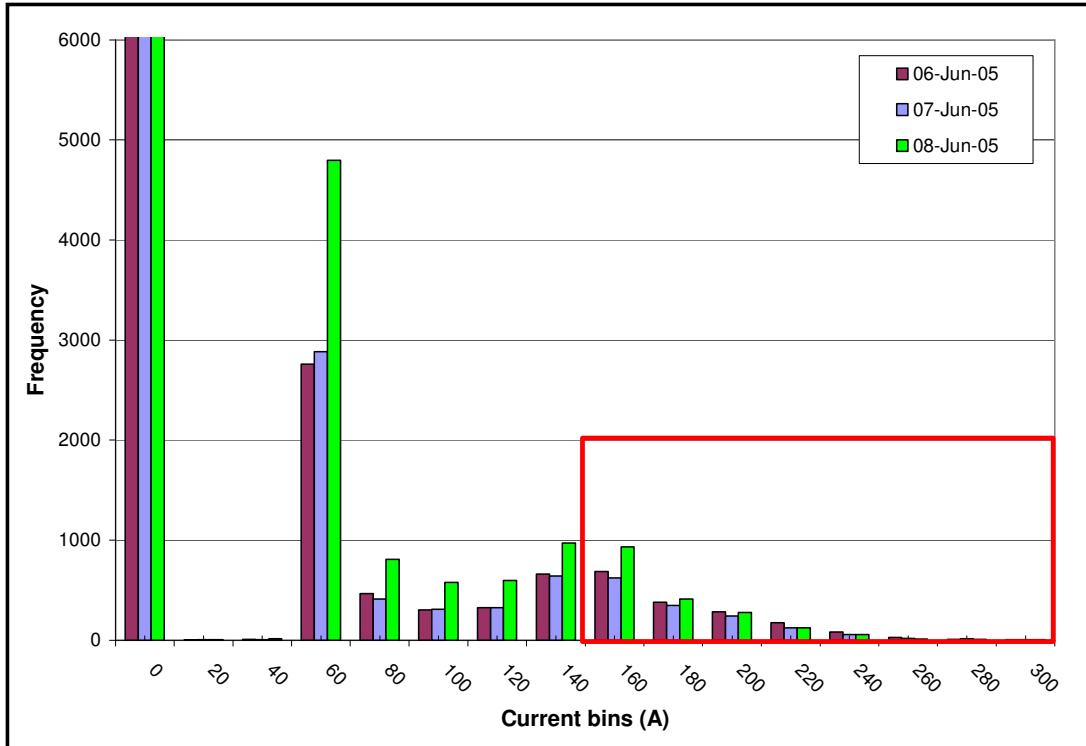


Figure L.2-6: Histogram for current consumed by a LH cutter motor.

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

	6-Jun-05	7-Jun-05	8-Jun-05
Tonnes/CM/Shift	1485	1435	2240
% Time of shift producing	39.74%	37.16%	59.32%
% of Production time underloaded	66.51%	69.83%	75.02%
% of Production time overloaded	33.49%	30.17%	24.98%

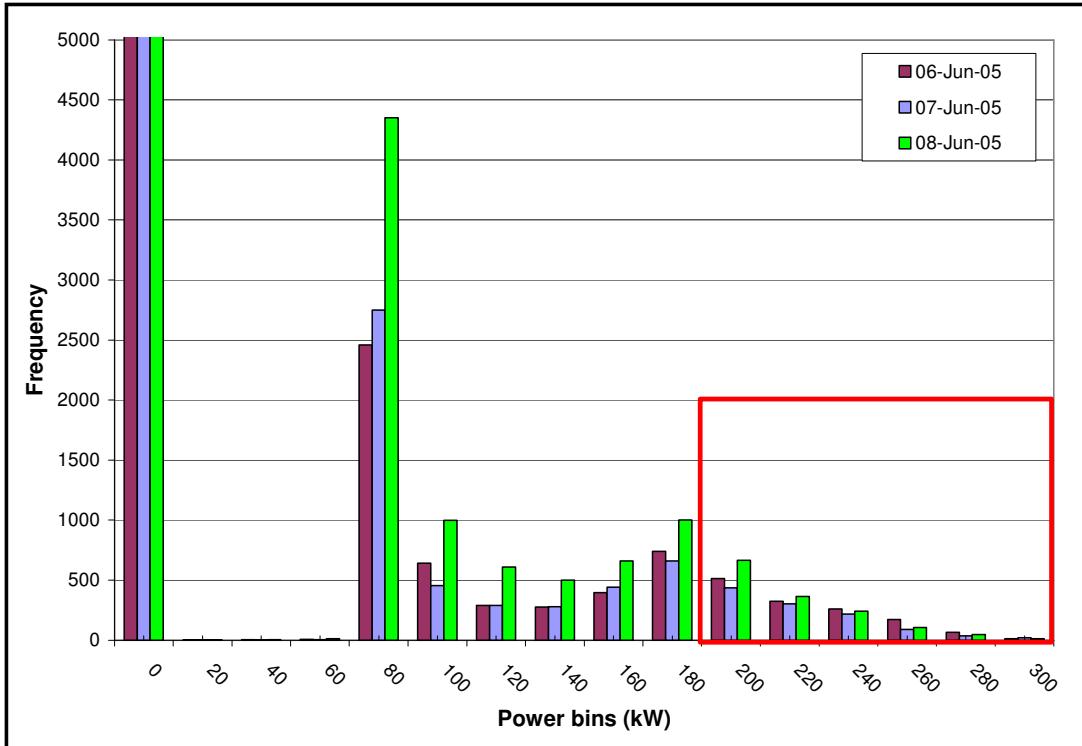


Figure L.2-7: Histogram for power consumed by a RH cutter motor.

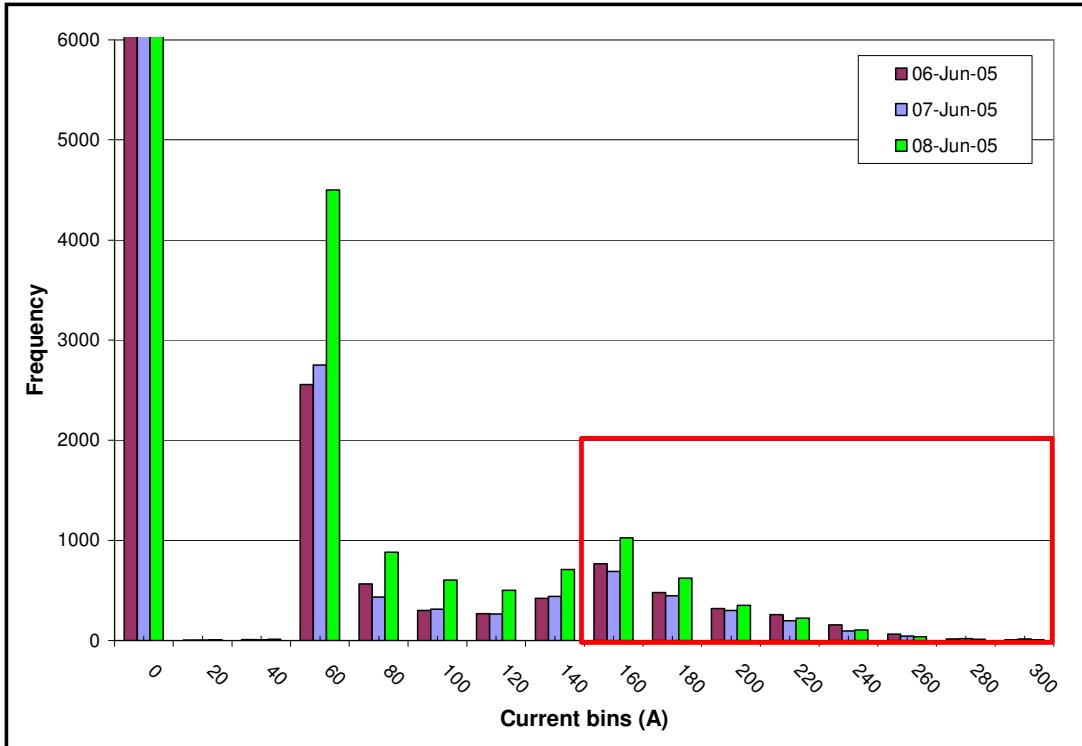


Figure L.2-8: Histogram for current consumed by a RH cutter motor.

L.2.2 SECTION 51

L.2.2.1 Morning shifts

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

	23-Jun-05	28-Jun-05
Tonnes/CM/Shift	1856	2204
% Time of shift producing	44.95%	60.67%
% of Production time underloaded	57.98%	74.41%
% of Production time overloaded	42.02%	25.59%

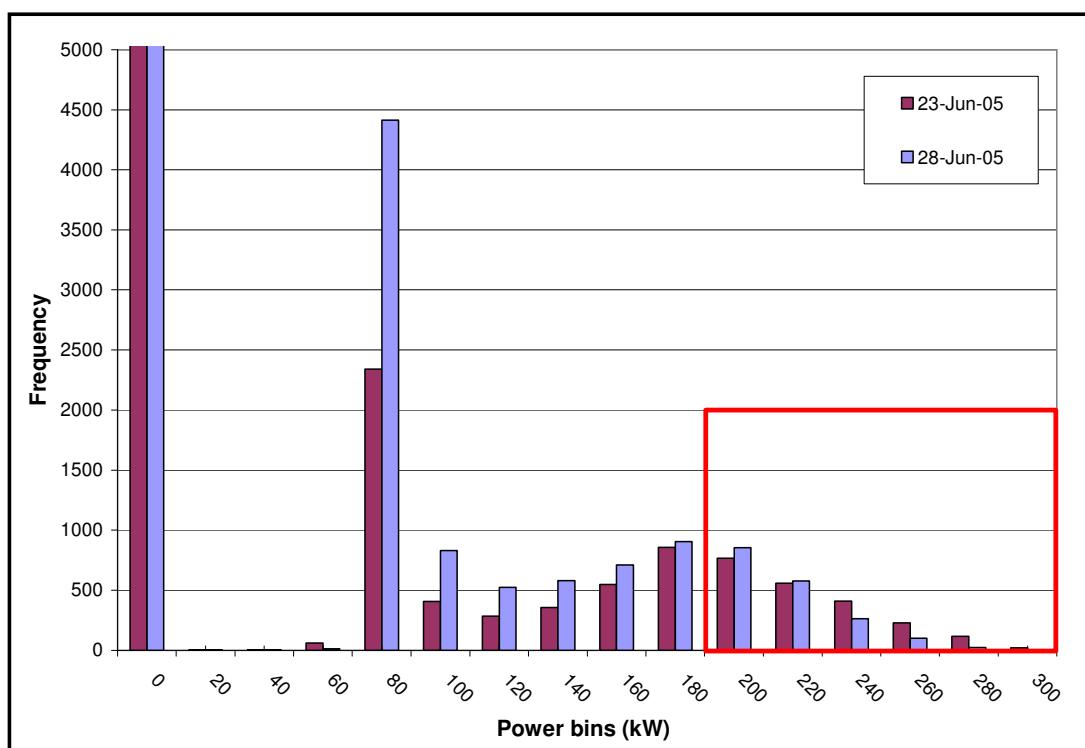


Figure L.2-9: Histogram for power consumed by a LH cutter motor.

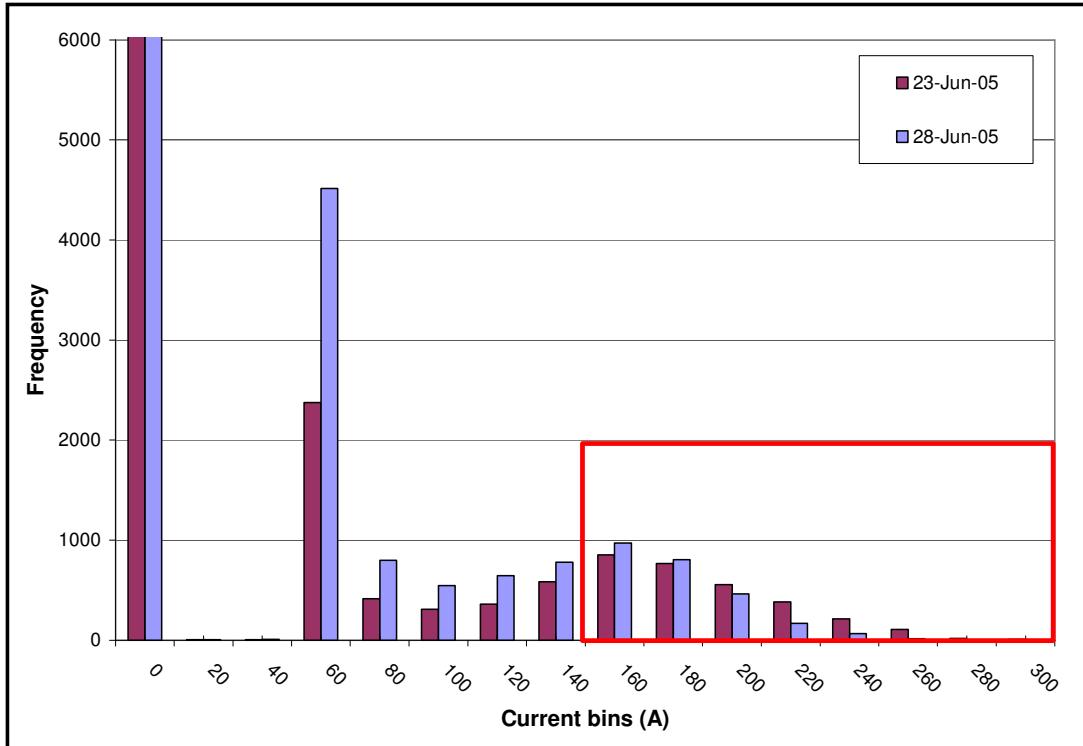


Figure L.2-10: Histogram for current consumed by a LH cutter motor.

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

	23-Jun-05	28-Jun-05
Tonnes/CM/Shift	1856	2204
% Time of shift producing	44.93%	60.68%
% of Production time underloaded	56.75%	74.47%
% of Production time overloaded	43.25%	25.53%

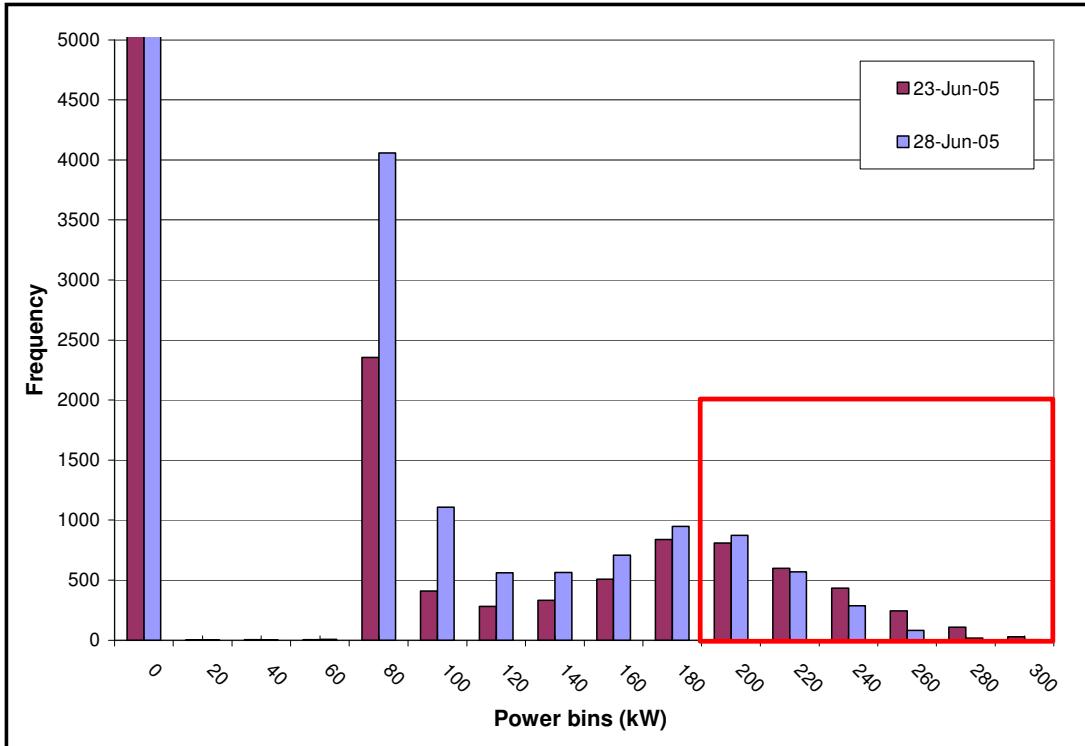


Figure L.2-11: Histogram for power consumed by a RH cutter motor.

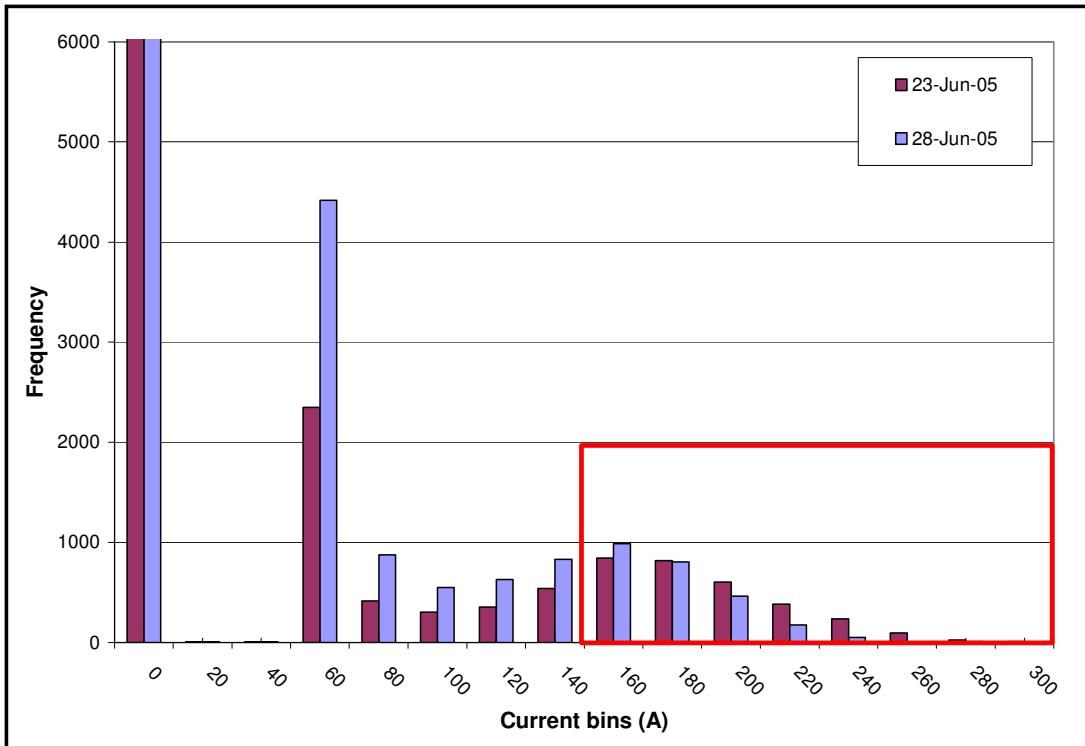


Figure L.2-12: Histogram for current consumed by a RH cutter motor.

L.2.2.2 Afternoon shifts

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

	23-Jun-05	28-Jun-05
Tonnes/CM/Shift	1566	1740
% Time of shift producing	49.55%	45.61%
% of Production time underloaded	72.03%	68.13%
% of Production time overloaded	27.97%	31.87%

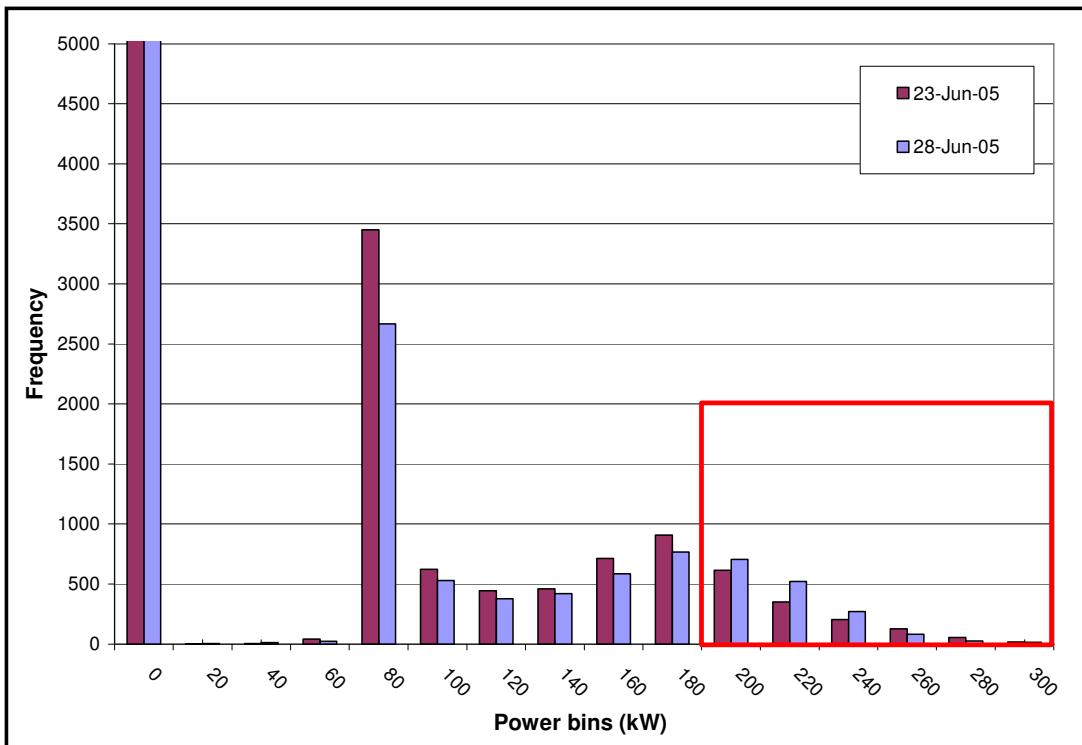


Figure L.2-13: Histogram for power consumed by a LH cutter motor.

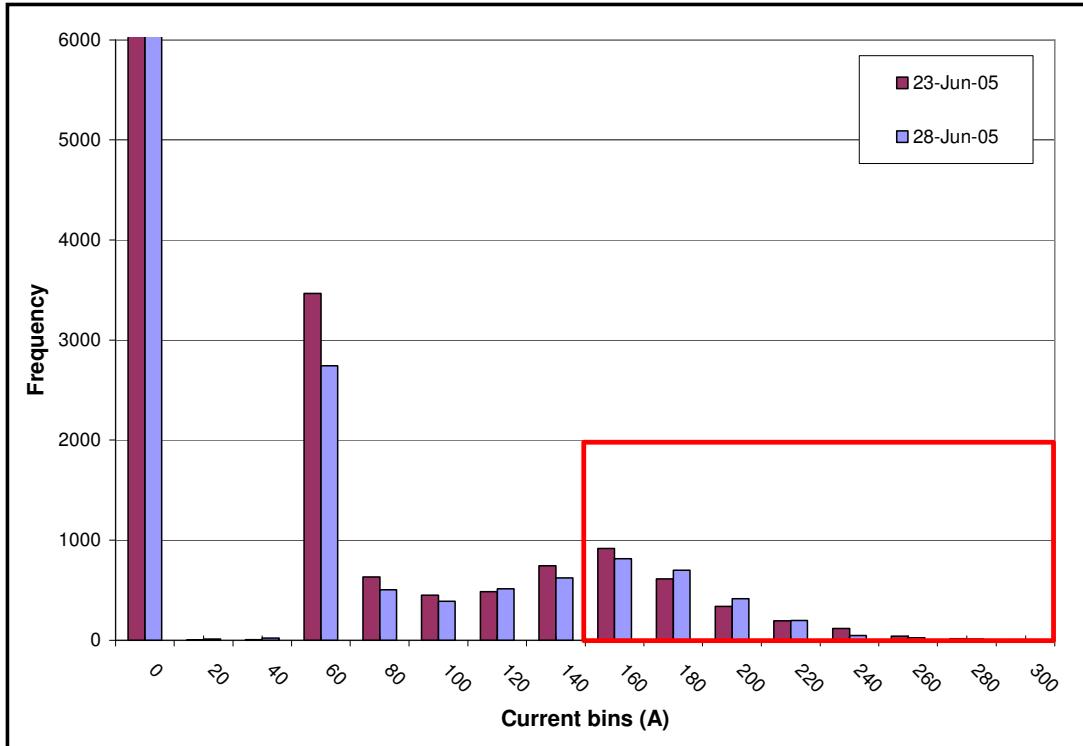


Figure L.2-14: Histogram for current consumed by a LH cutter motor.

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

	23-Jun-05	28-Jun-05
Tonnes/CM/Shift	1566	1740
% Time of shift producing	49.57%	45.59%
% of Production time underloaded	70.95%	67.80%
% of Production time overloaded	29.05%	32.20%

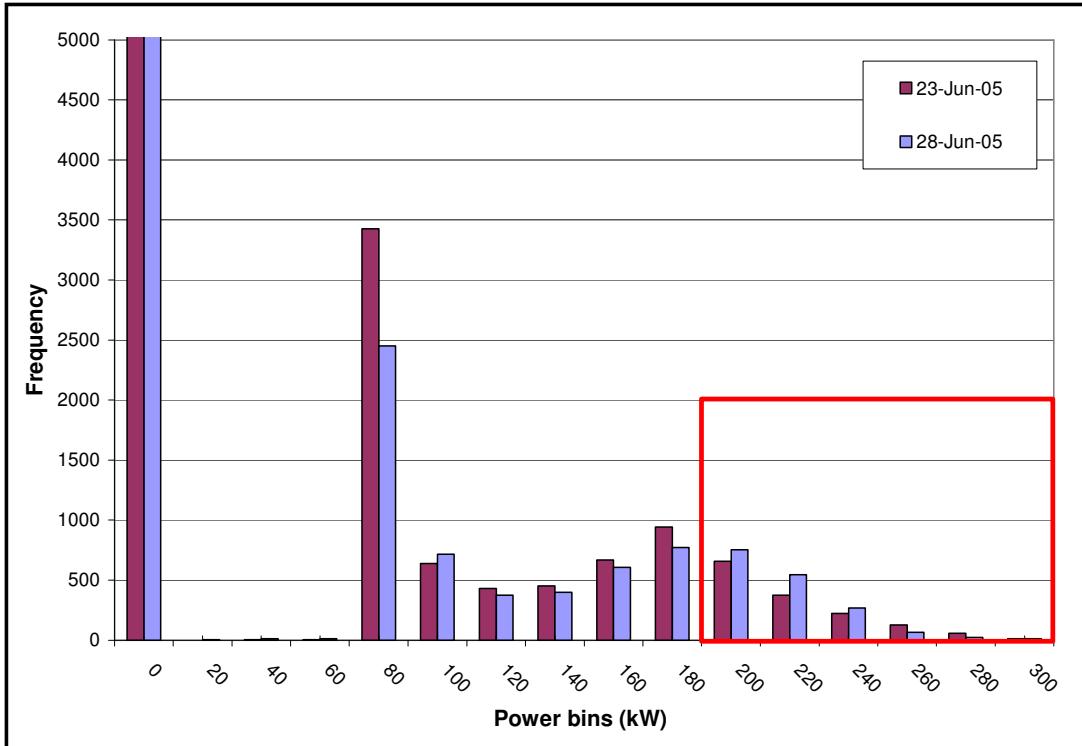


Figure L.2-15: Histogram for power consumed by a RH cutter motor.

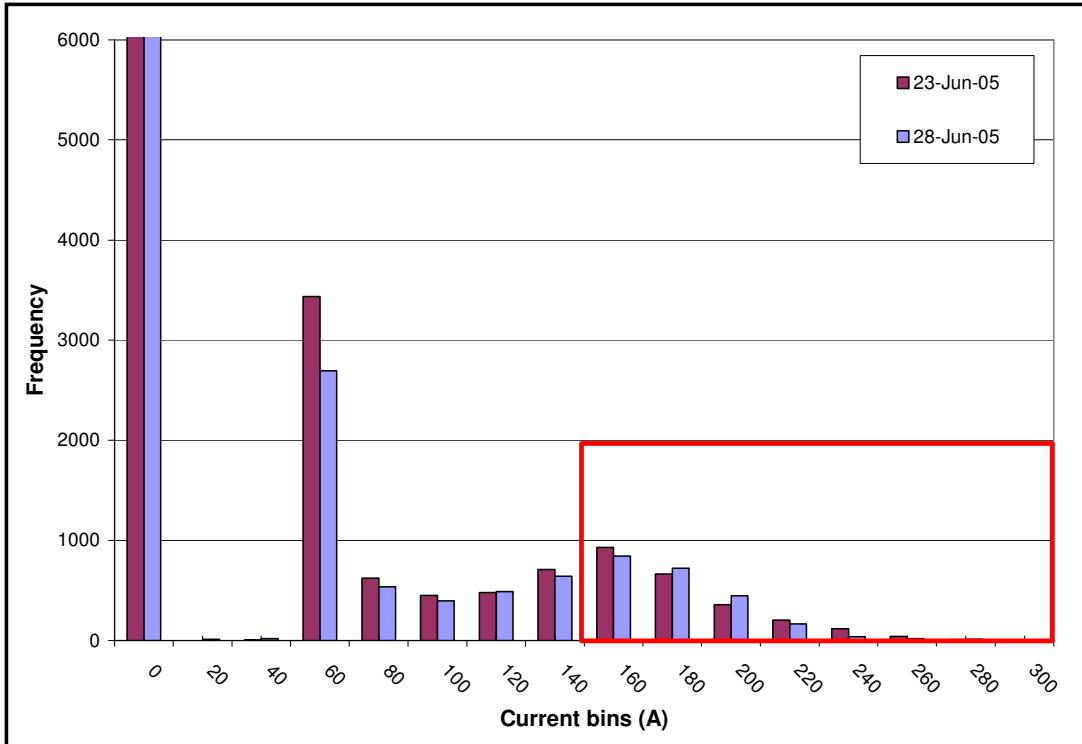


Figure L.2-16: Histogram for current consumed by a RH cutter motor.

L.2.3 FLASHCARD RECORDER

L.2.3.1 Morning shifts

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

	16-May-05	17-May-05	18-May-05	23-May-05
Tonnes/CM/Shift	1551	858	1320	1740
% Time of shift producing	60.68%	28.99%	40.47%	59.69%
% of Production time underloaded	78.70%	80.30%	80.10%	85.27%
% of Production time overloaded	21.30%	19.70%	19.90%	14.73%

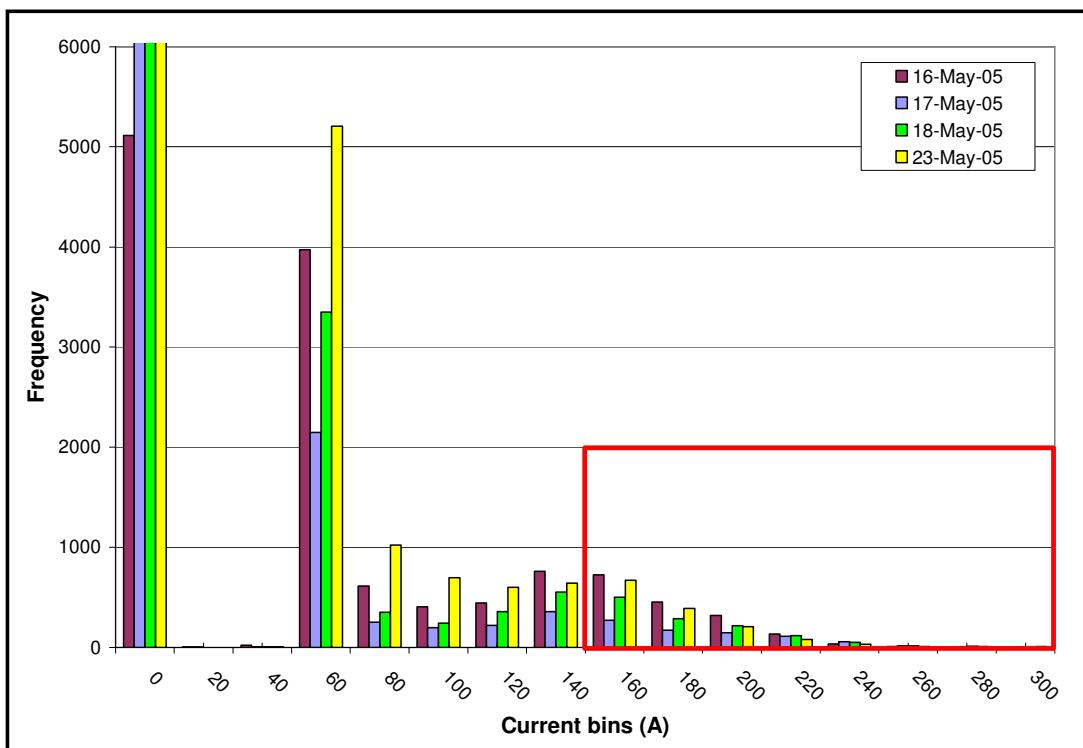


Figure L.2-17: Histogram for current consumed by a LH cutter motor.

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

	16-May-05	17-May-05	18-May-05	23-May-05
Tonnes/CM/Shift	1551	858	1320	1740
% Time of shift producing	60.70%	29.00%	40.50%	59.71%
% of Production time underloaded	83.42%	83.62%	85.21%	92.32%
% of Production time overloaded	16.58%	16.38%	14.79%	7.68%

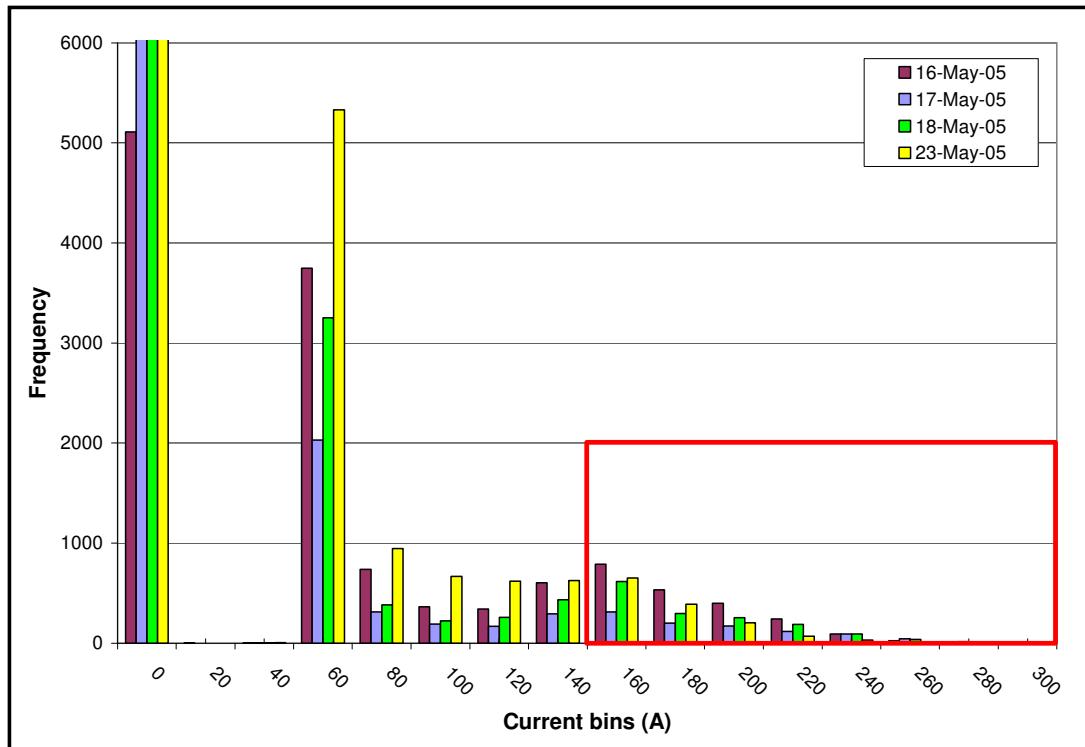


Figure L.2-18: Histogram for current consumed by a RH cutter motor.

L.2.3.2 Afternoon shifts

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

	16-May-05	17-May-05	18-May-05	23-May-05
Tonnes/CM/Shift	1485	2145	2112	2030
% Time of shift producing	55.99%	58.02%	60.48%	69.22%
% of Production time underloaded	78.76%	69.92%	78.56%	78.12%
% of Production time overloaded	21.24%	30.08%	21.44%	21.88%

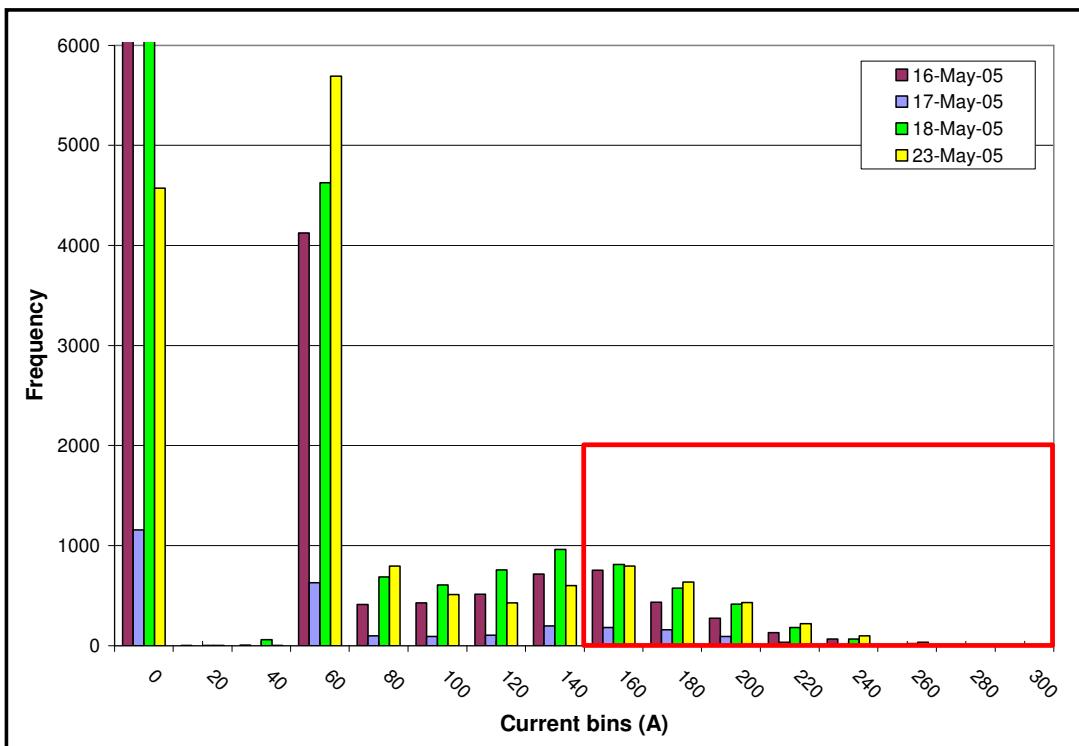


Figure L.2-19: Histogram for current consumed by a LH cutter motor.

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

	16-May-05	17-May-05	18-May-05	23-May-05
Tonnes/CM/Shift	1485	2145	2112	2030
% Time of shift producing	56.03%	58.02%	60.48%	69.20%
% of Production time underloaded	73.91%	64.35%	73.48%	78.19%
% of Production time overloaded	26.09%	35.65%	26.52%	21.81%

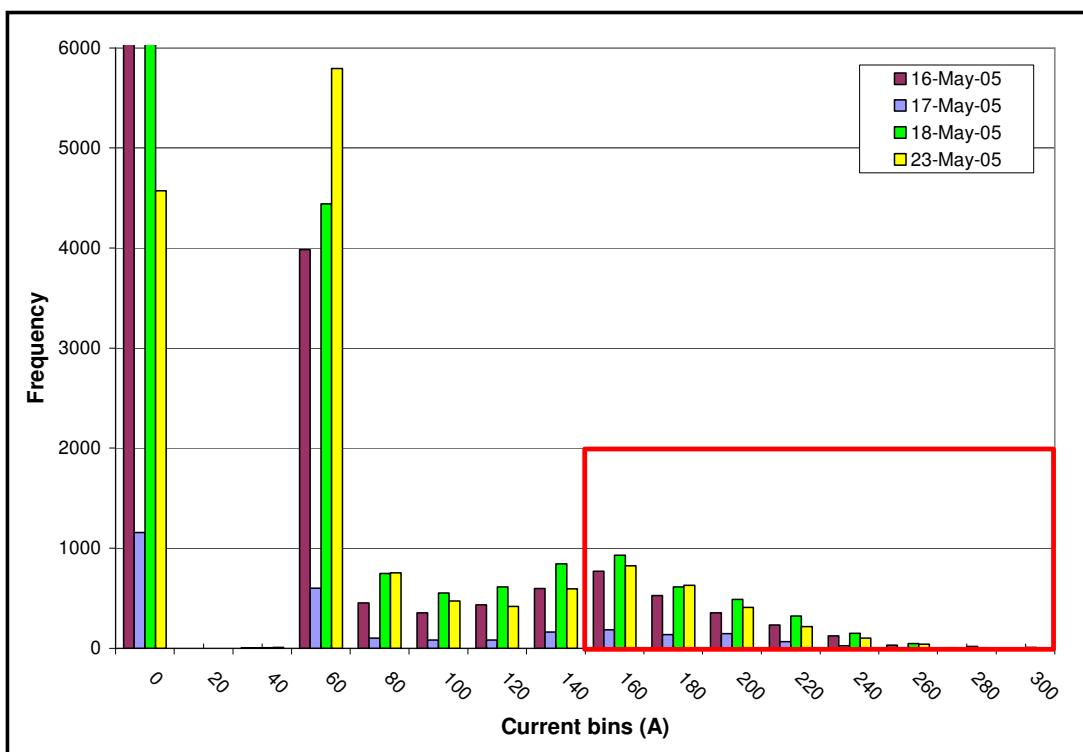


Figure L.2-20: Histogram for current consumed by a RH cutter motor.

L.3 THERMAL CAPACITY

The next section focuses on the temperature of the windings of the cutter 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 70 minutes.

L.3.1 SECTION 21

L.3.1.1 Morning shifts

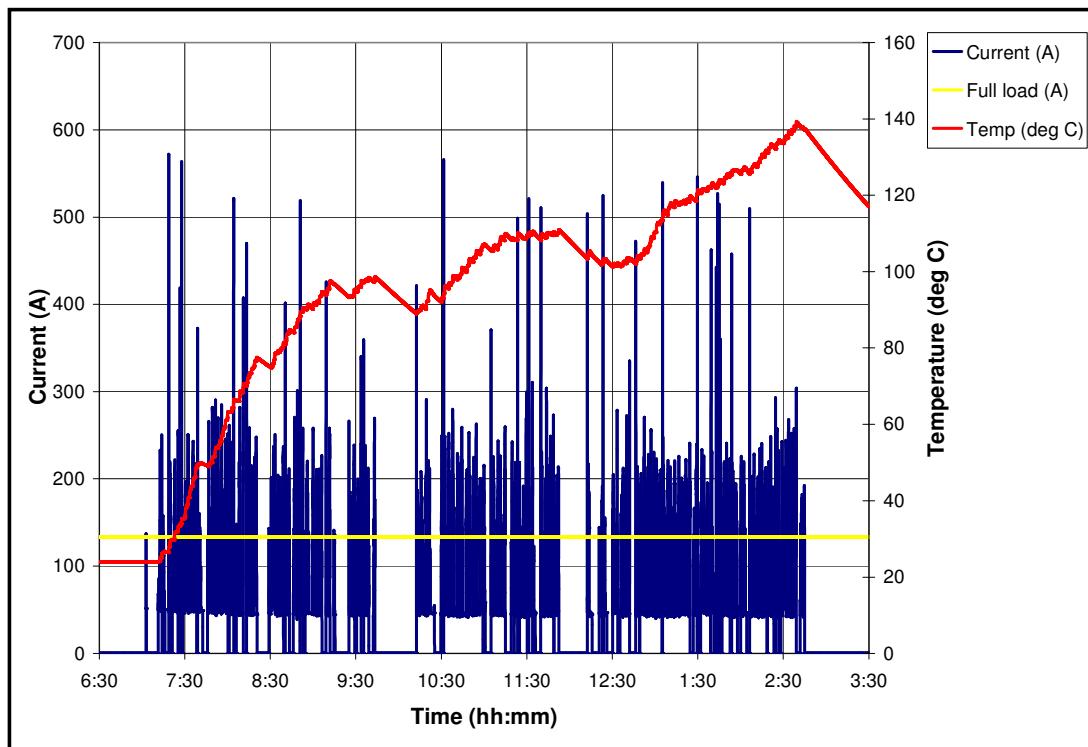
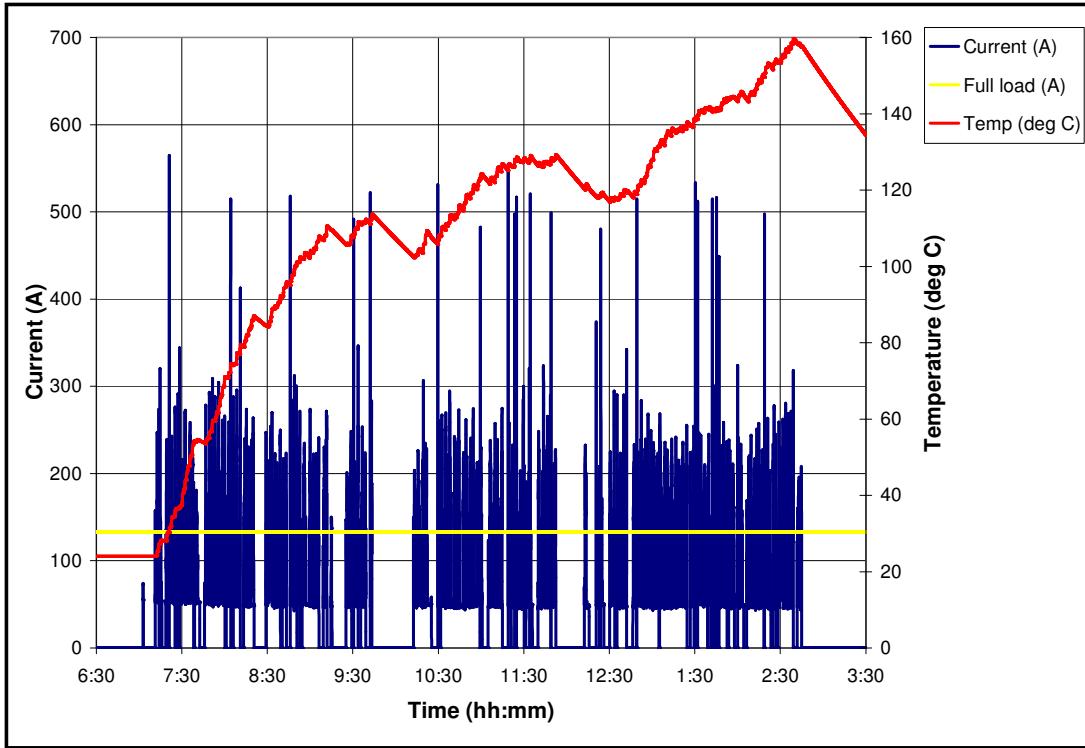
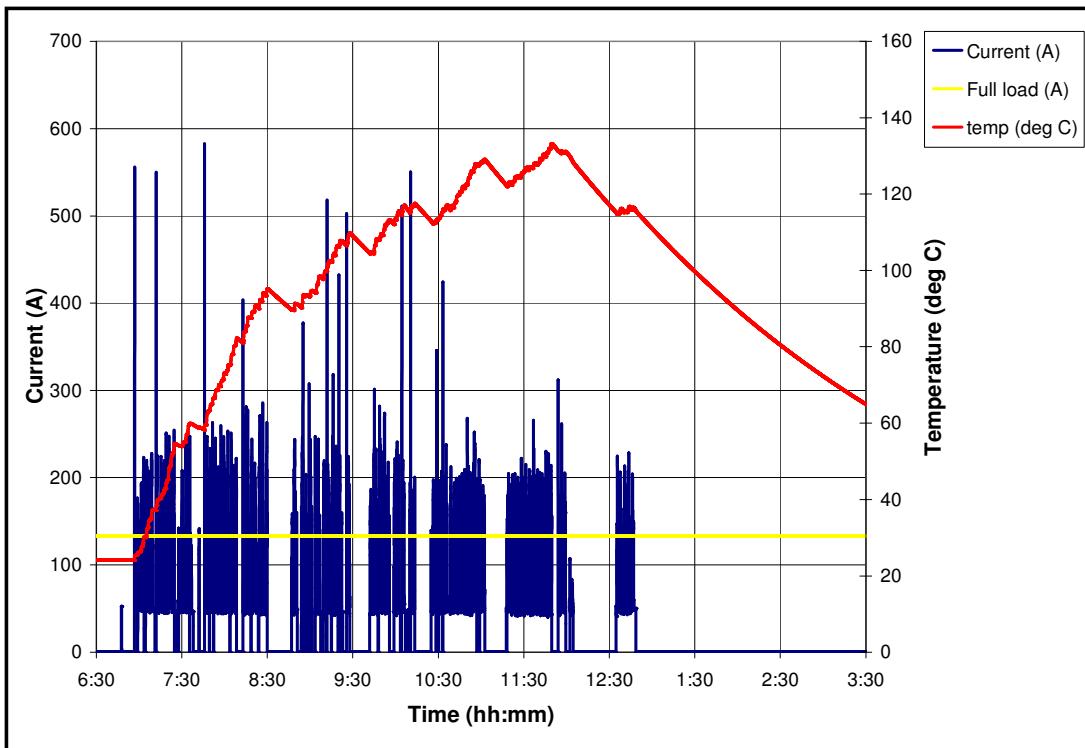


Figure L.3-1: Load current and motor temperature for a LH cutter motor

– 6 June 2005.



**Figure L.3-2: Lo Load current and motor temperature for a RH cutter motor
– 6 June 2005.**



**Figure L.3-3: Load current and motor temperature for a LH cutter motor
– 7 June 2005.**

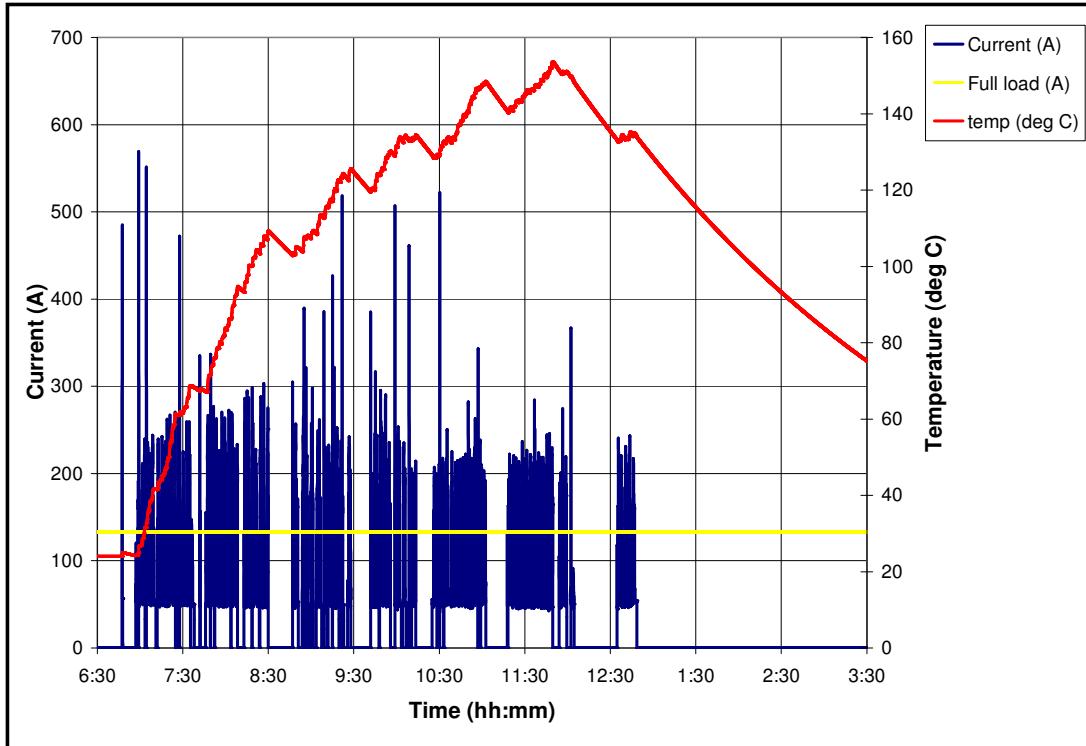


Figure L.3-4: Load current and motor temperature for a RH cutter motor
– 7 June 2005.

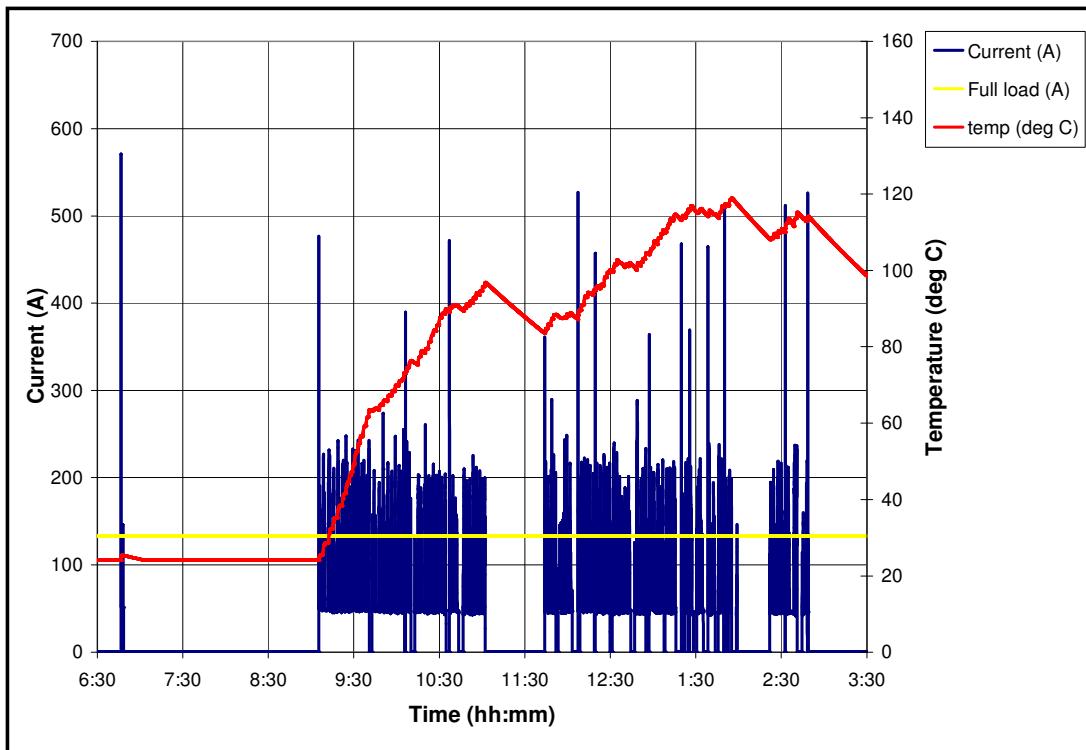


Figure L.3-5: Lo Load current and motor temperature for a LH cutter motor
– 8 June 2005.

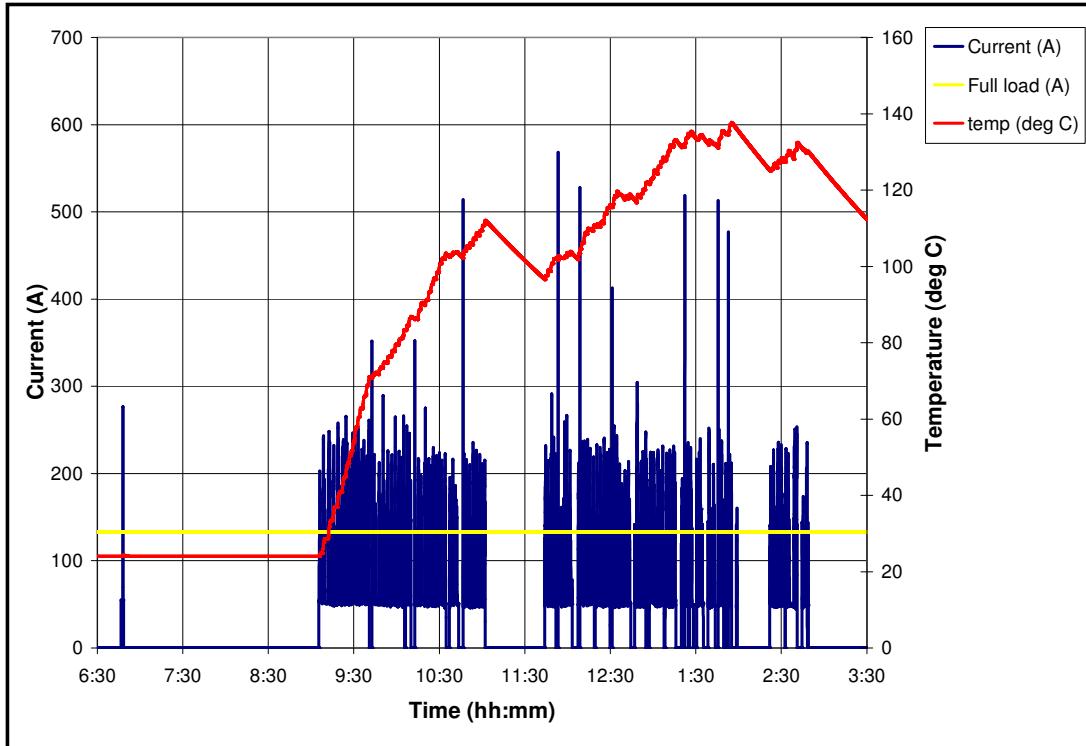


Figure L.3-6: Load current and motor temperature for a RH cutter motor
– 8 June 2005.

L.3.1.2 Afternoon shifts

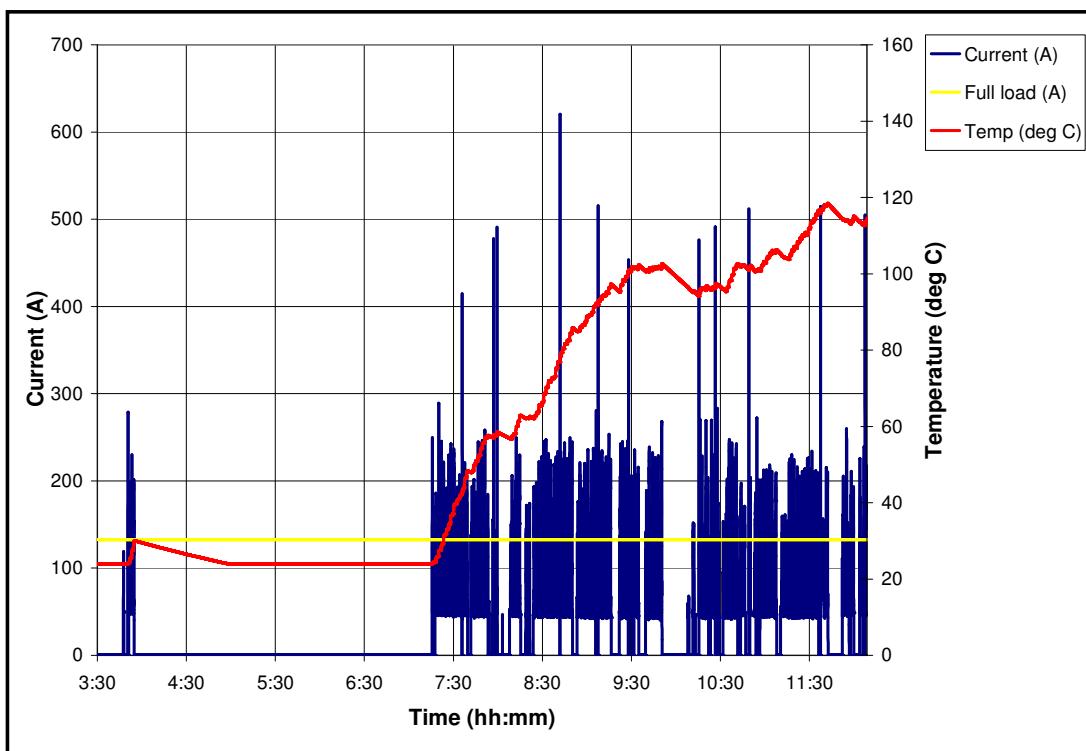
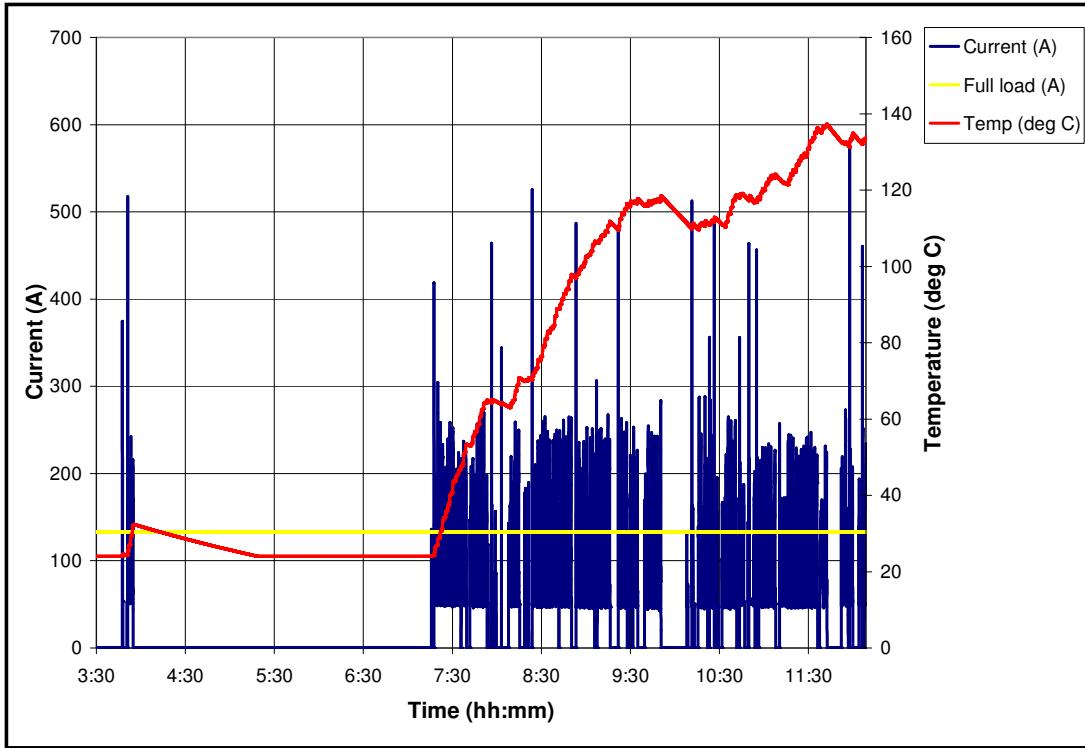
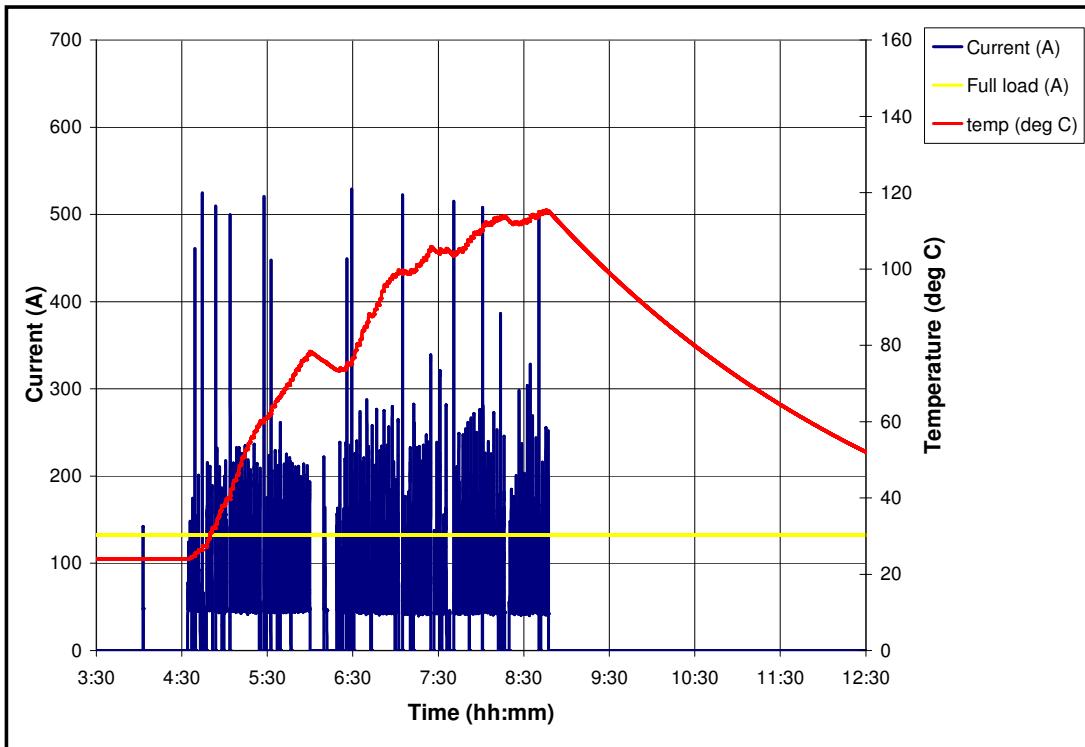


Figure L.3-7: Load current and motor temperature for a LH cutter motor

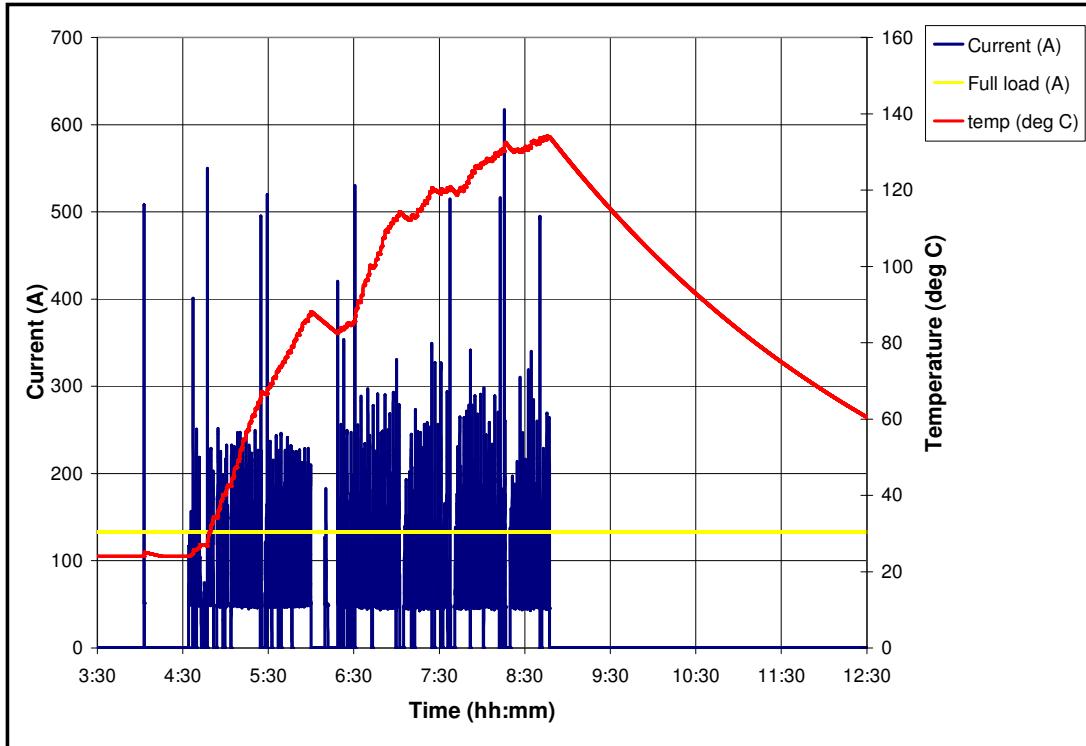
– 6 June 2005.



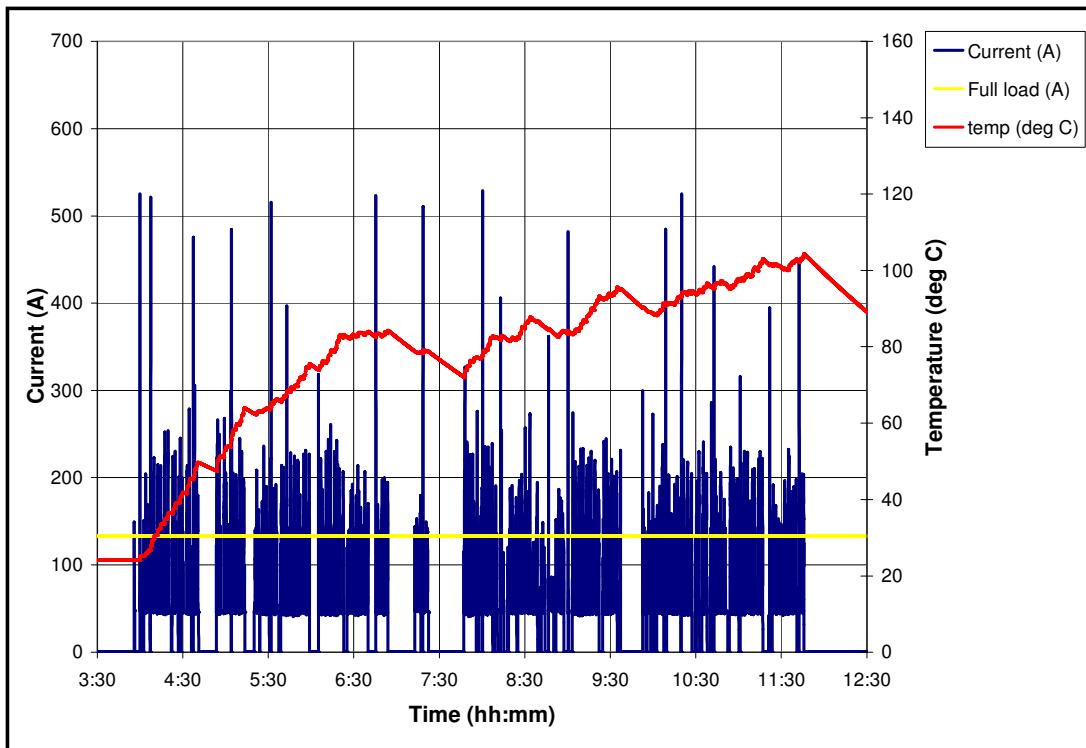
**Figure L.3-8: Lo Load current and motor temperature for a RH cutter motor
– 6 June 2005.**



**Figure L.3-9: Load current and motor temperature for a LH cutter motor
– 7 June 2005.**



**Figure L.3-10: Load current and motor temperature for a RH cutter motor
– 7 June 2005.**



**Figure L.3-11: Load current and motor temperature for a LH cutter motor
– 8 June 2005.**

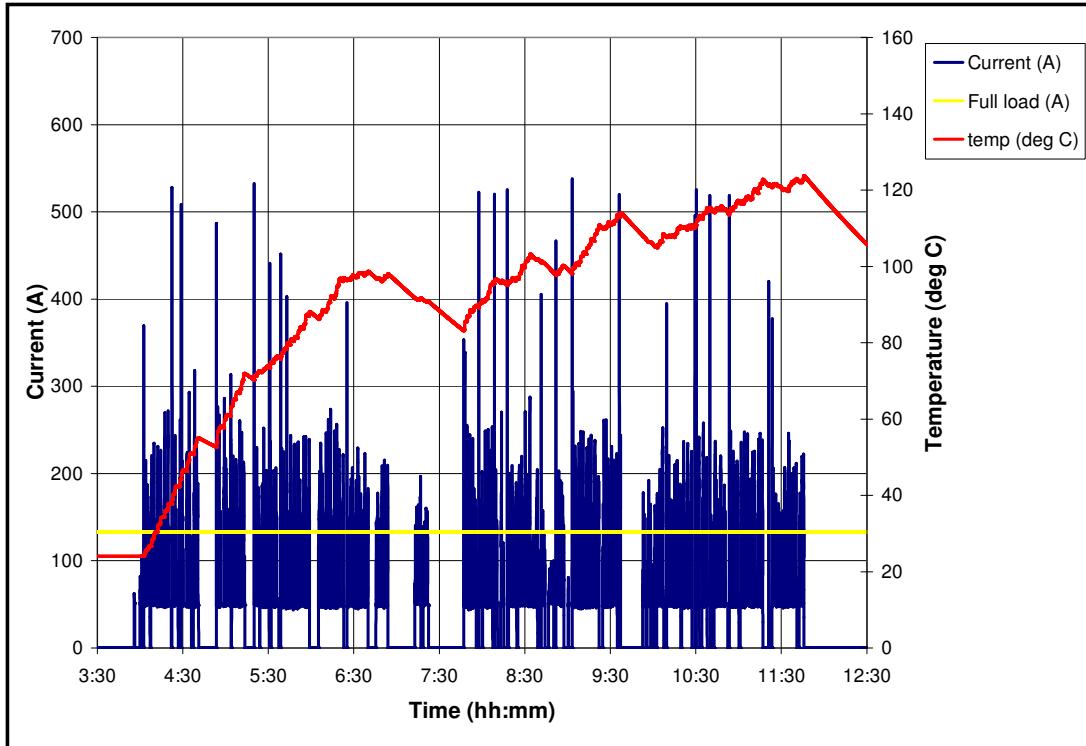
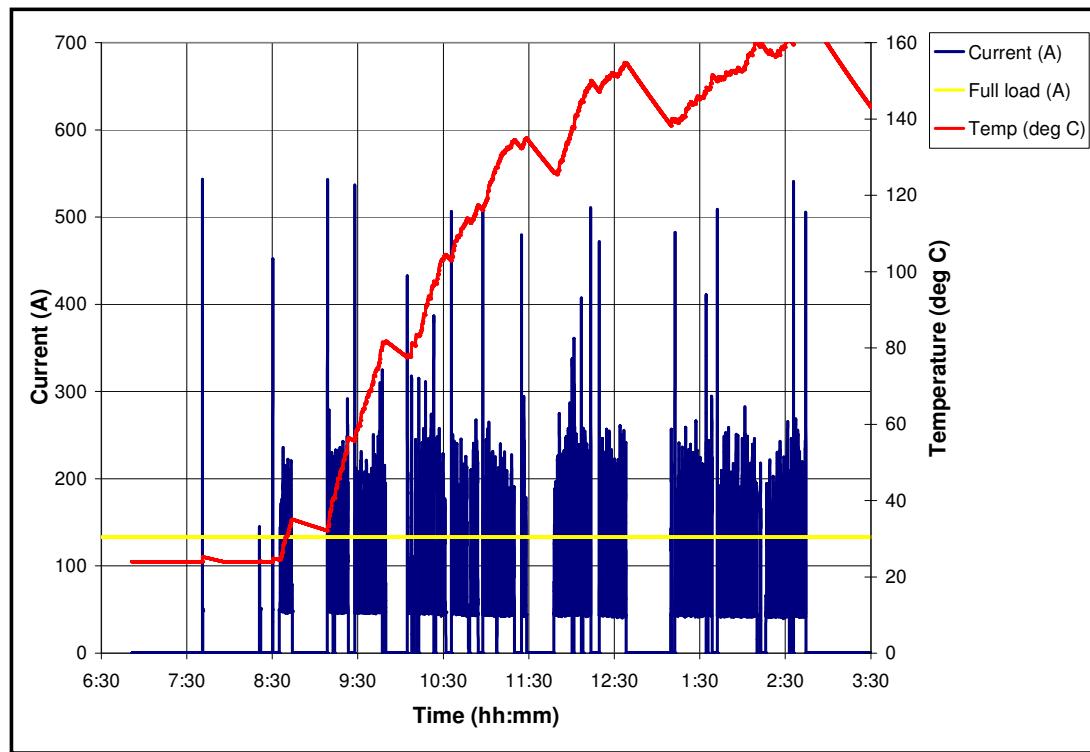


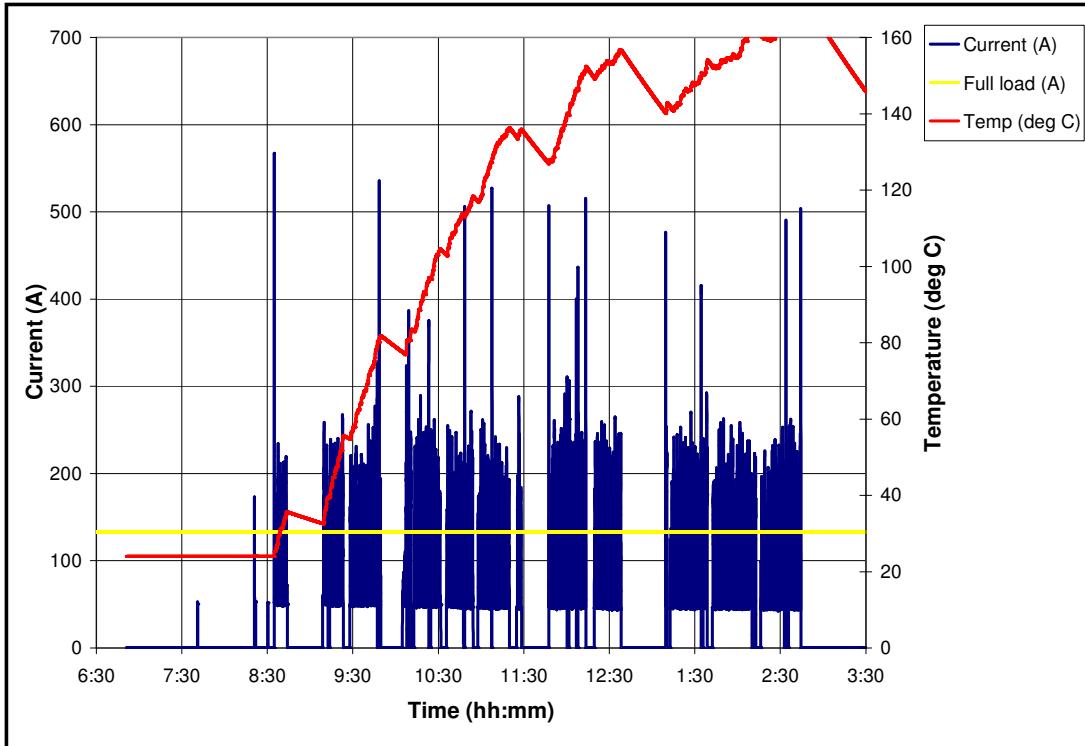
Figure L.3-12: Load current and motor temperature for a RH cutter motor
– 8 June 2005.

L.3.2 SECTION 51

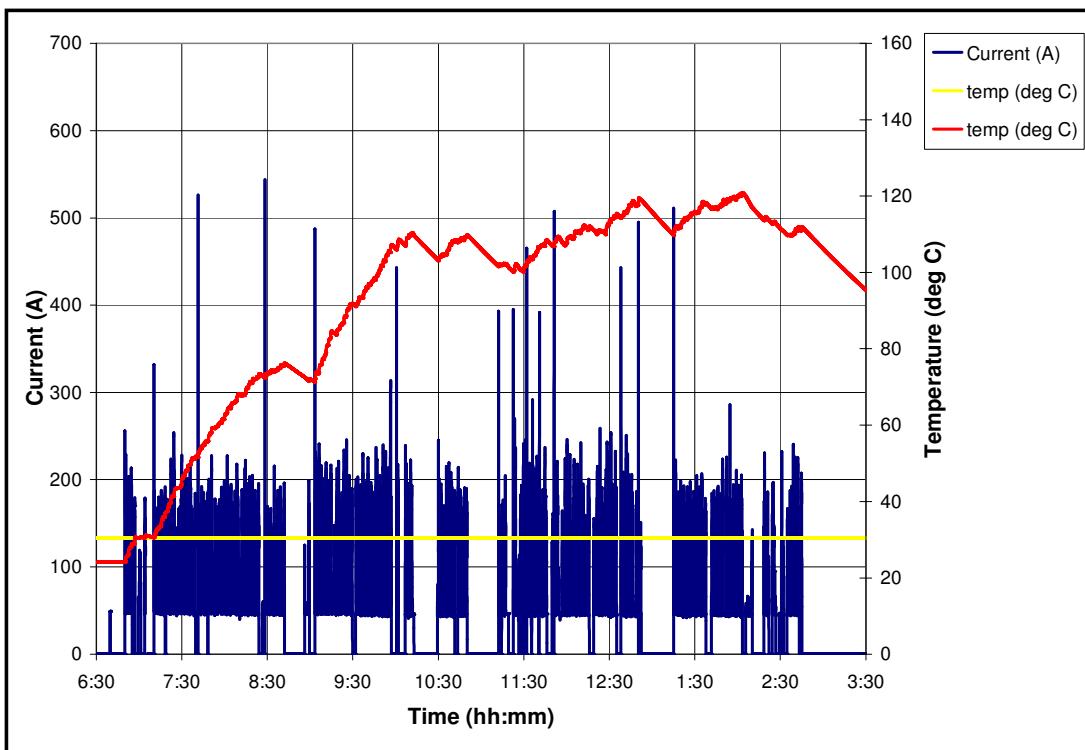
L.3.2.1 Morning shifts



**Figure L.3-13: Load current and motor temperature for a LH cutter motor
– 23 June 2005.**



**Figure L.3-14: Load current and motor temperature for a RH cutter motor
– 23 June 2005.**



**Figure L.3-15: Load current and motor temperature for a LH cutter motor
– 28 June 2005.**

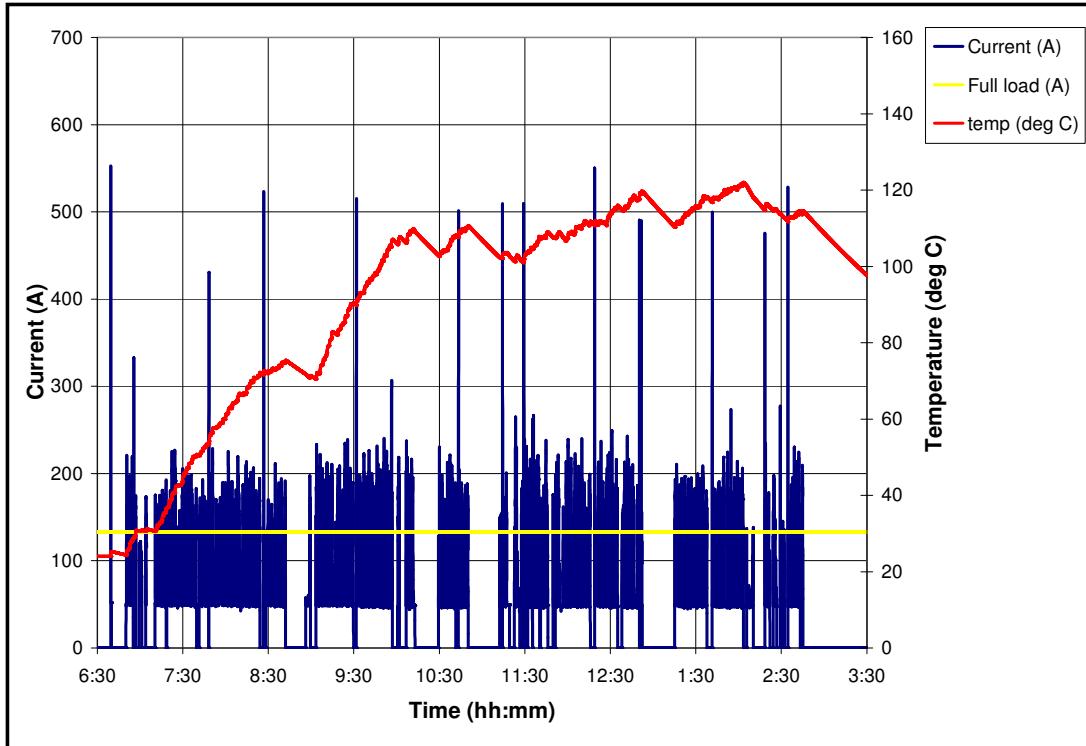
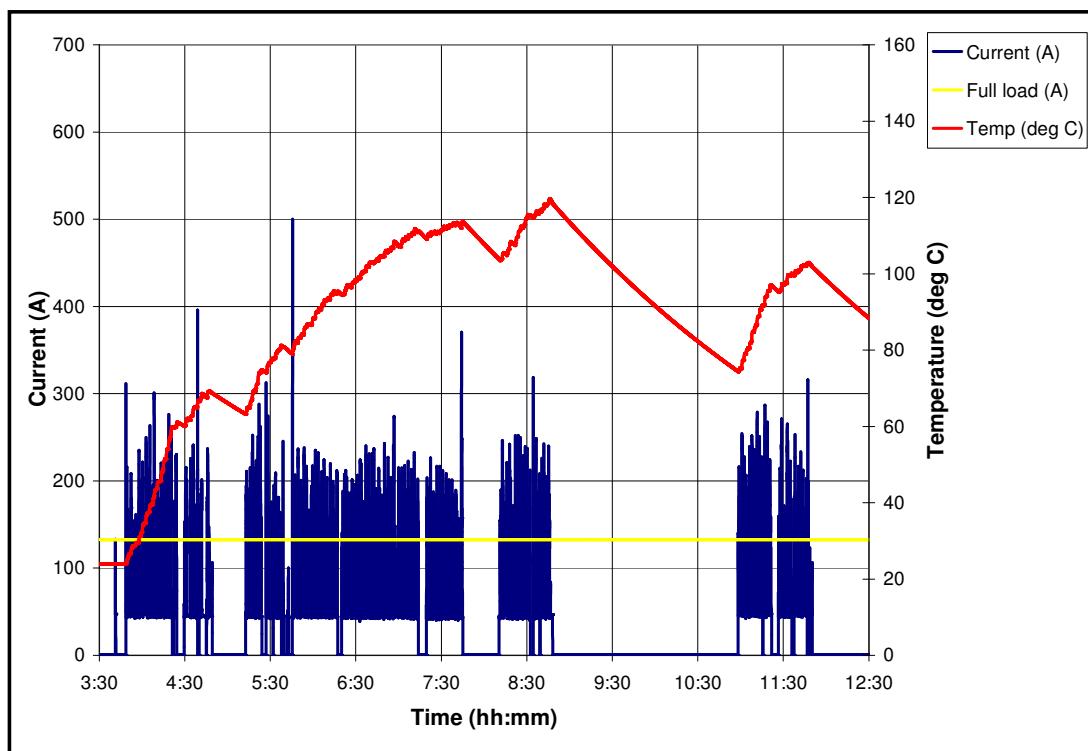
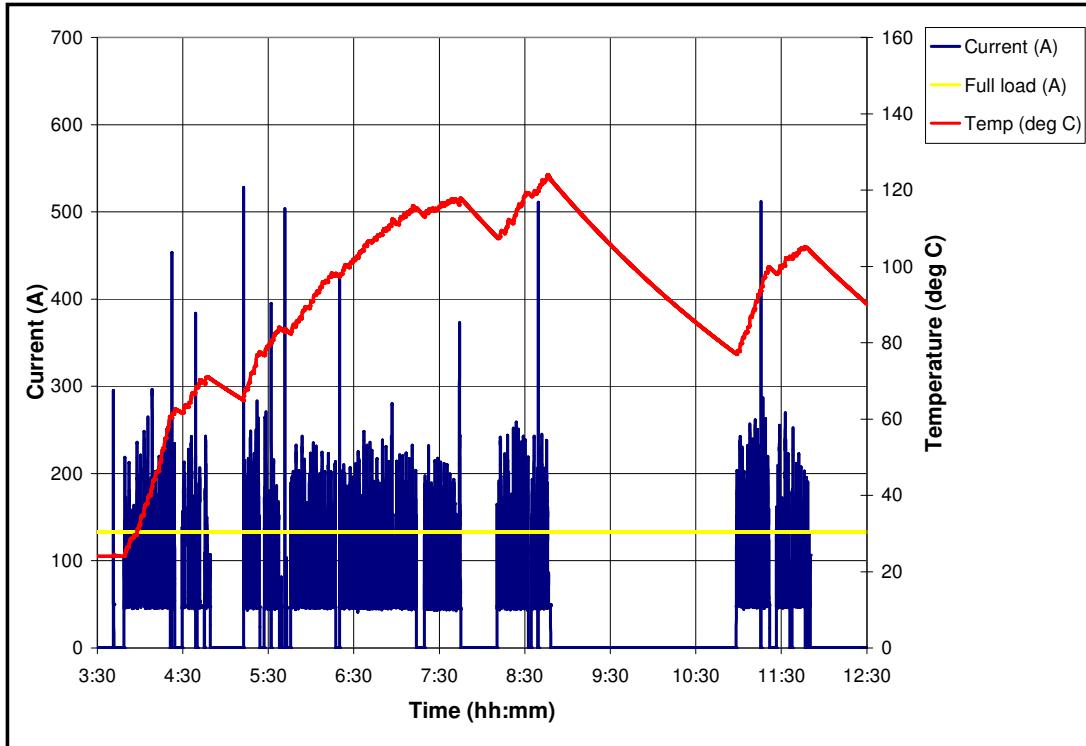


Figure L.3-16: Load current and motor temperature for a RH cutter motor
– 28 June 2005.

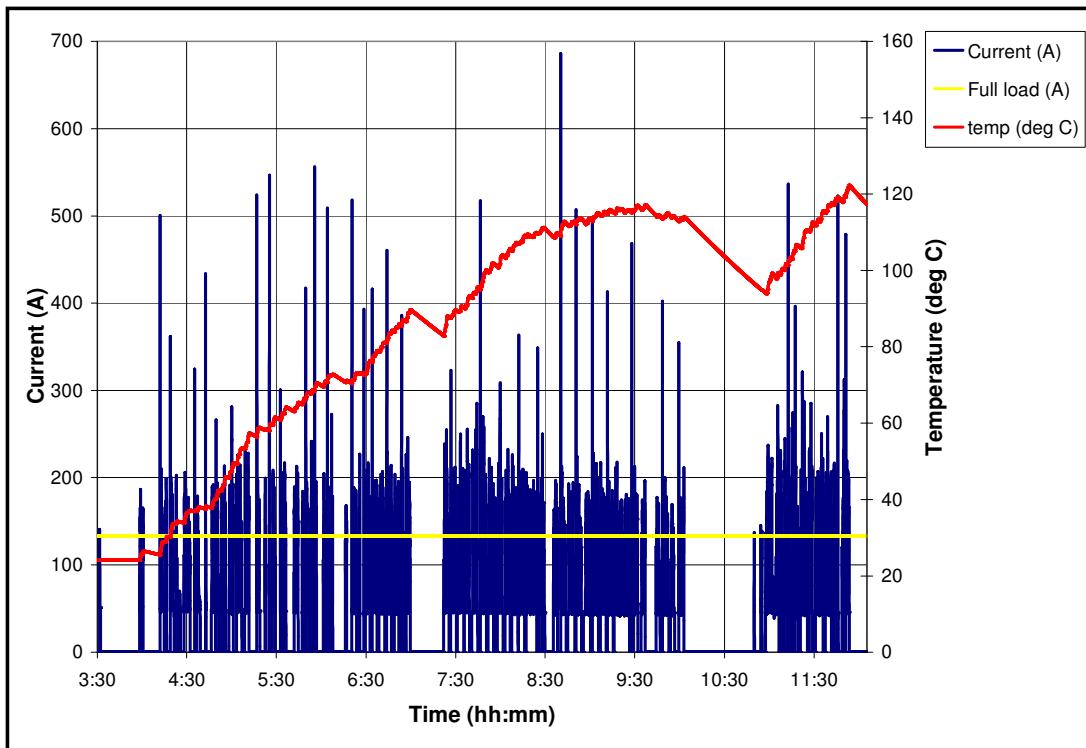
L.3.2.2 Afternoon shifts



**Figure L.3-17: Load current and motor temperature for a LH cutter motor
– 23 June 2005.**



**Figure L.3-18: Load current and motor temperature for a RH cutter motor
– 23 June 2005.**



**Figure L.3-19: Load current and motor temperature for a LH cutter motor
– 28 June 2005.**

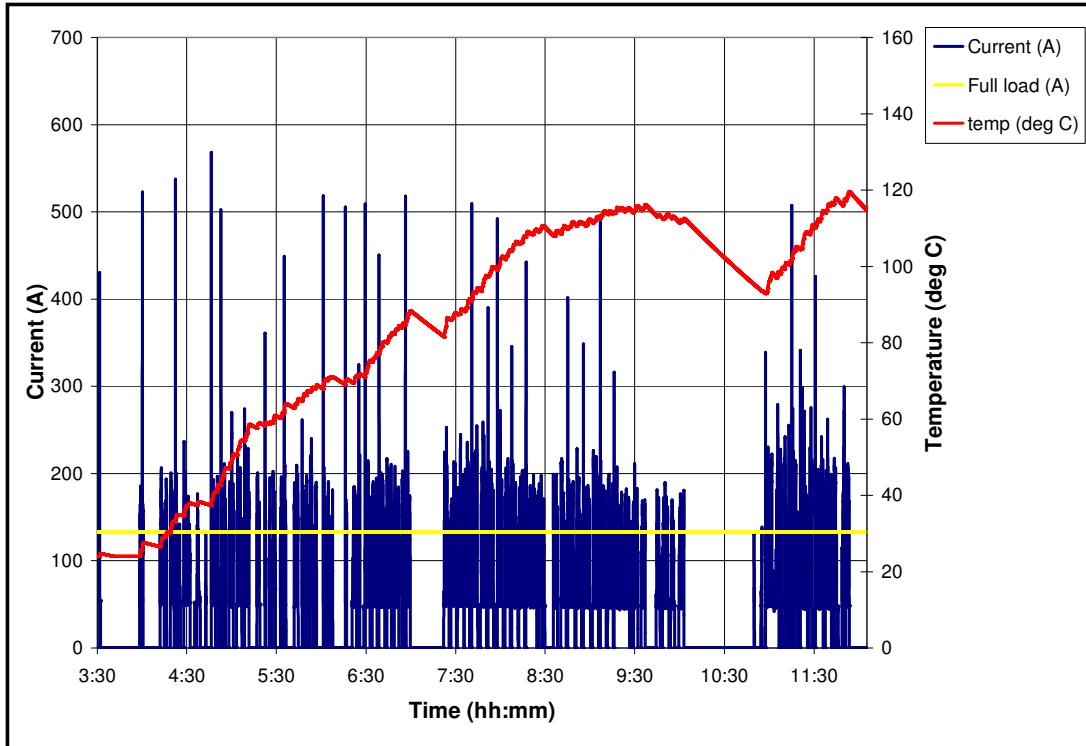


Figure L.3-20: Load current and motor temperature for a RH cutter motor
– 28 June 2005.