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APPENDIX K

CM GATHERING HEAD MOTORS

Typical nameplate data for the gathering head motors of a CM can be seen in Table K-1. The gathering head motors measured at all the sections was a 40 kW induction motor with a full load current rating of 33 A.

Table K-1: Nameplate data of the gathering head motor on a CM.

| CM Gathering head Motors | | | | | |
|--------------------------|----|----|---------|------|---|
| Power | 40 | kW | Voltage | 1000 | V |
| Duty | S1 | HR | Current | 33 | A |
| Ins class | H | | RPM | 1390 | |
| | | | pf | 0.76 | |

Table K-2: Production figures for shifts that the gathering head 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 | - | - |
| 9-Jun-2005 | 1225 | 1400 | - | - | - | - |
| 10-Jun-2005 | 1575 | 2695 | - | - | - | - |
| 13-Jun-2005 | 2310 | 2520 | - | - | - | - |
| 29-Jun-2005 | - | - | - | - | 1305 | 2175 |
| 30-Jun-2005 | - | - | - | - | 1740 | 2320 |

K.1 LOAD PROFILE

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

K.1.1 SECTION 21

K.1.1.1 Morning shifts

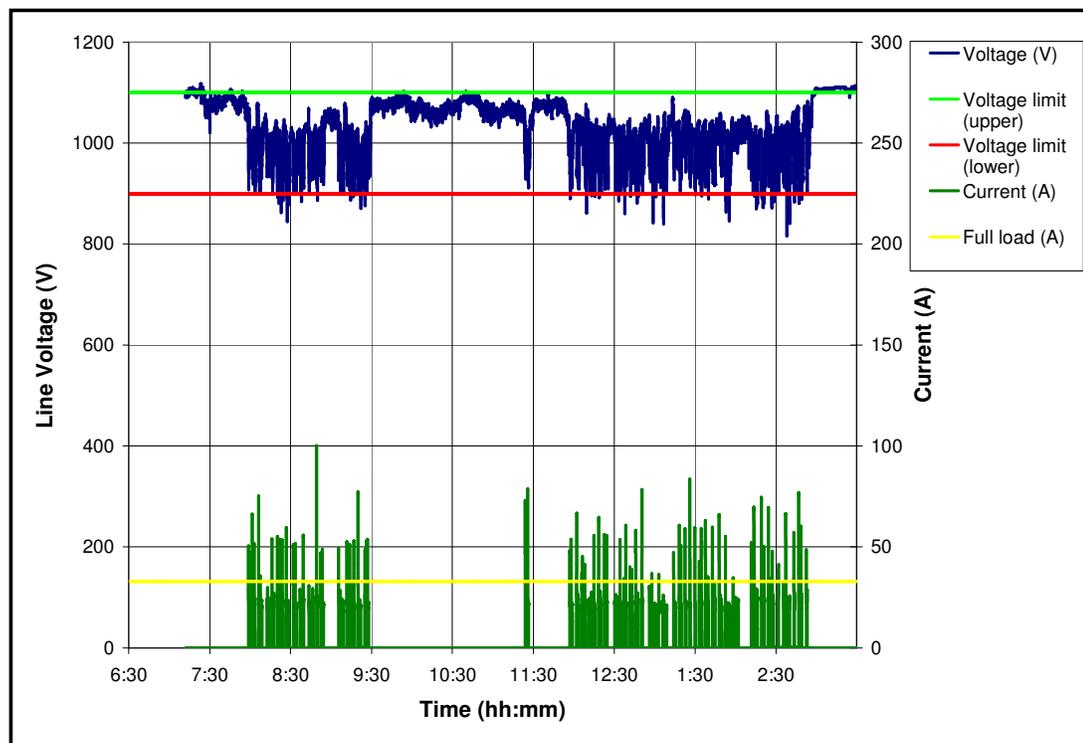
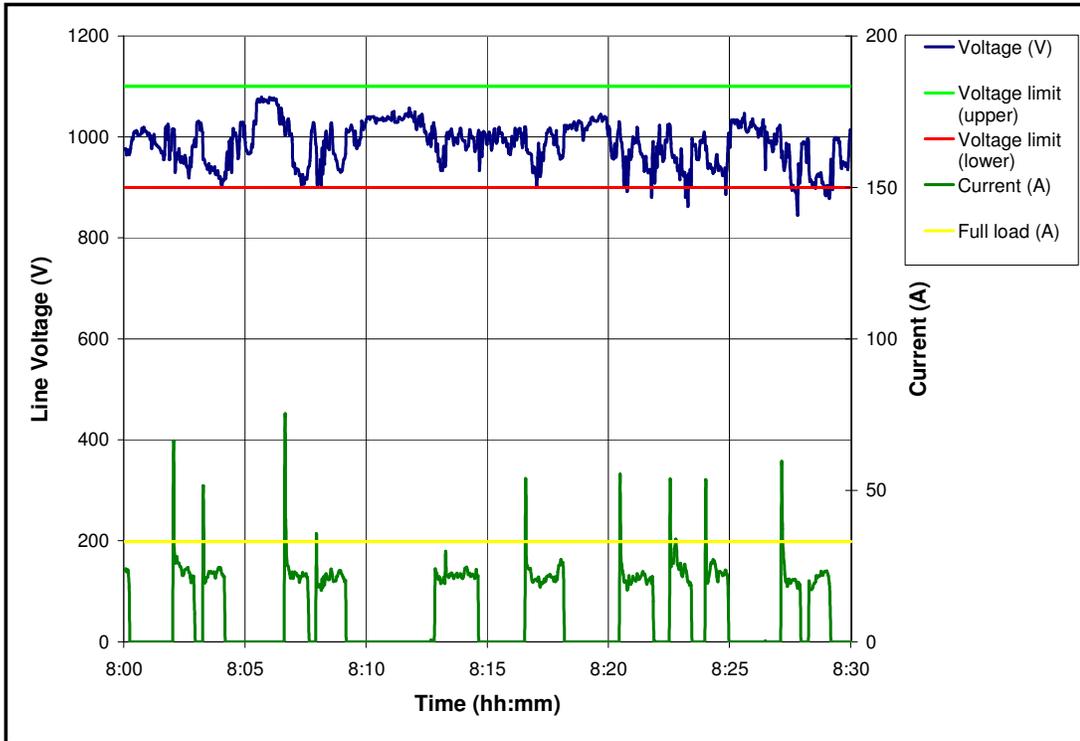
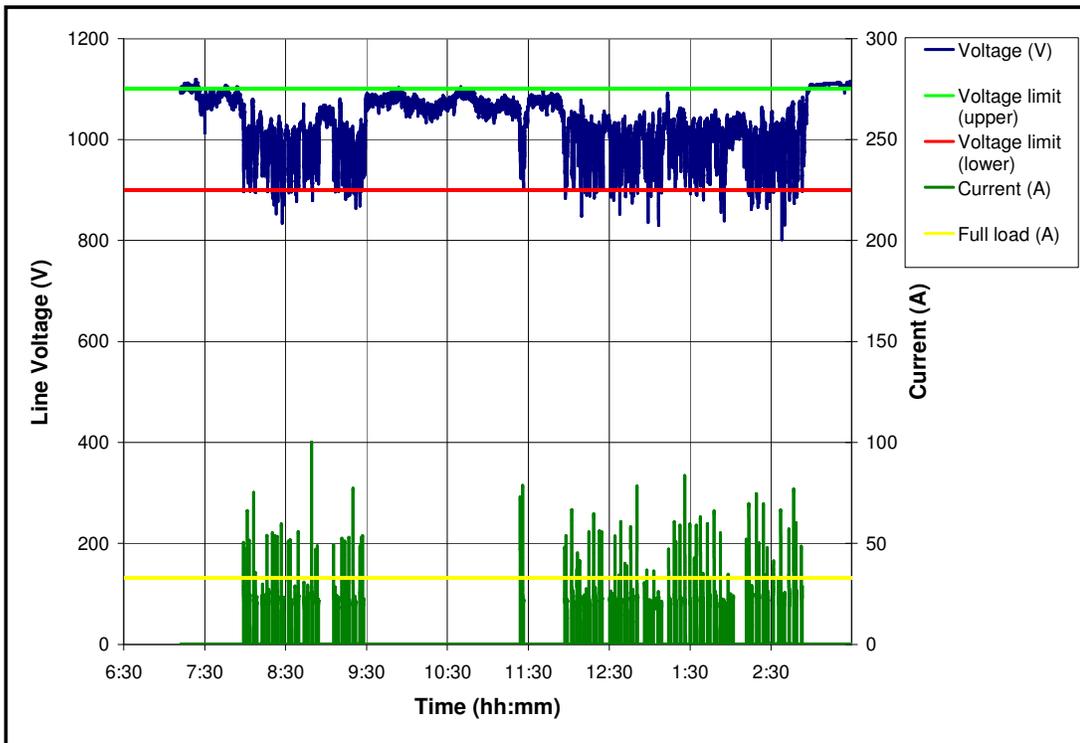


Figure K.1-1: Load current and voltage for a LH gathering head motor

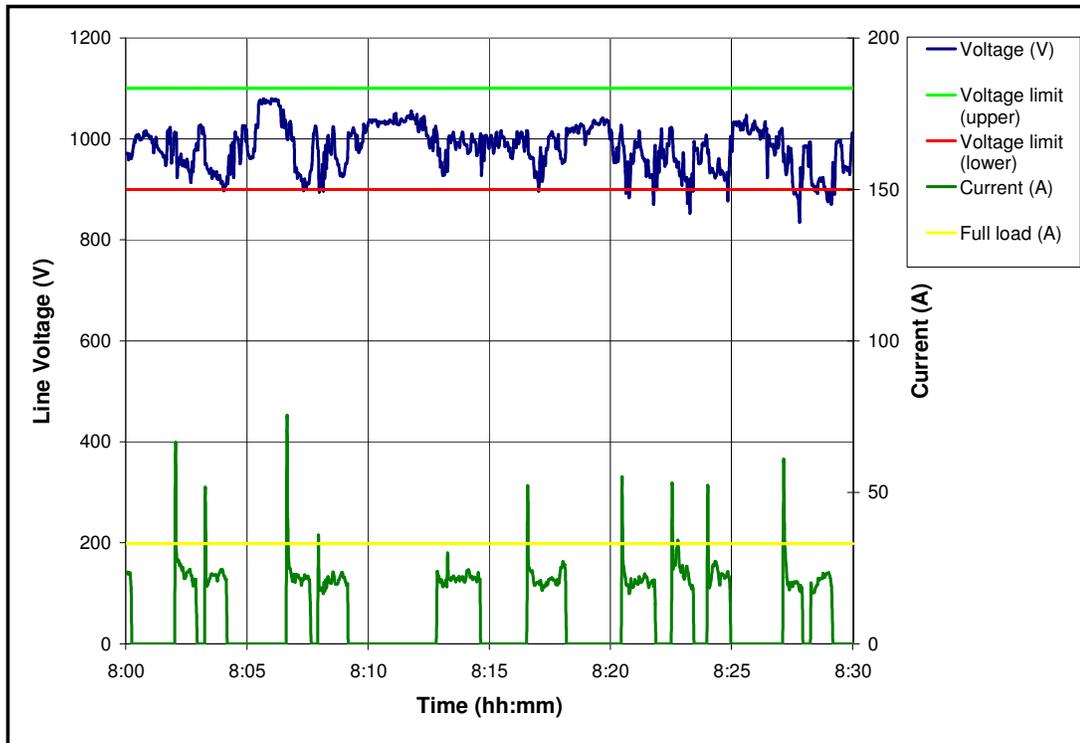
– 9 June 2005.



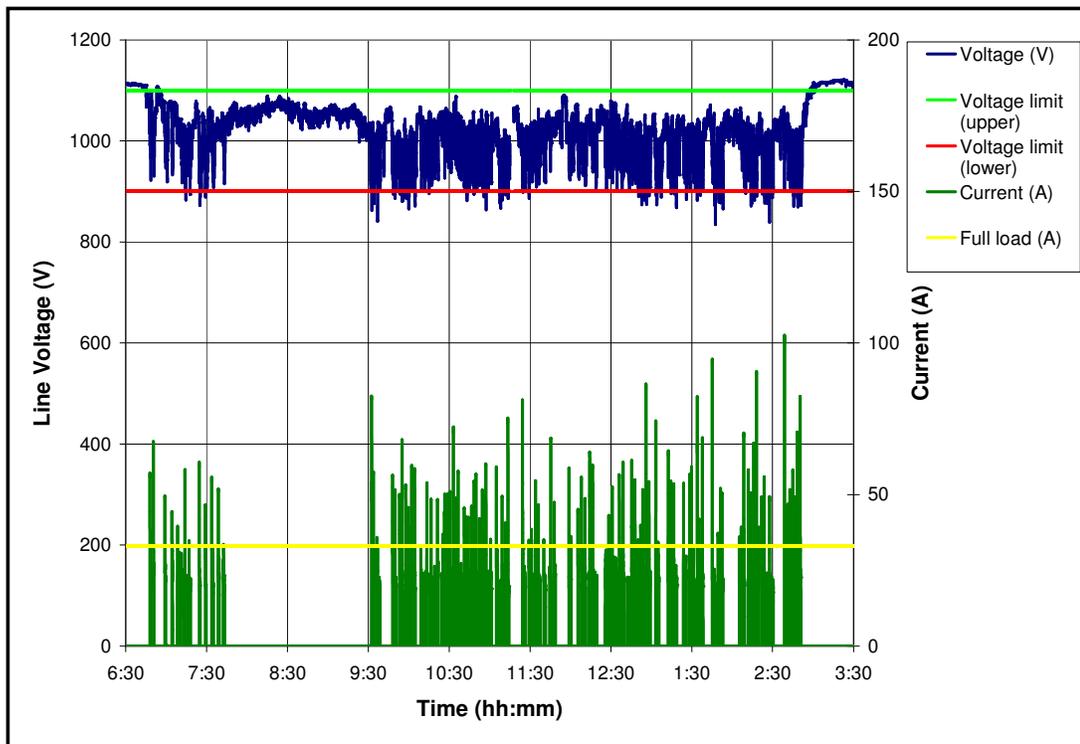
**Figure K.1-2: Load current and voltage for a LH gathering head motor
– 9 June 2005 (30 minute period).**



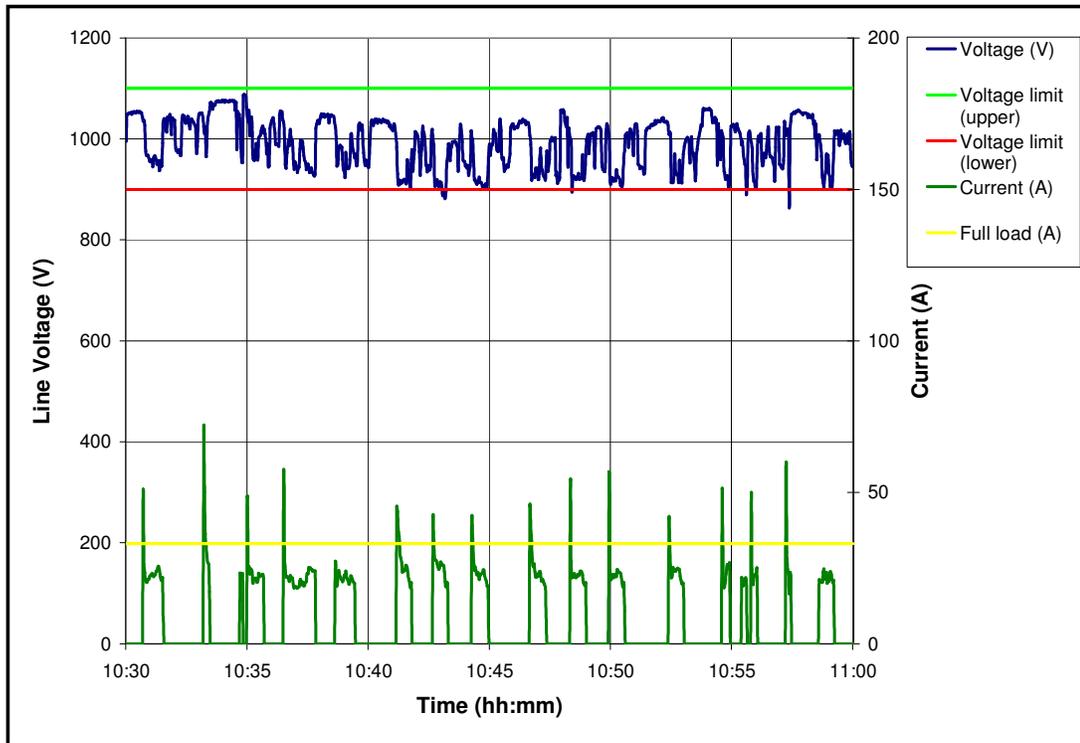
**Figure K.1-3: Load current and voltage for a RH gathering head motor
– 9 June 2005.**



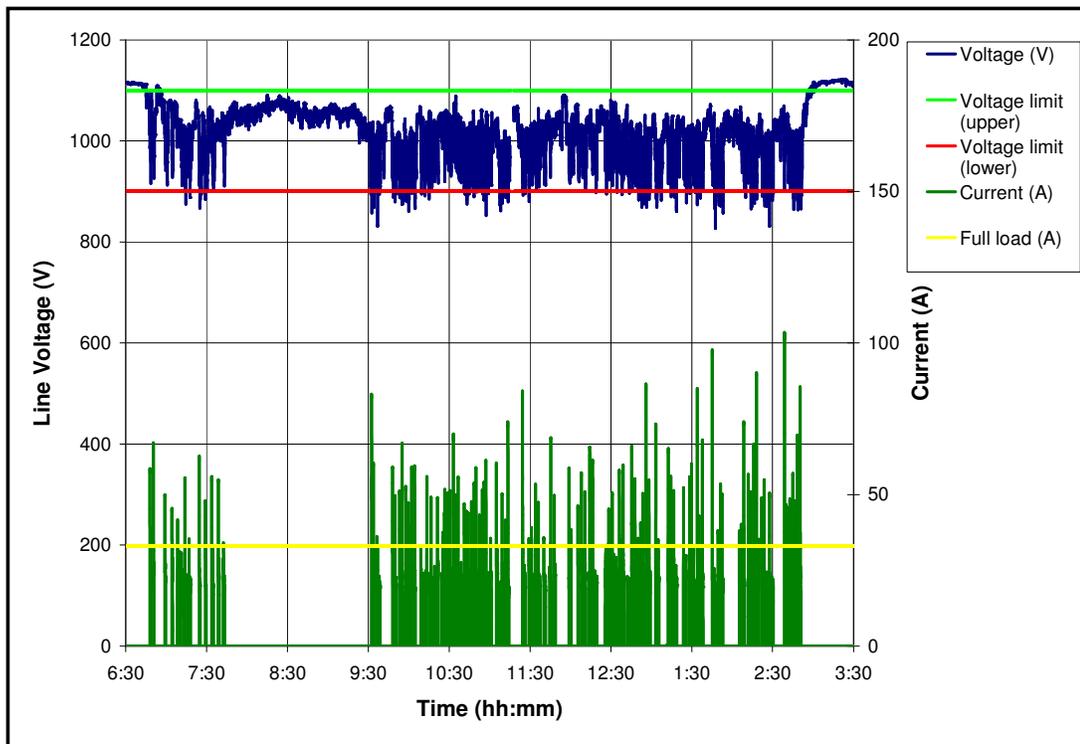
**Figure K.1-4: Load current and voltage for a RH gathering head motor
– 9 June 2005 (30 minute period).**



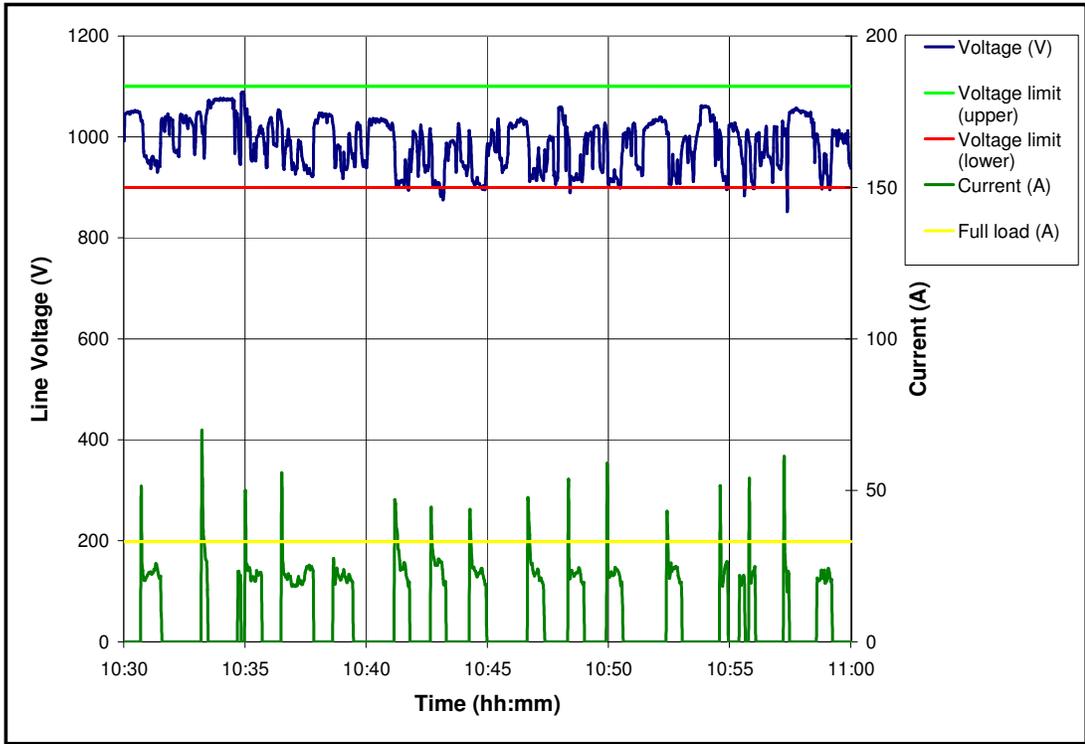
**Figure K.1-5: Load current and voltage for a LH gathering head motor
– 10 June 2005.**



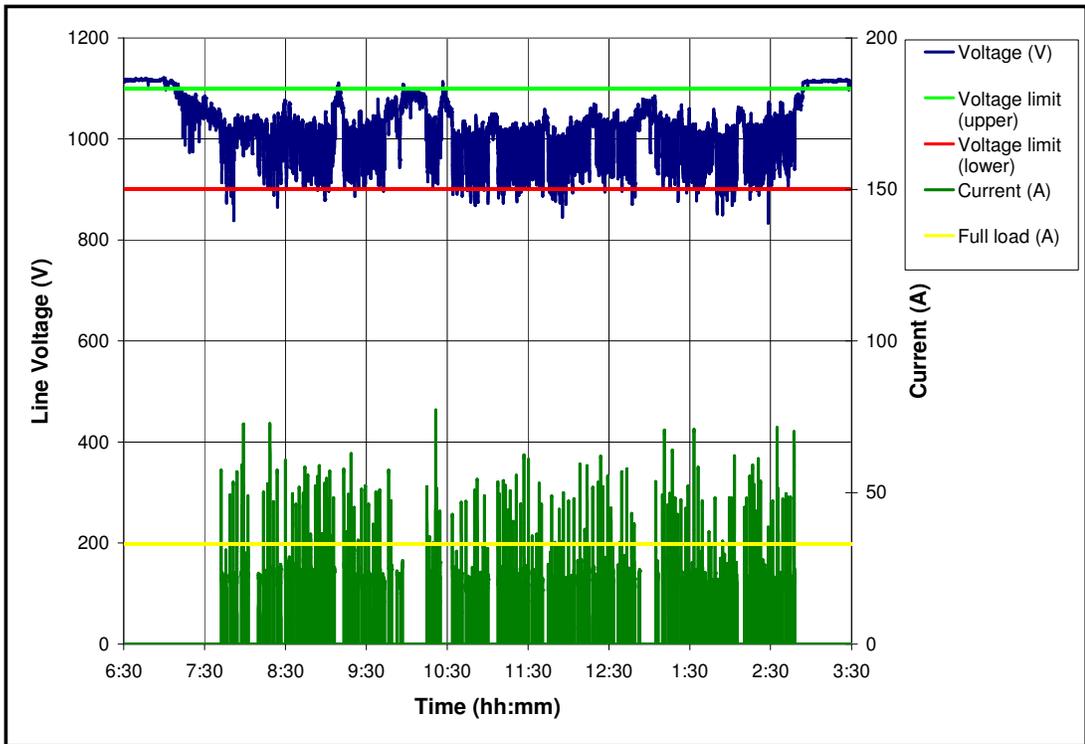
**Figure K.1-6: Load current and voltage for a LH gathering head motor
– 10 June 2005 (30 minute period).**



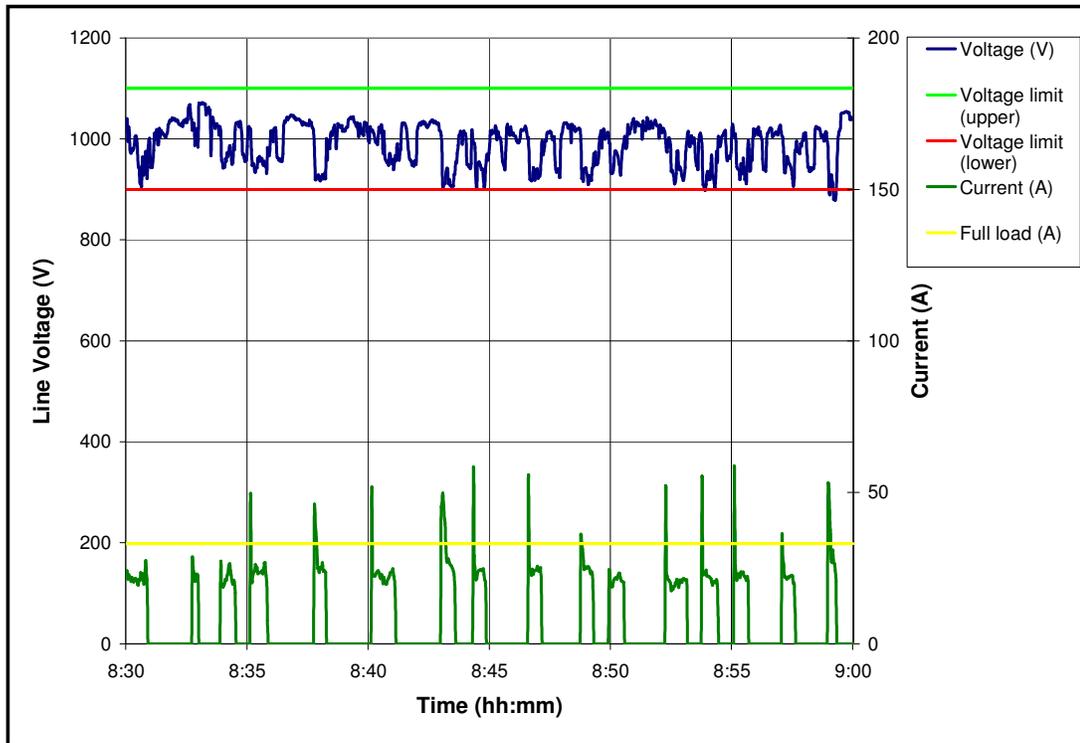
**Figure K.1-7: Load current and voltage for a RH gathering head motor
– 10 June 2005.**



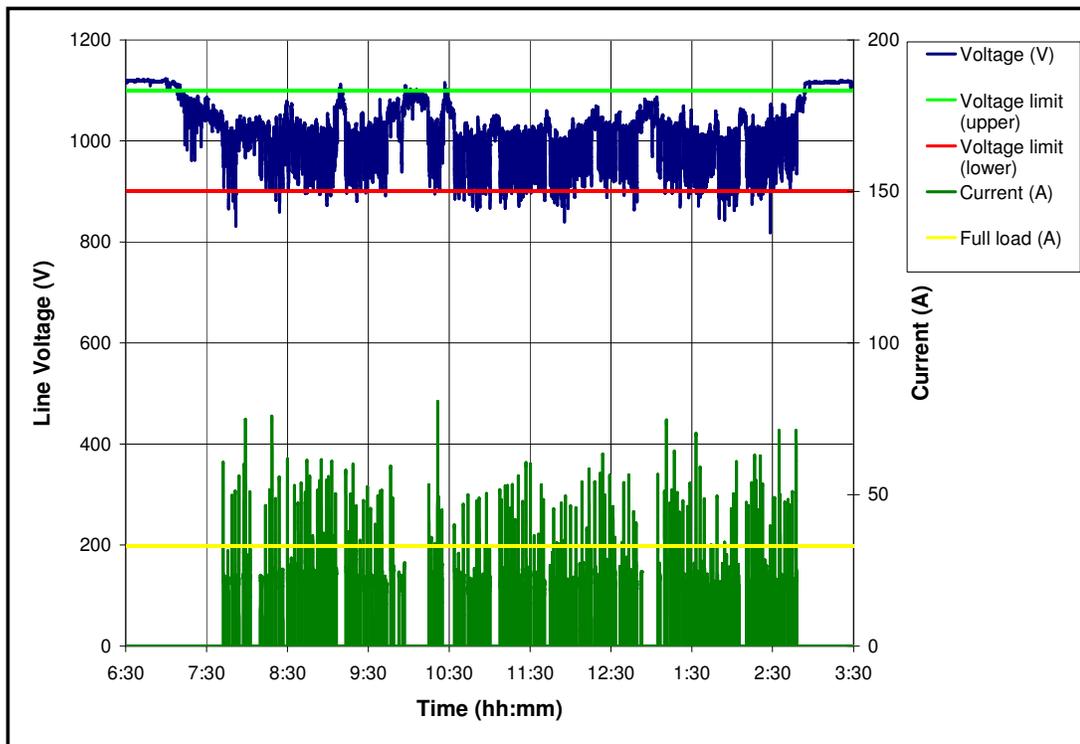
**Figure K.1-8: Load current and voltage for a RH gathering head motor
– 10 June 2005 (30 minute period).**



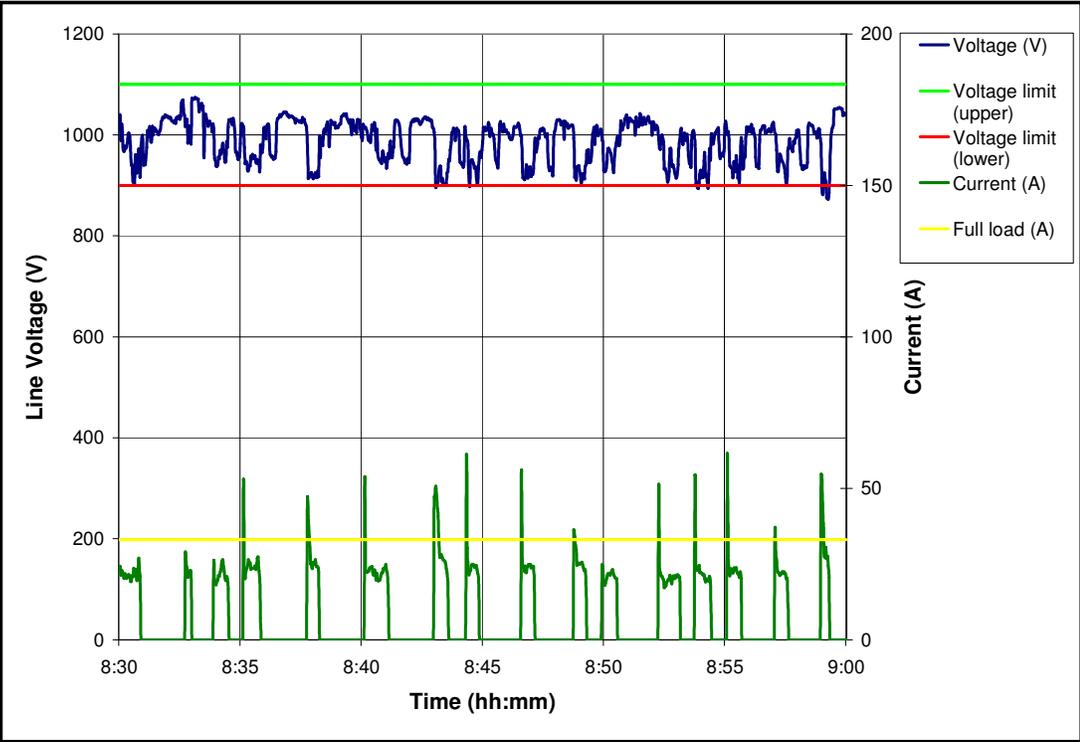
**Figure K.1-9: Load current and voltage for a LH gathering head motor
– 13 June 2005.**



**Figure K.1-10: Load current and voltage for a LH gathering head motor
– 13 June 2005 (30 minute period).**

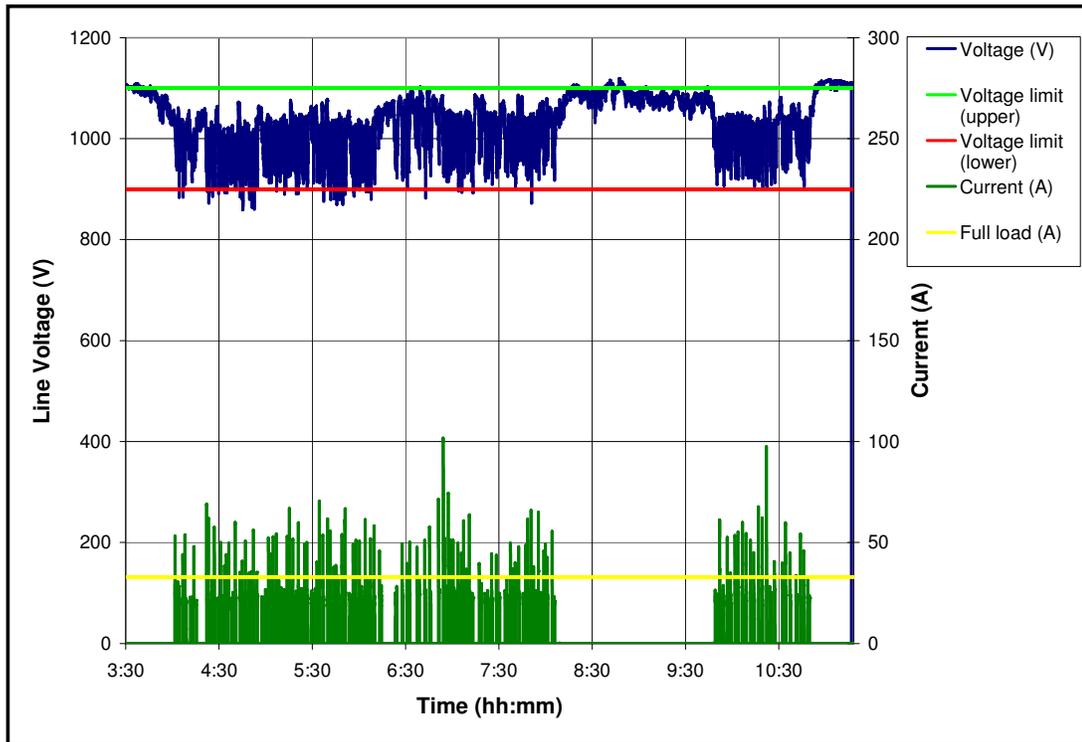


**Figure K.1-11: Load current and voltage for a RH gathering head motor
– 13 June 2005.**

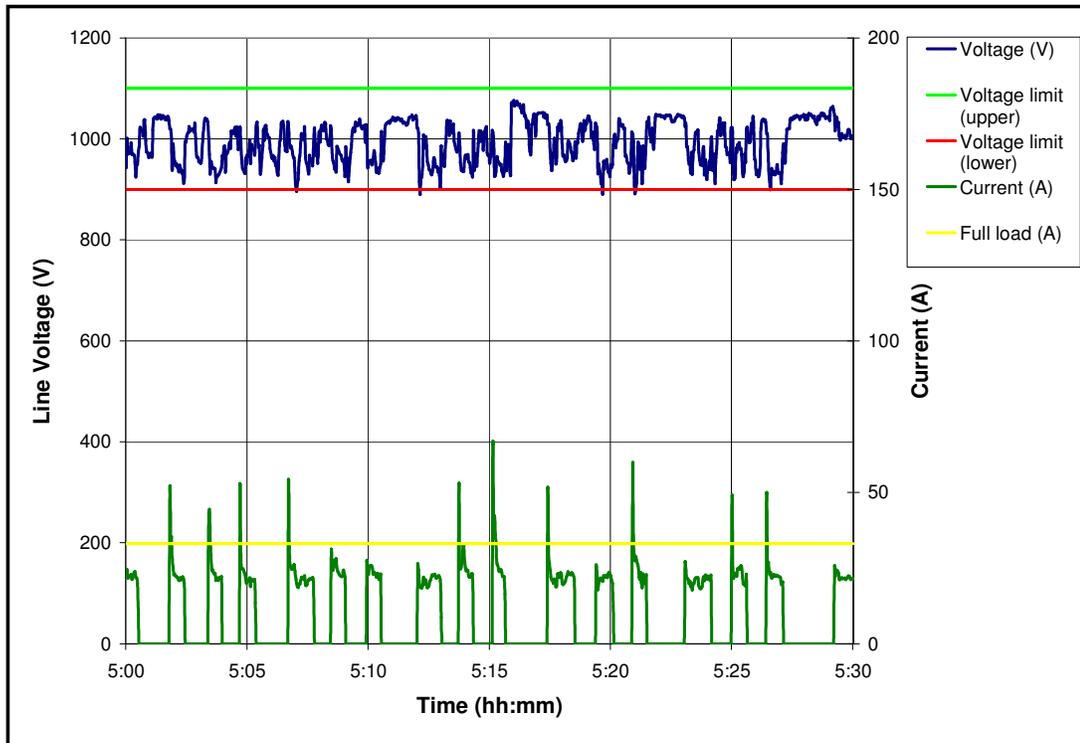


**Figure K.1-12: Load current and voltage for a RH gathering head motor
– 13 June 2005 (30 minute period).**

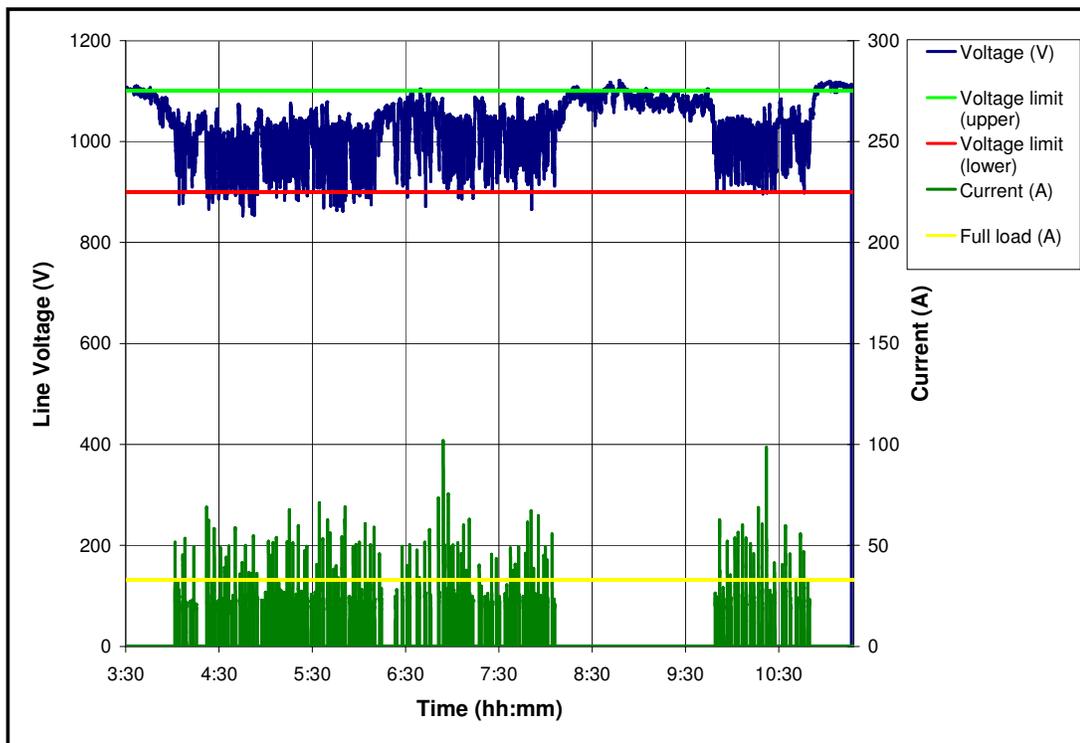
K.1.1.2 Afternoon shifts



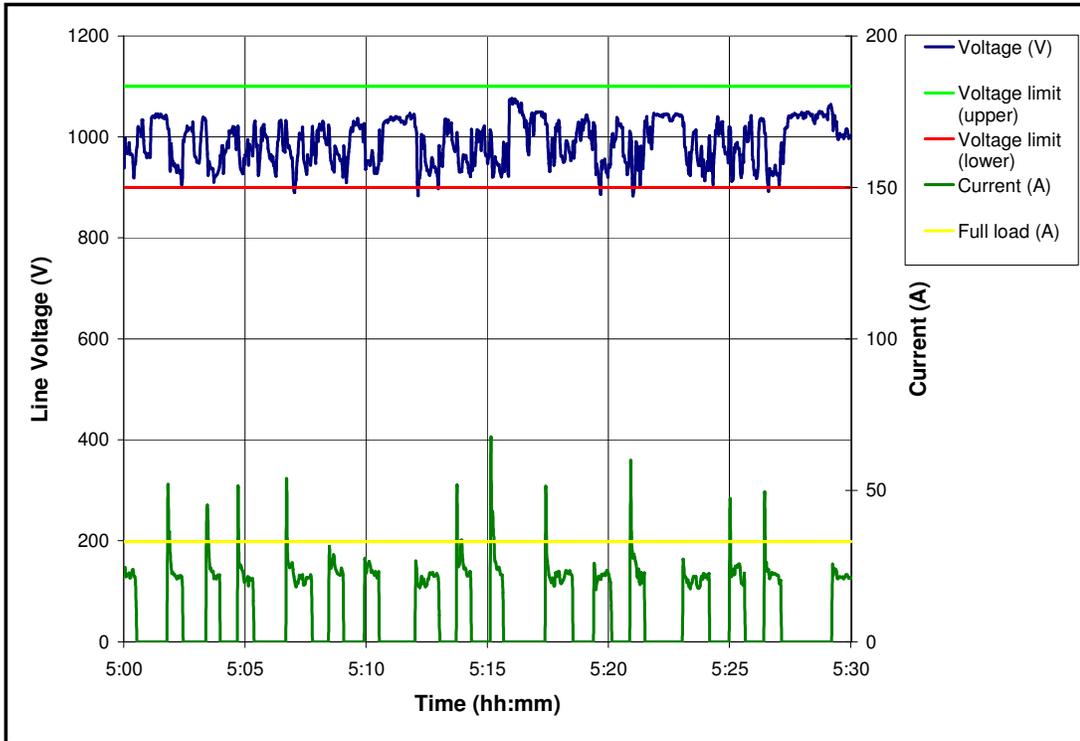
**Figure K.1-13: Load current and voltage for a LH gathering head motor
– 9 June 2005.**



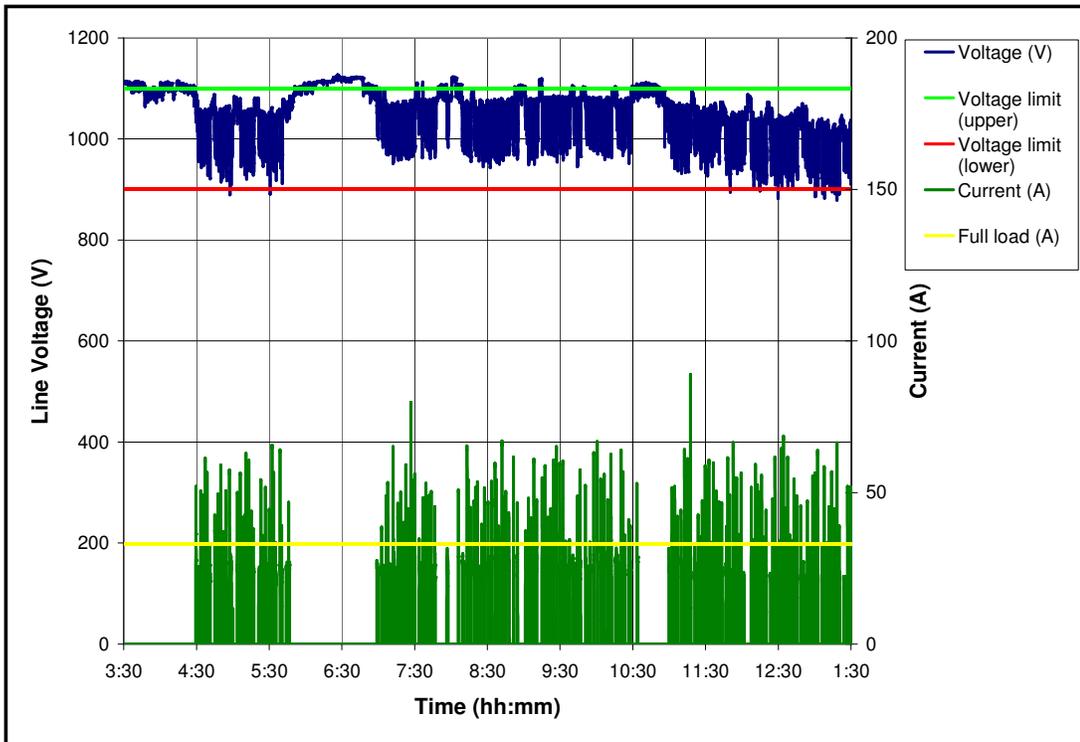
**Figure K.1-14: Load current and voltage for a LH gathering head motor
– 9 June 2005 (30 minute period).**



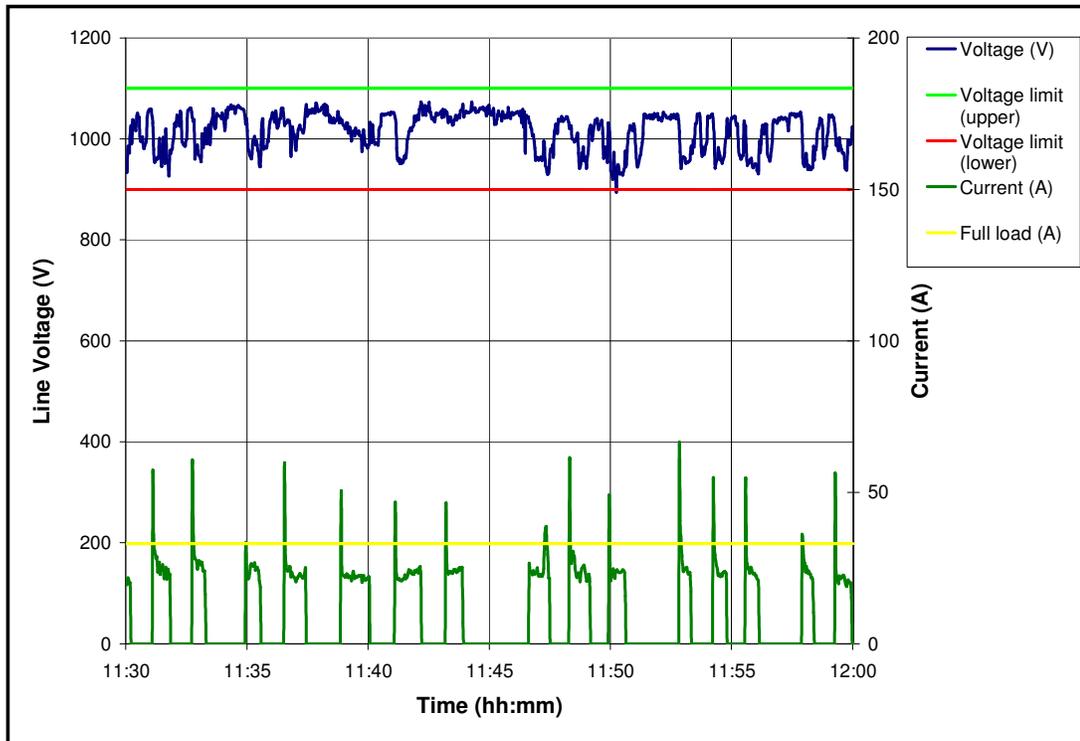
**Figure K.1-15: Load current and voltage for a RH gathering head motor
– 9 June 2005.**



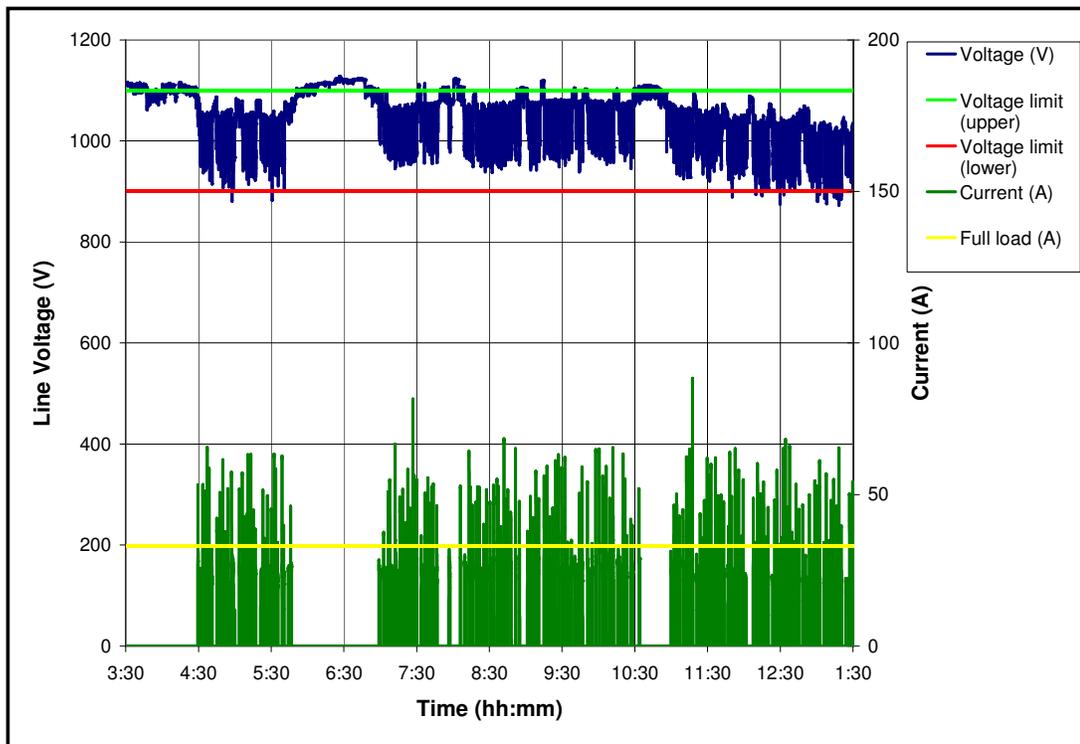
**Figure K.1-16: Load current and voltage for a RH gathering head motor
– 9 June 2005 (30 minute period).**



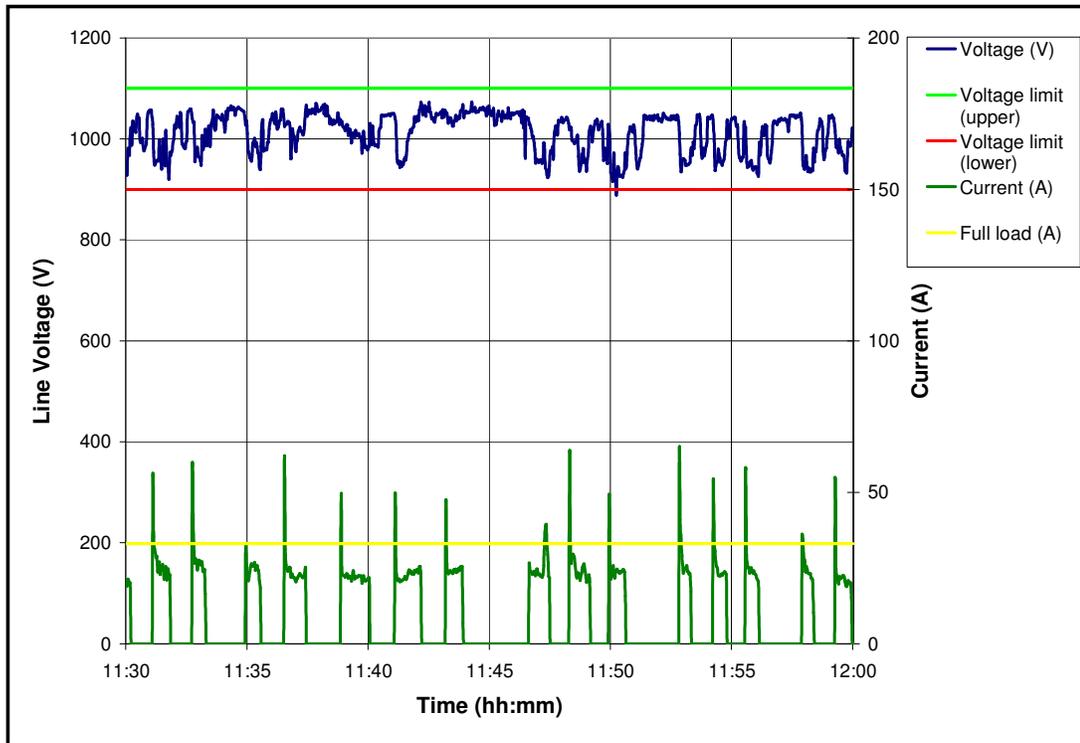
**Figure K.1-17: Load current and voltage for a LH gathering head motor
– 10 June 2005.**



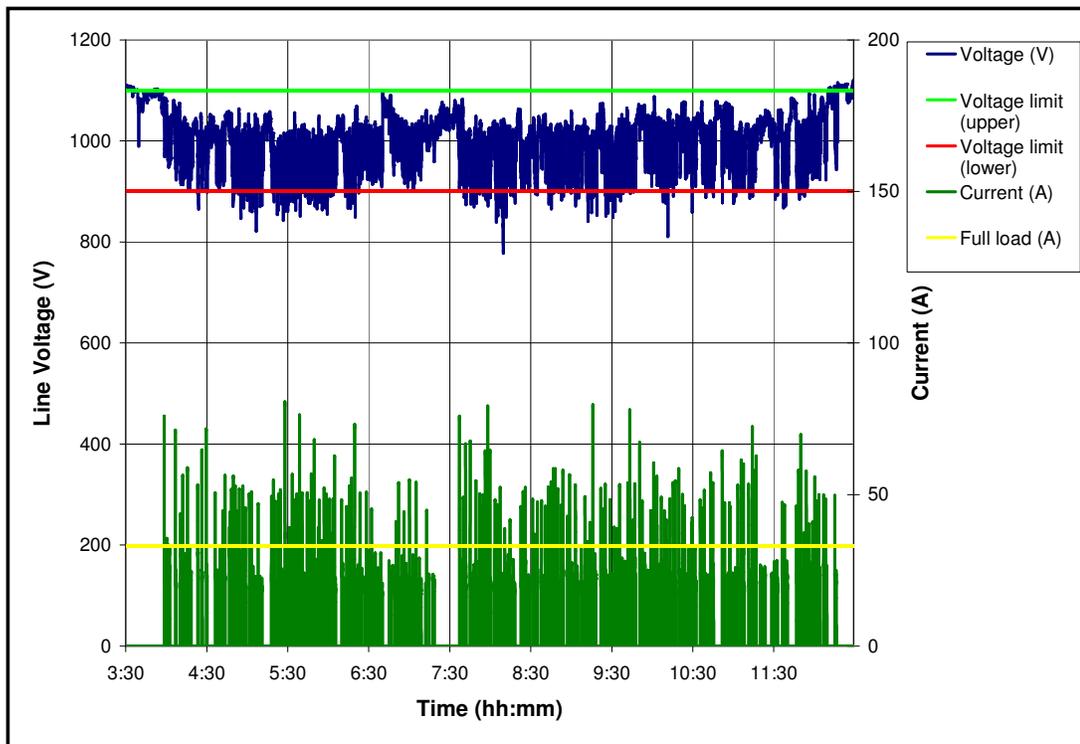
**Figure K.1-18: Loa Load current and voltage for a LH gathering head motor
– 10 June 2005 (30 minute period).**



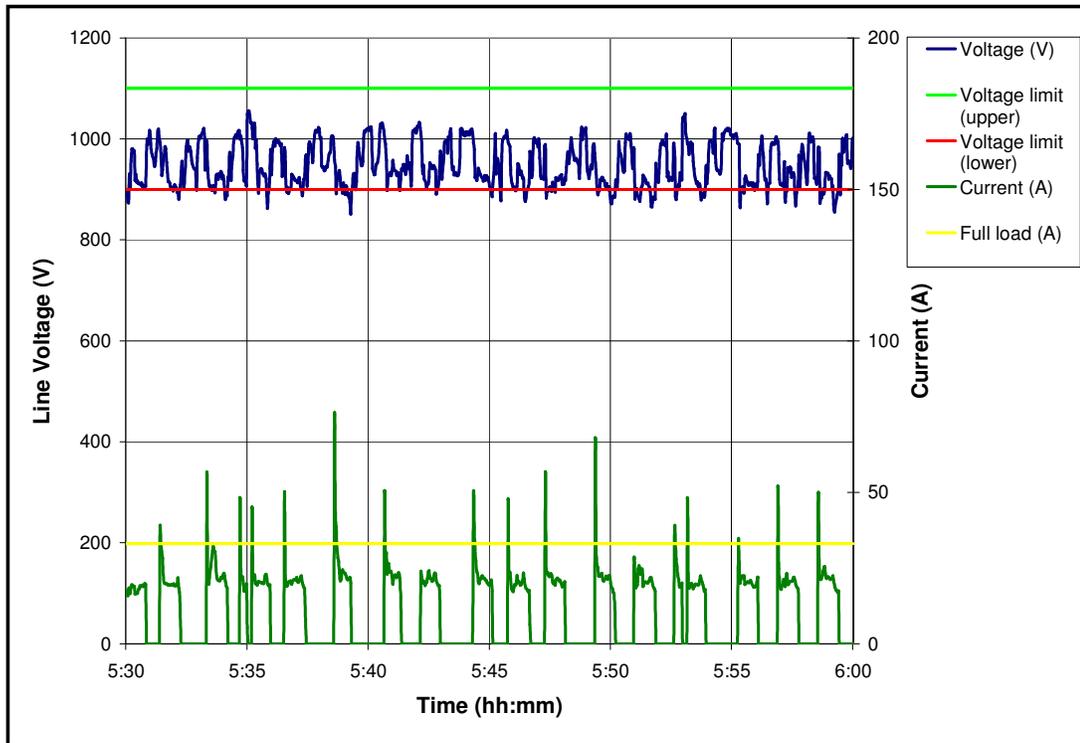
**Figure K.1-19: Load current and voltage for a RH gathering head motor
– 10 June 2005.**



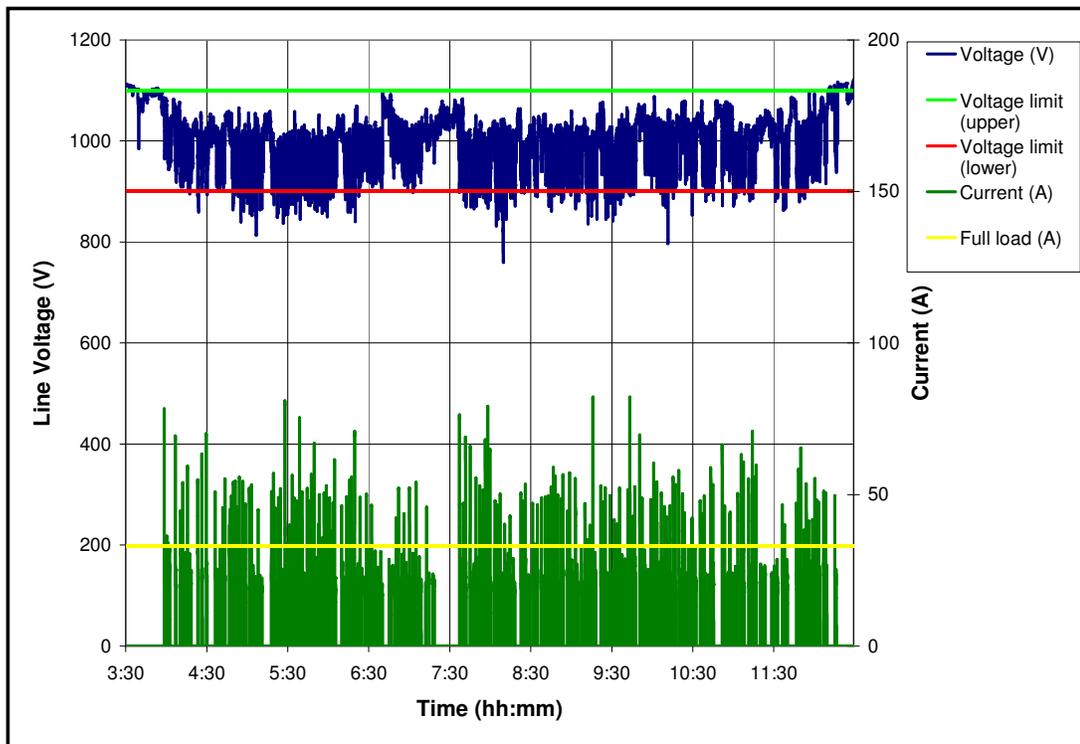
**Figure K.1-20: Load current and voltage for a RH gathering head motor
– 10 June 2005 (30 minute period).**



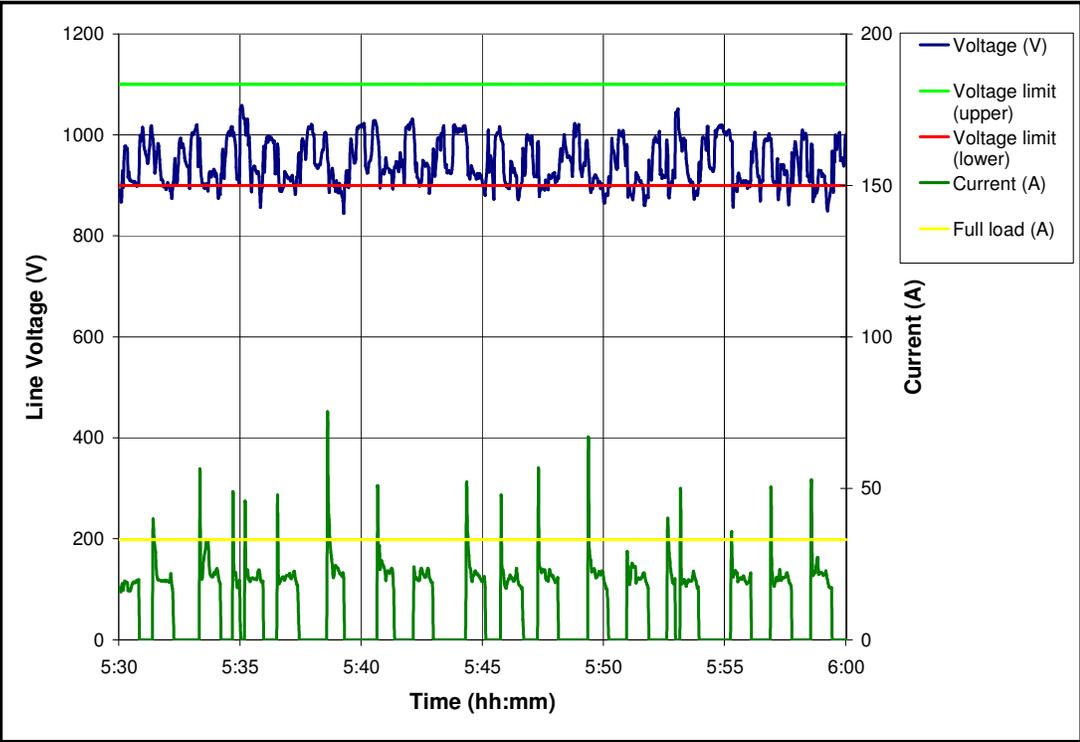
**Figure K.1-21: L Load current and voltage for a LH gathering head motor
– 13 June 2005.**



**Figure K.1-22: Lo Load current and voltage for a LH gathering head motor
– 13 June 2005 (30 minute period).**



**Figure K.1-23: Lo Load current and voltage for a RH gathering head motor
– 13 June 2005.**



**Figure K.1-24: Loa Load current and voltage for a RH gathering head motor
 – 13 June 2005 (30 minute period).**

K.1.2 SECTION 51

K.1.2.1 Morning shifts

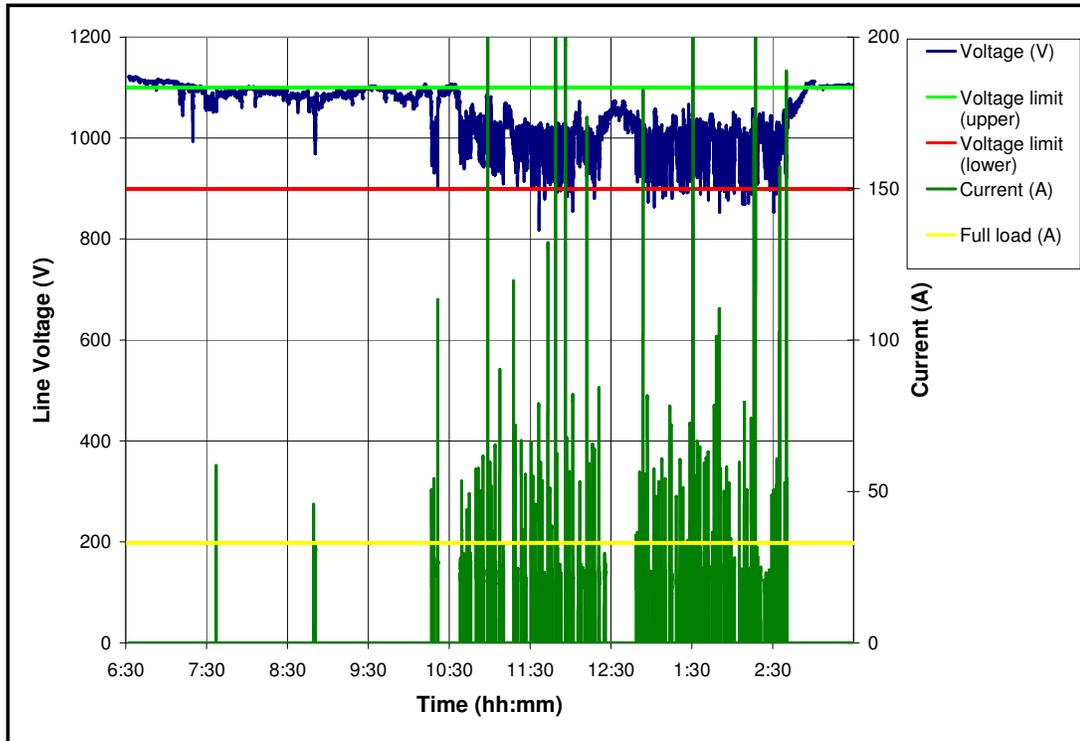
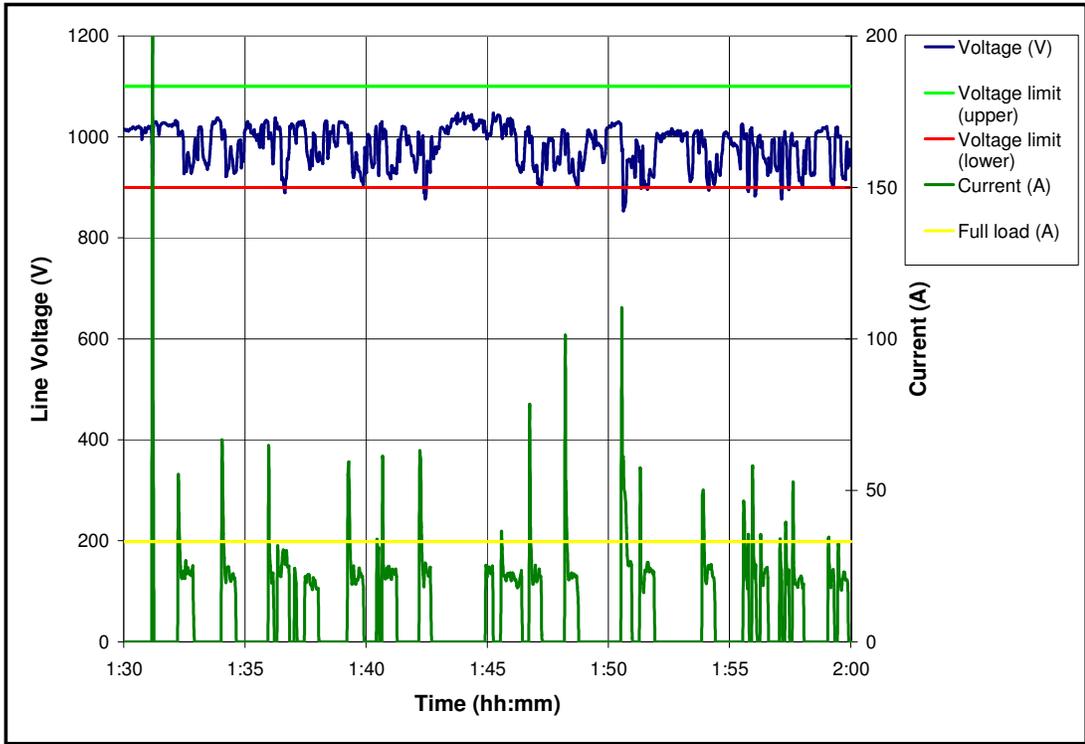
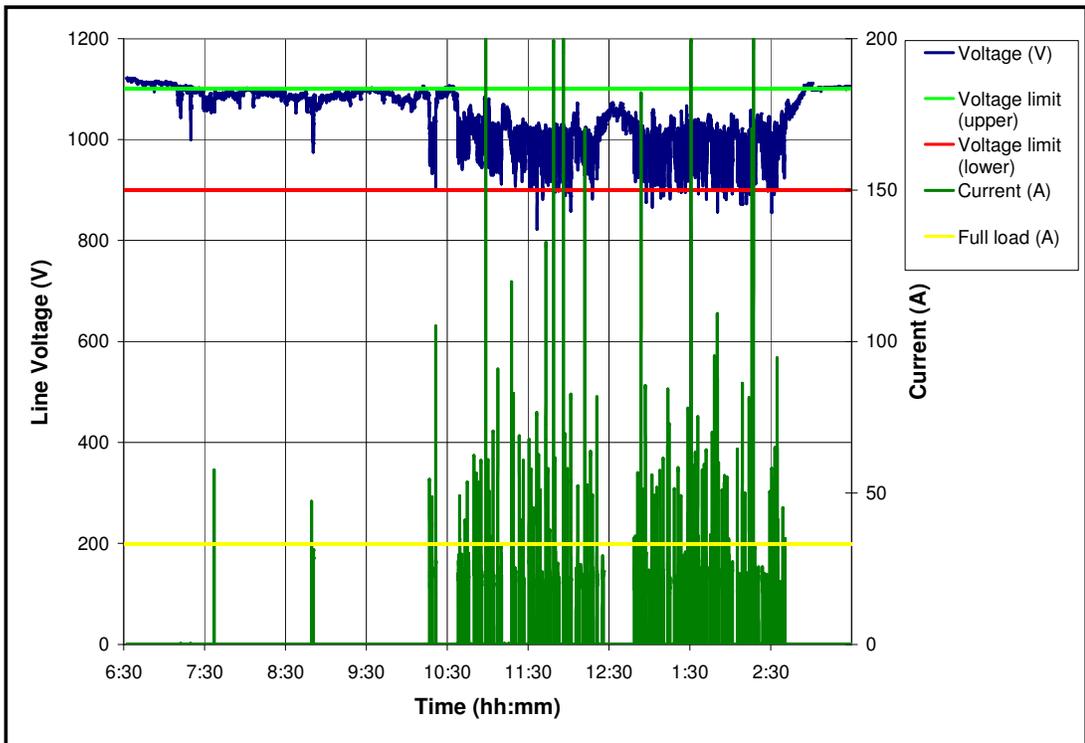


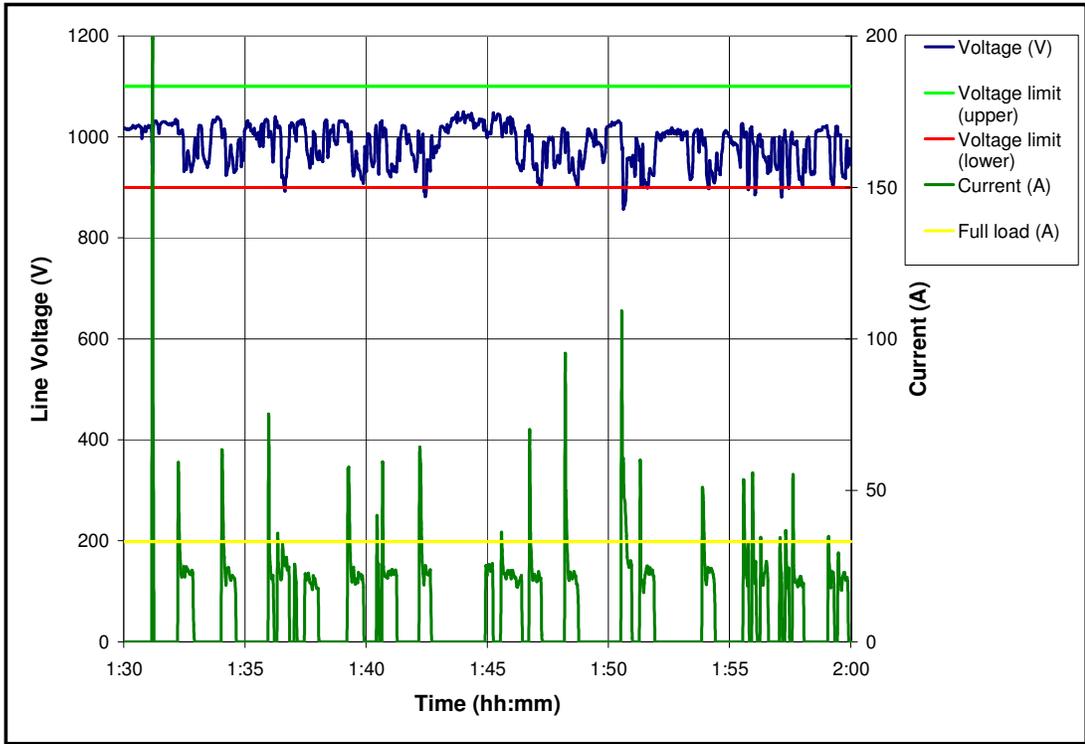
Figure K.1-25: Load current and voltage for a LH gathering head motor
– 29 June 2005.



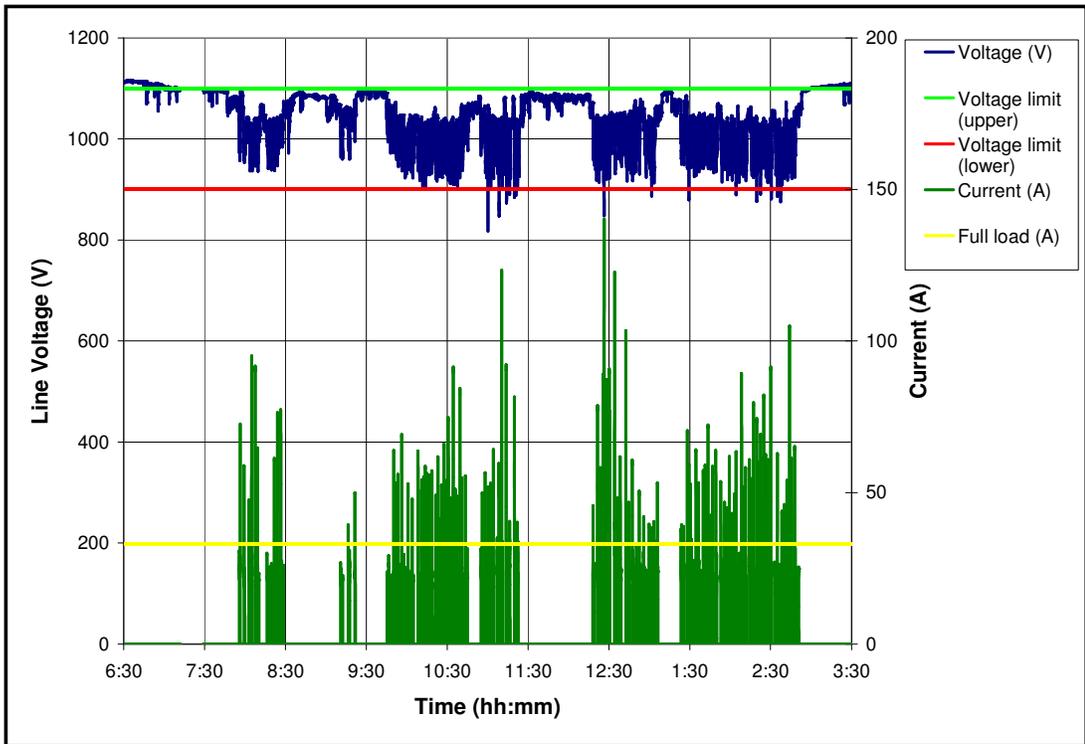
**Figure K.1-26: L Load current and voltage for a LH gathering head motor
– 29 June 2005 (30 minute period).**



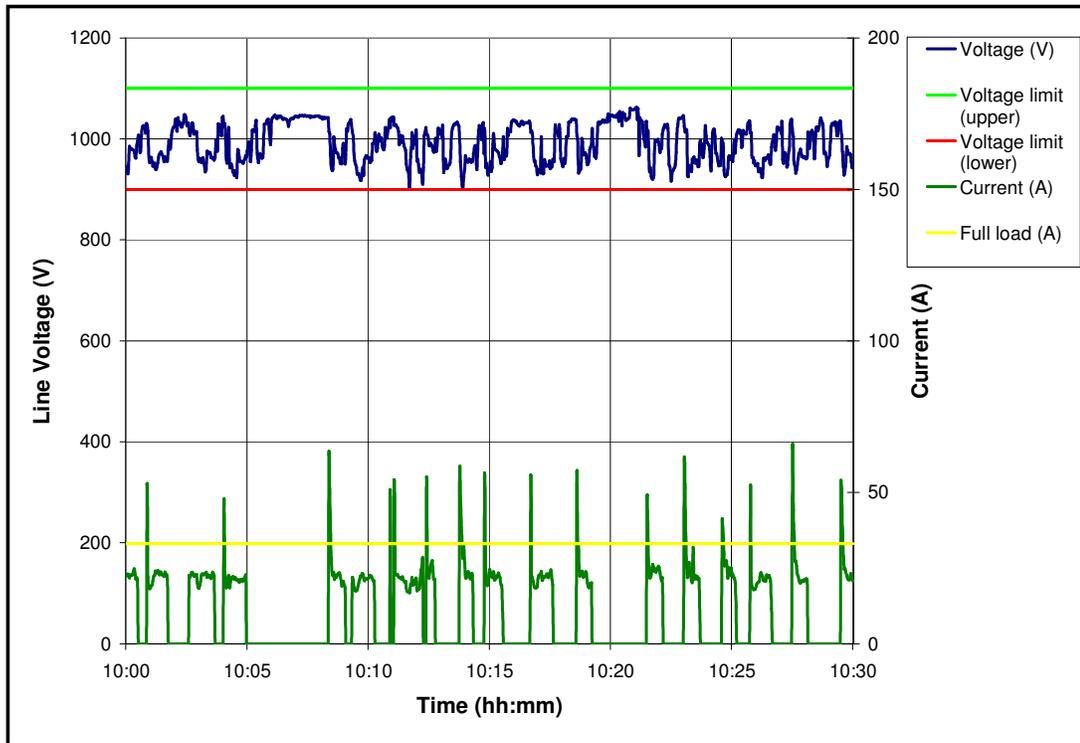
**Figure K.1-27: Load current and voltage for a RH gathering head motor
– 29 June 2005.**



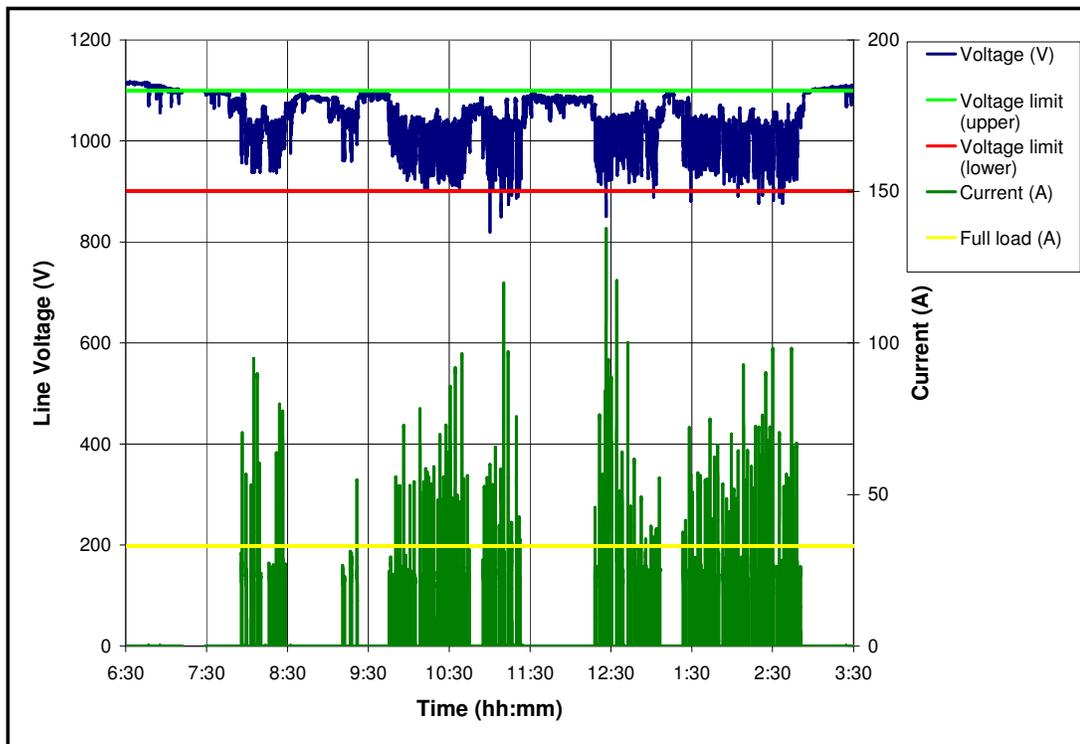
**Figure K.1-28: Load current and voltage for a RH gathering head motor
– 29 June 2005 (30 minute period).**



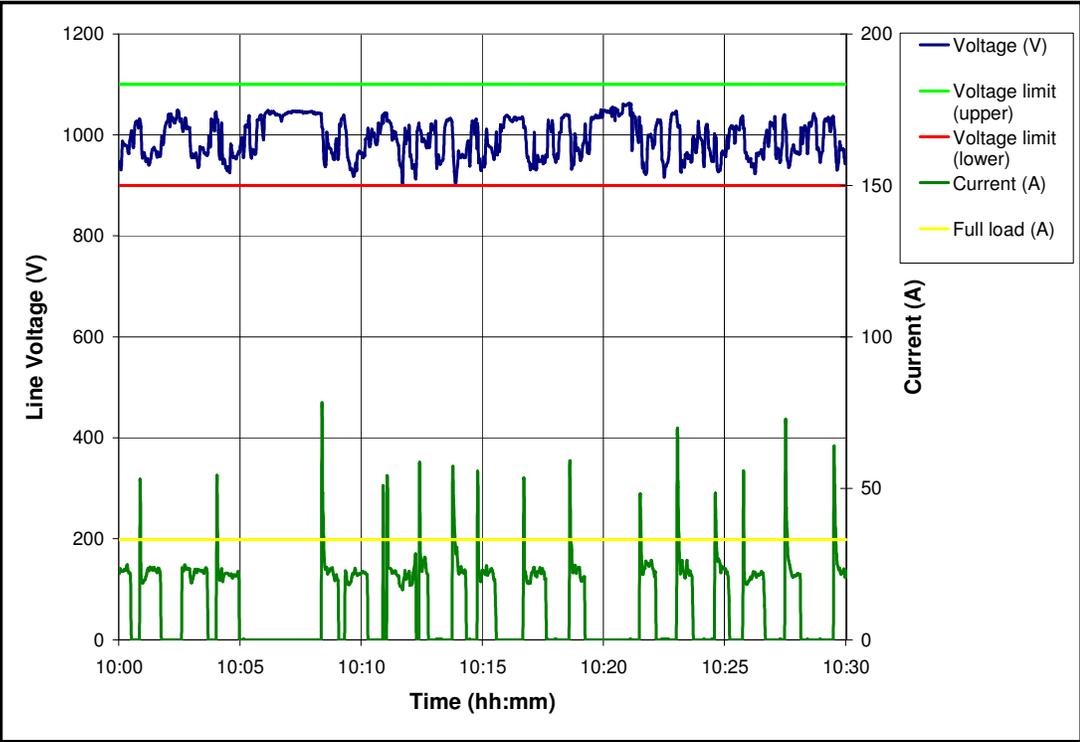
**Figure K.1-29: Load current and voltage for a LH gathering head motor
– 30 June 2005.**



**Figure K.1-30: Load current and voltage for a LH gathering head motor
– 30 June 2005 (30 minute period).**

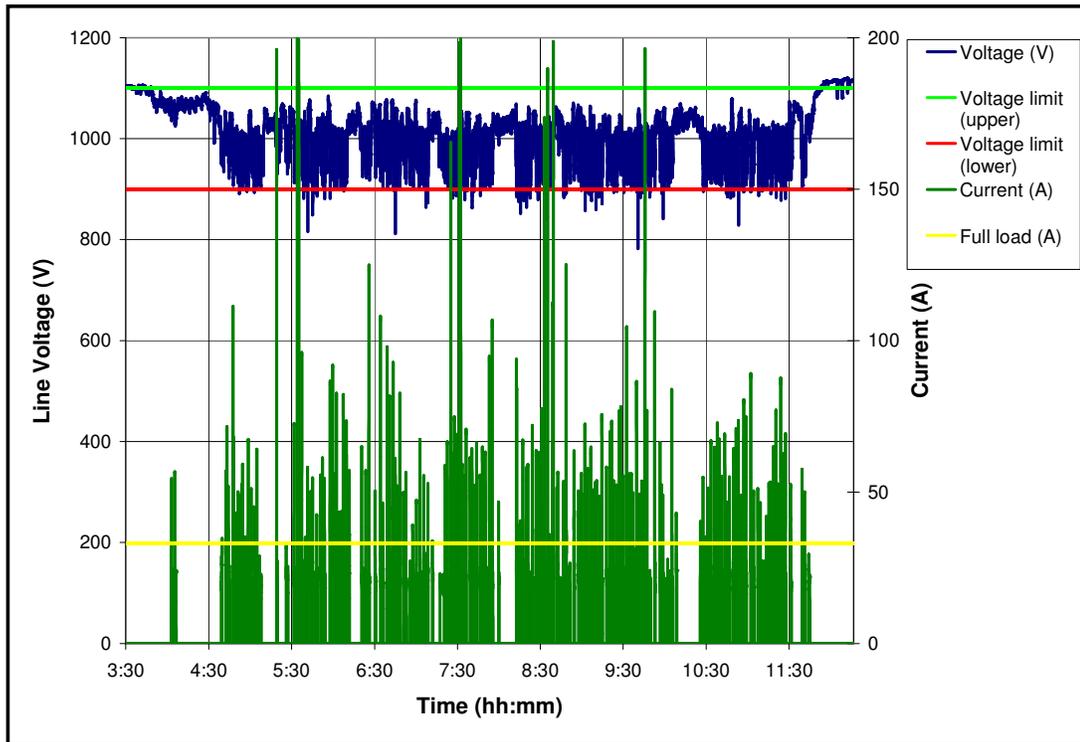


**Figure K.1-31: Load current and voltage for a RH gathering head motor
– 30 June 2005.**

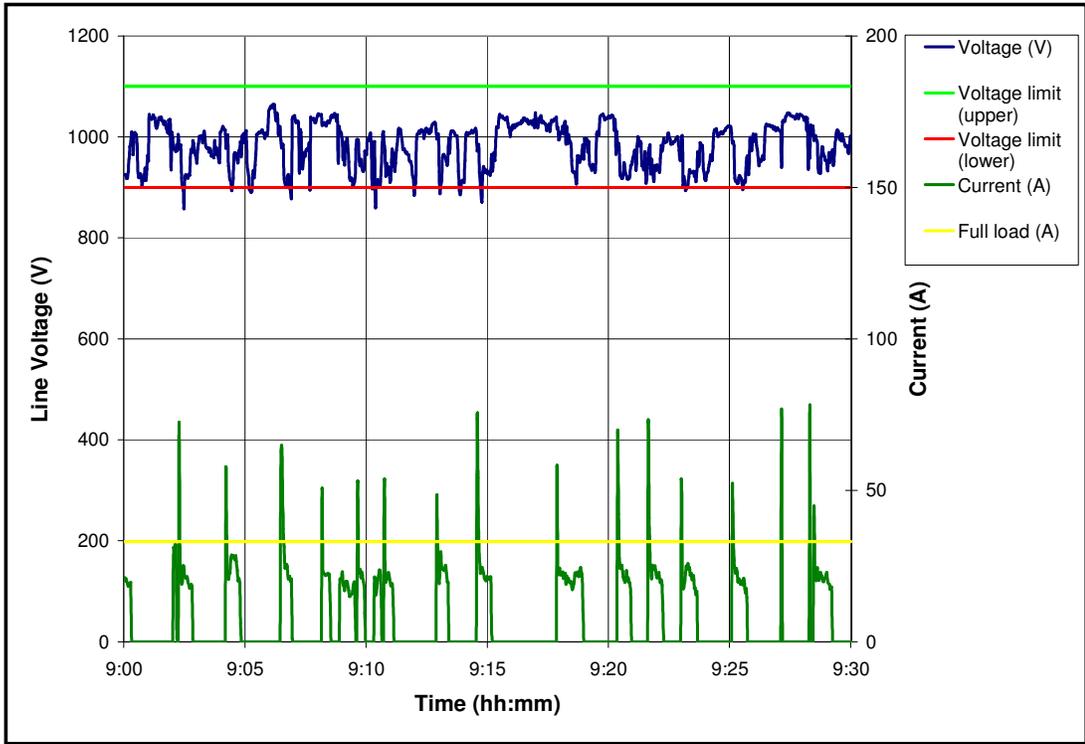


**Figure K.1-32: Load current and voltage for a RH gathering head motor
– 30 June 2005 (30 minute period).**

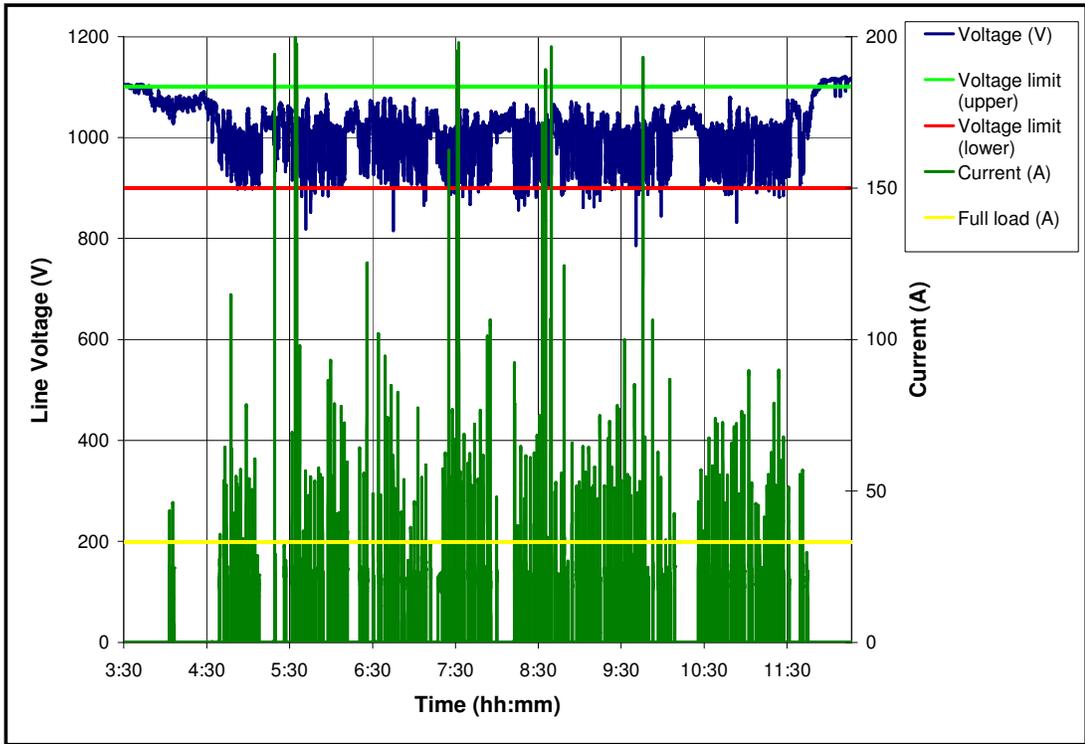
K.1.2.2 Afternoon shifts



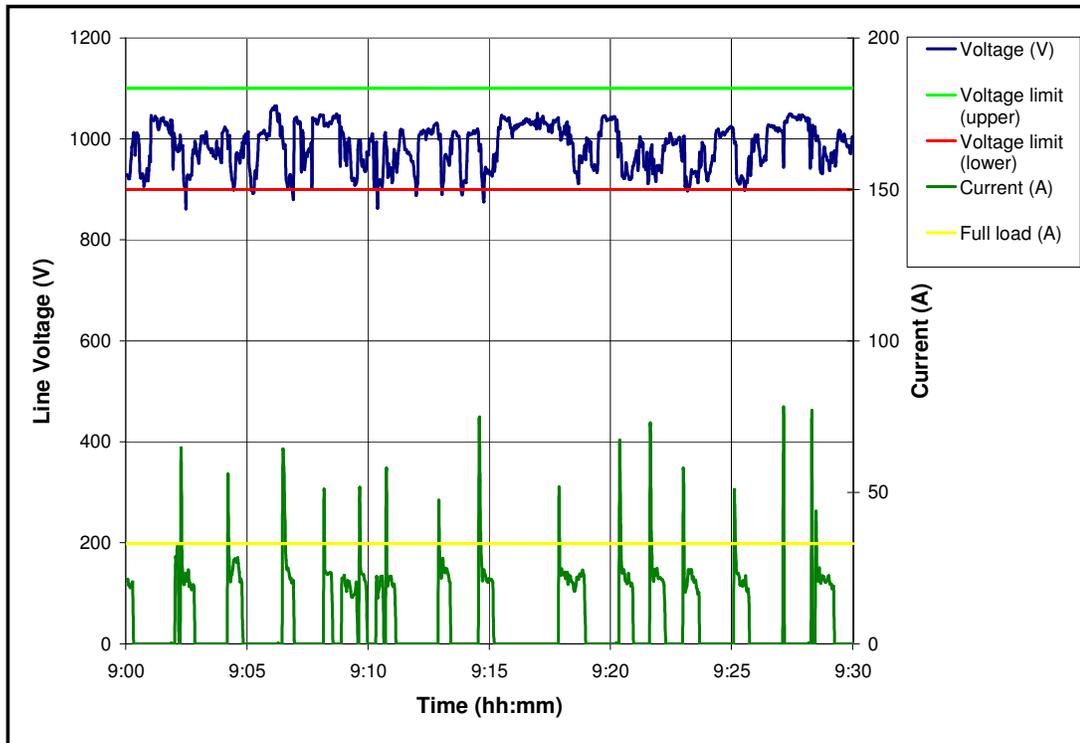
**Figure K.1-33: Load current and voltage for a LH gathering head motor
– 29 June 2005.**



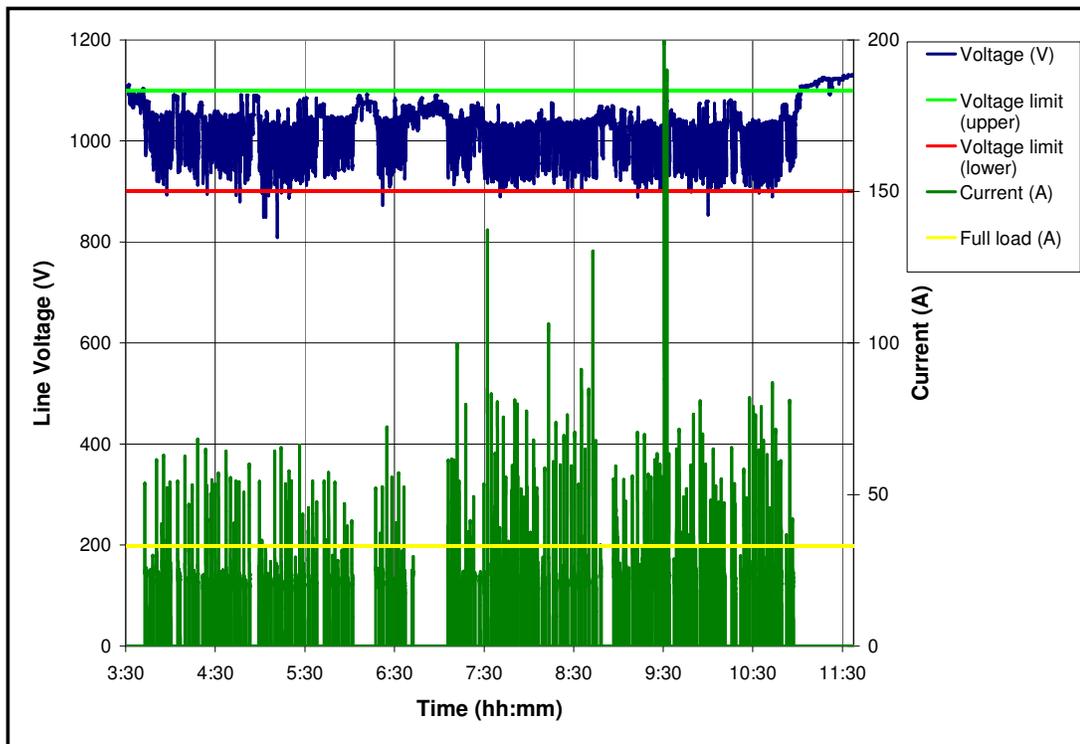
**Figure K.1-34: Load current and voltage for a LH gathering head motor
– 29 June 2005 (30 minute period).**



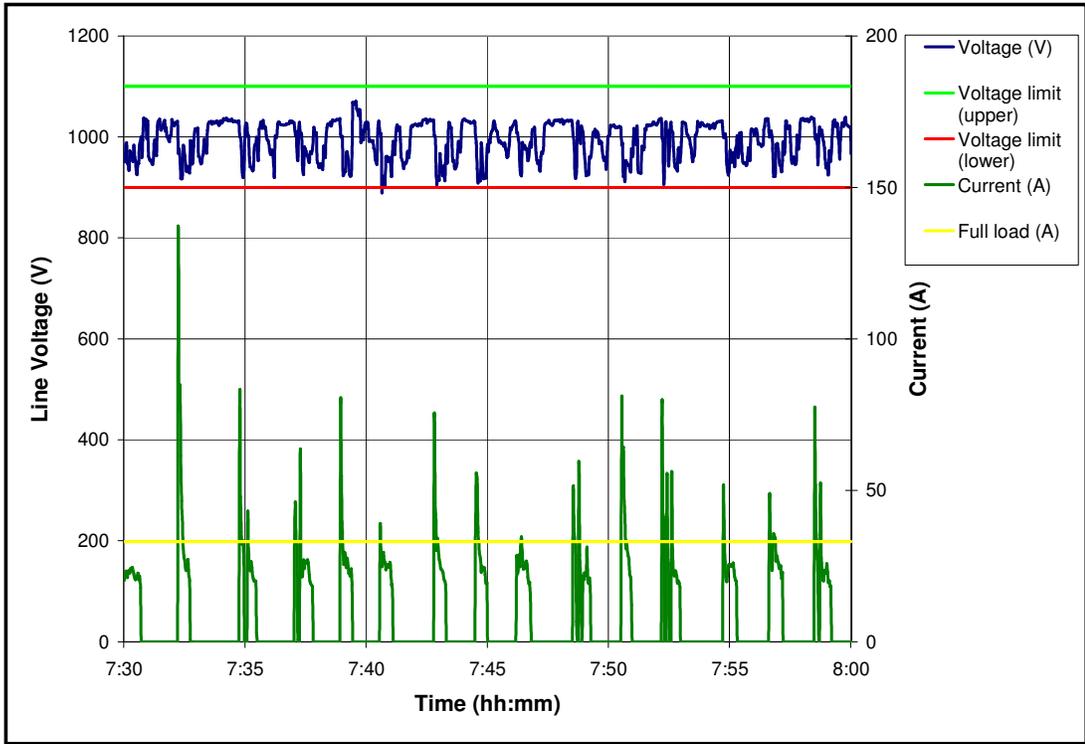
**Figure K.1-35: Load current and voltage for a RH gathering head motor
– 29 June 2005.**



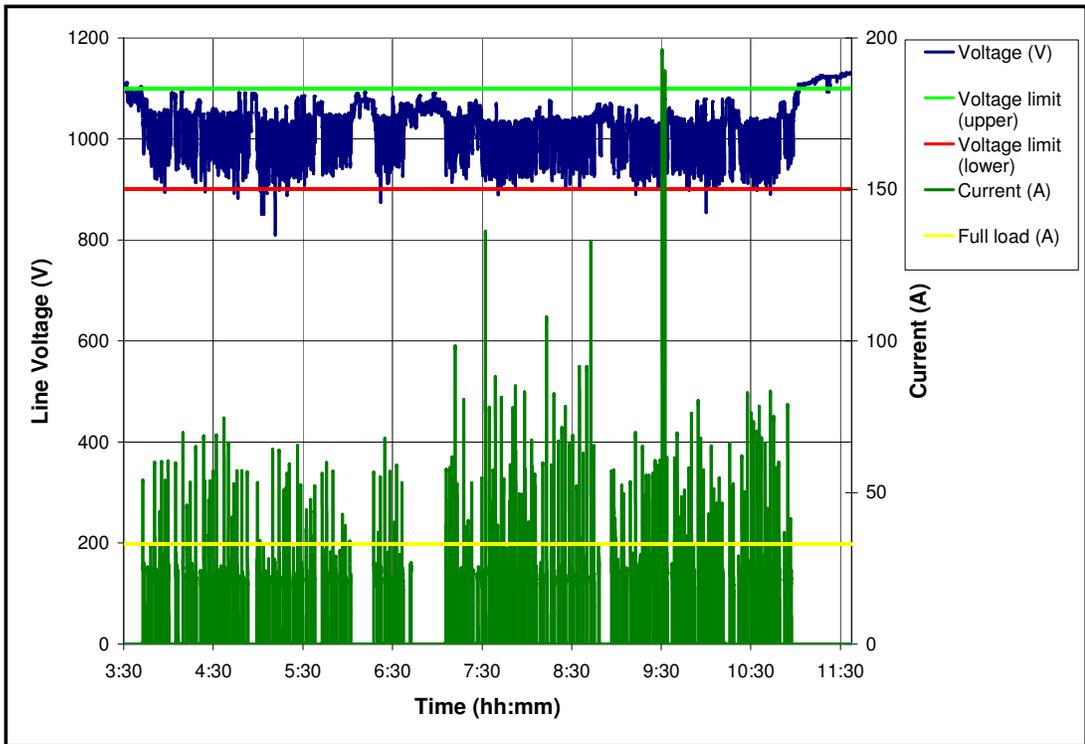
**Figure K.1-36: Load current and voltage for a RH gathering head motor
– 29 June 2005 (30 minute period).**



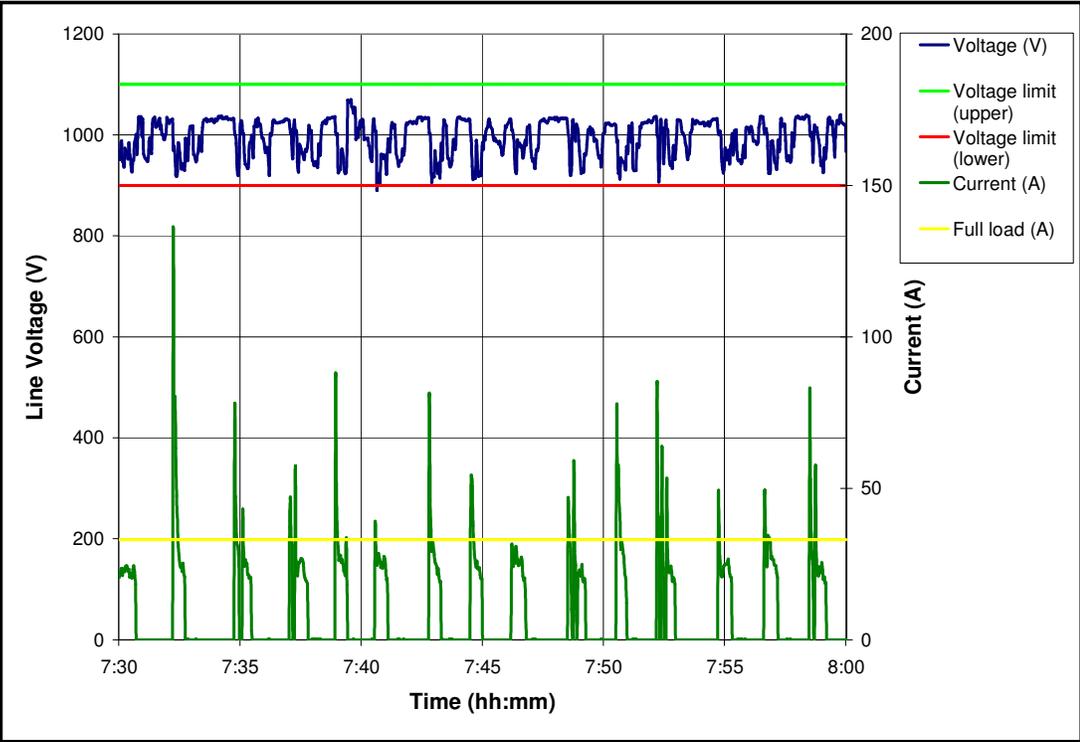
**Figure K.1-37: Load current and voltage for a LH gathering head motor
– 30 June 2005.**



**Figure K.1-38: Load current and voltage for a LH gathering head motor
– 30 June 2005 (30 minute period).**



**Figure K.1-39: Load current and voltage for a RH gathering head motor
– 30 June 2005.**



**Figure K.1-40: Load current and voltage for a RH gathering head motor
 – 30 June 2005 (30 minute period).**

K.2 HISTOGRAM

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

K.2.1 SECTION 21

K.2.1.1 Morning shifts

Table K-3: Data for the total consumption of a LH gathering head motor in section 21.

| | 9-Jun-05 | 10-Jun-05 | 13-Jun-05 |
|----------------------------------|----------|-----------|-----------|
| Tonnes/CM/Shift | 1225 | 1575 | 2310 |
| % Time of shift producing | 18.07% | 19.59% | 26.20% |
| % of Production time underloaded | 94.85% | 93.54% | 95.76% |
| % of Production time overloaded | 5.15% | 6.46% | 4.24% |

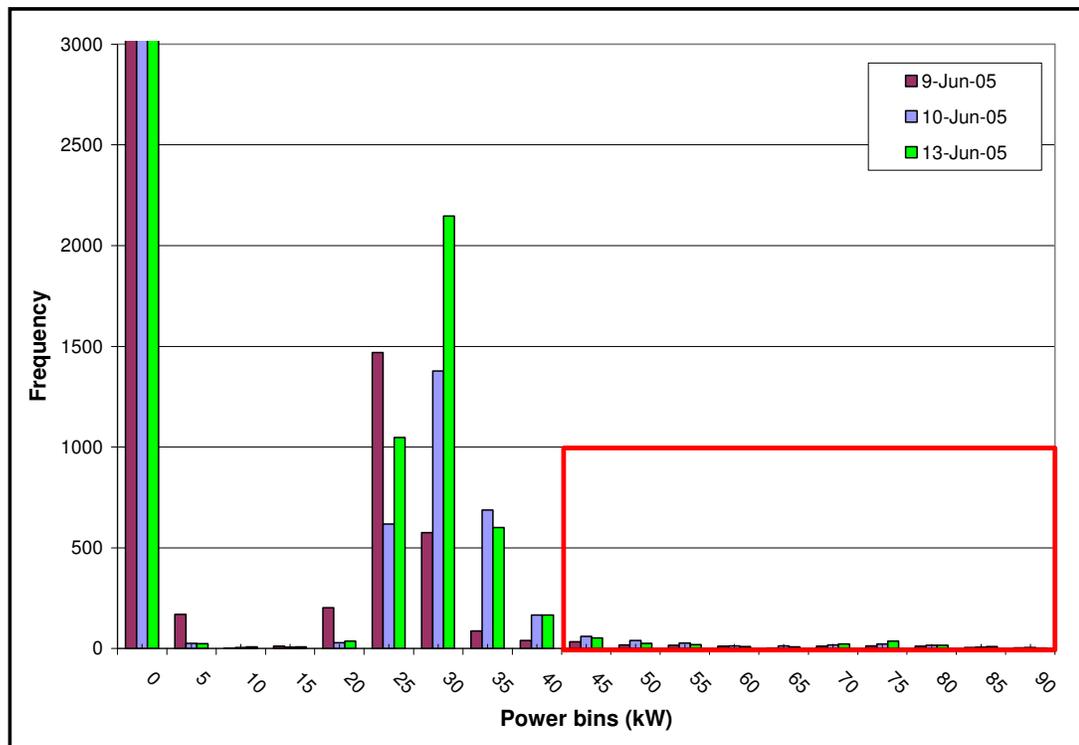


Figure K.2-1: Histogram for power consumed by a LH gathering head motor.

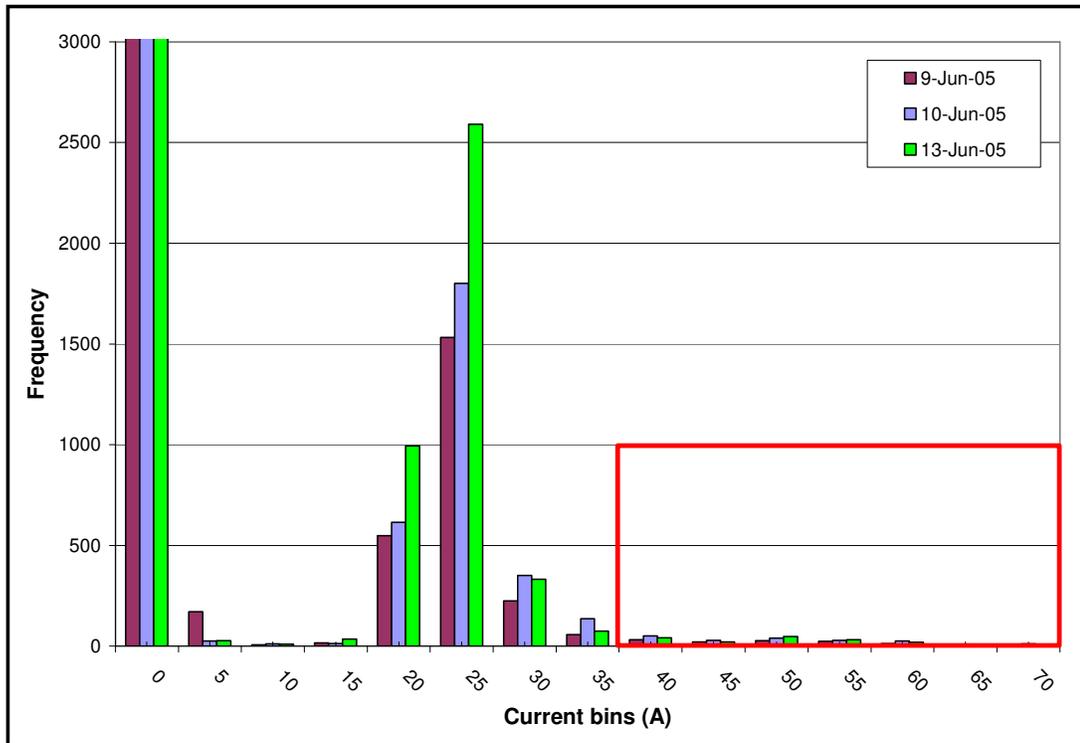


Figure K.2-2: Histogram for current consumed by a LH gathering head motor.

Table K-4: Data for the total consumption of a RH gathering head motor in section 21.

| | 9-Jun-05 | 10-Jun-05 | 13-Jun-05 |
|----------------------------------|----------|-----------|-----------|
| Tonnes/CM/Shift | 1225 | 1575 | 2310 |
| % Time of shift producing | 16.98% | 19.51% | 26.17% |
| % of Production time underloaded | 94.12% | 92.97% | 95.57% |
| % of Production time overloaded | 5.88% | 7.03% | 4.43% |

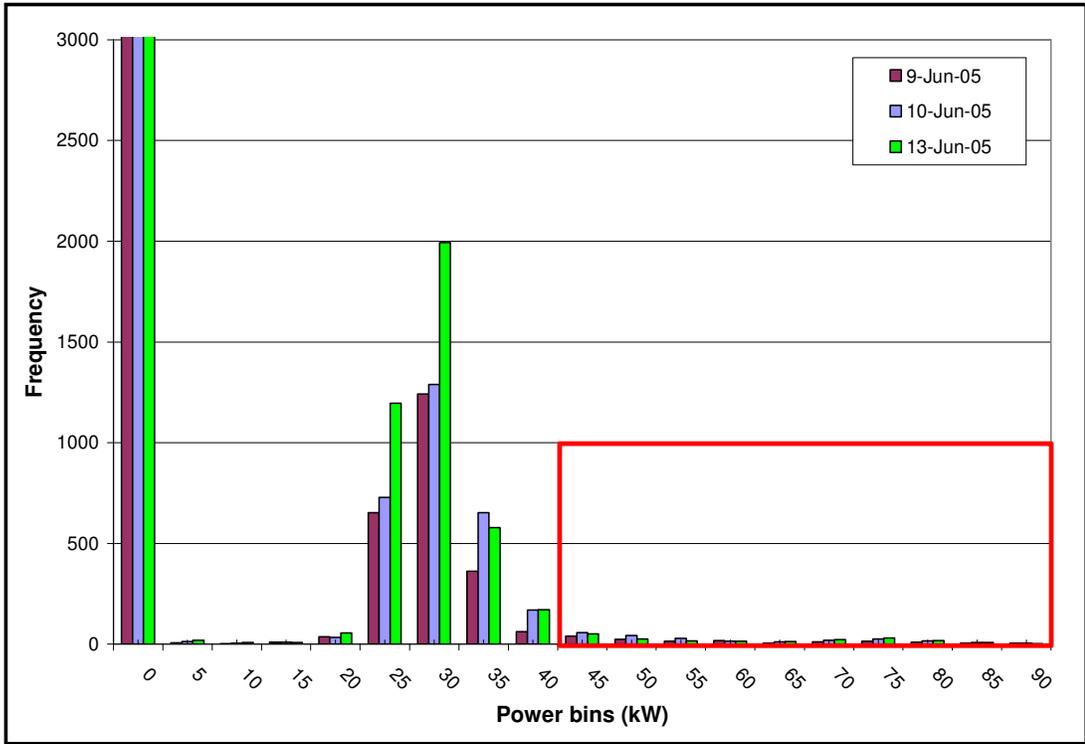


Figure K.2-3: Histogram for power consumed by a RH gathering head motor.

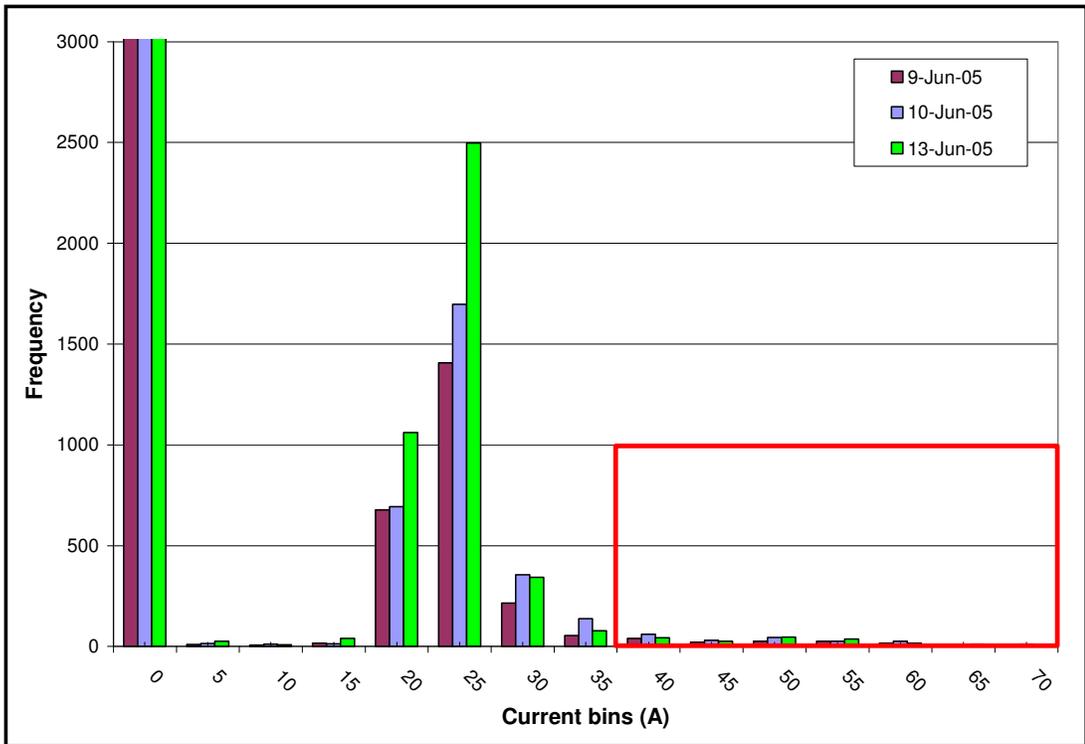


Figure K.2-4: Histogram for current consumed by a RH gathering head motor.

K.2.1.2 Afternoon shifts

Table K-5: Data for the total consumption of a LH gathering head motor in section 21.

| | 9-Jun-05 | 10-Jun-05 | 13-Jun-05 |
|----------------------------------|----------|-----------|-----------|
| Tonnes/CM/Shift | 1400 | 2695 | 2520 |
| % Time of shift producing | 21.89% | 22.56% | 34.92% |
| % of Production time underloaded | 94.21% | 93.11% | 95.43% |
| % of Production time overloaded | 5.79% | 6.89% | 4.57% |

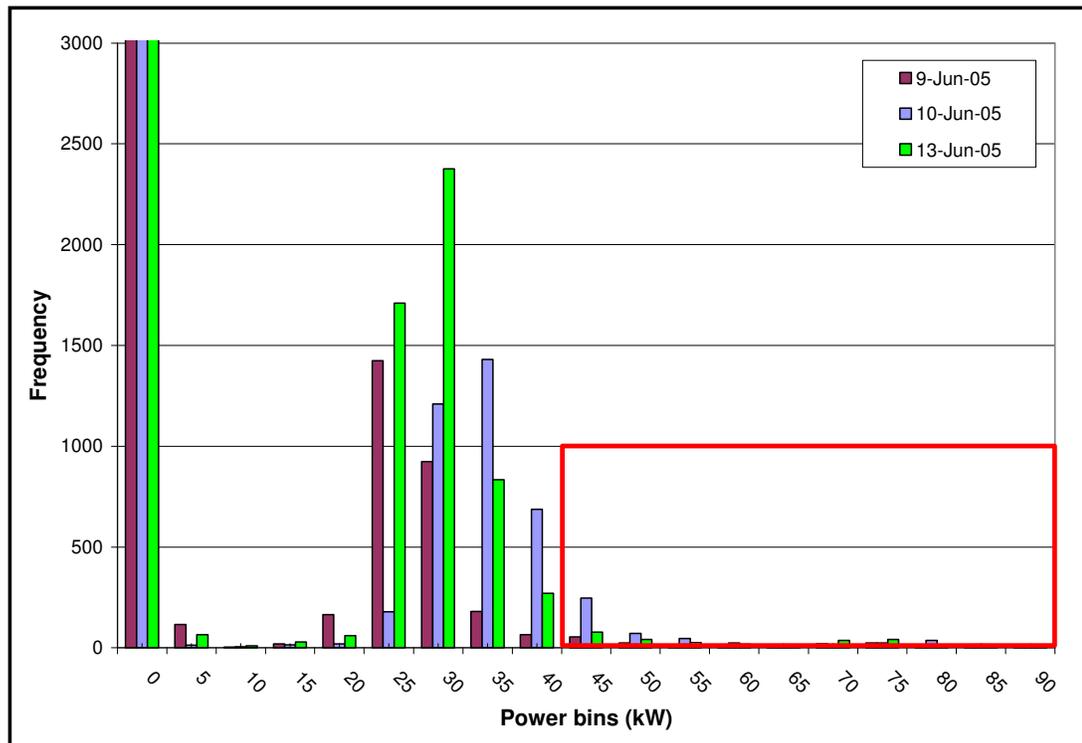


Figure K.2-5: Histogram for power consumed by a LH gathering head motor.

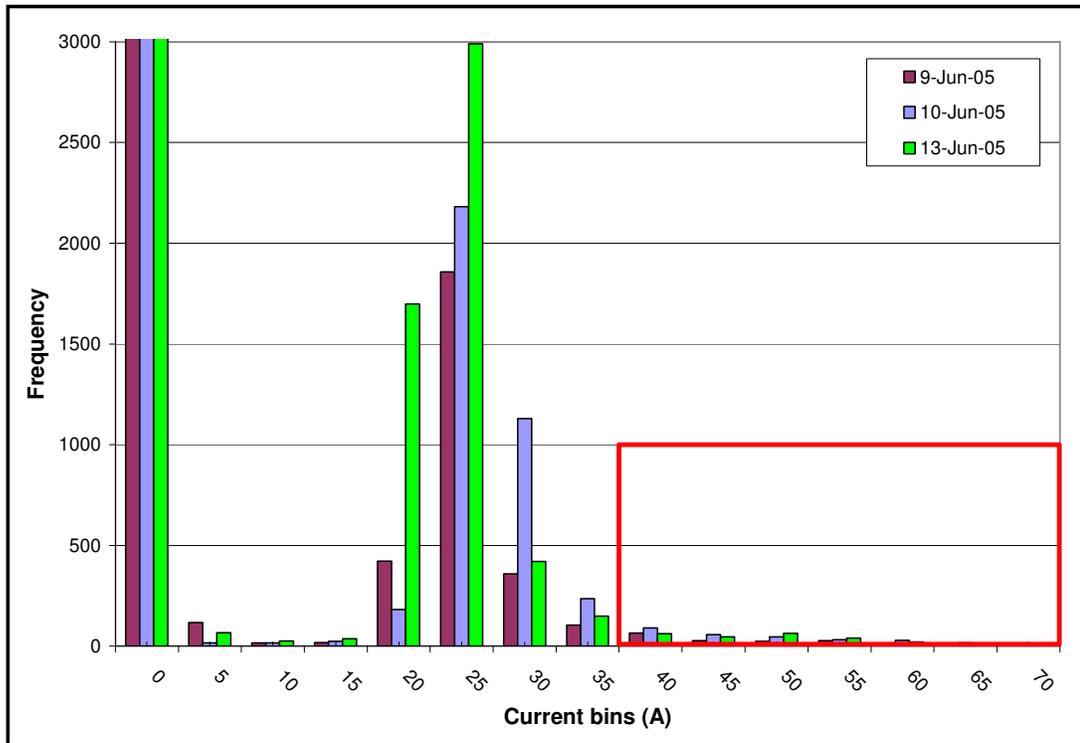


Figure K.2-6: Histogram for current consumed by a LH gathering head motor.

Table K-6: D Data for the total consumption of a RH gathering head motor in section 21.

| | 9-Jun-05 | 10-Jun-05 | 13-Jun-05 |
|----------------------------------|----------|-----------|-----------|
| Tonnes/CM/Shift | 1400 | 2695 | 2520 |
| % Time of shift producing | 21.14% | 22.55% | 34.66% |
| % of Production time underloaded | 93.50% | 92.69% | 95.15% |
| % of Production time overloaded | 6.50% | 7.31% | 4.85% |

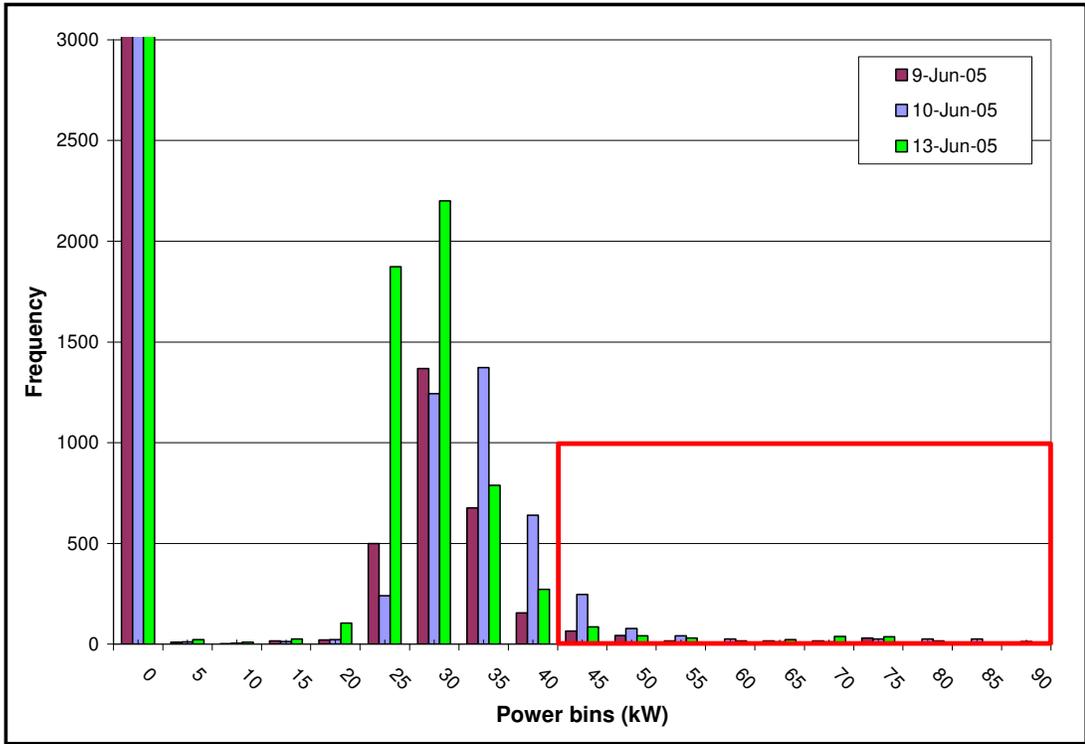


Figure K.2-7: Histogram for power consumed by a RH gathering head motor.

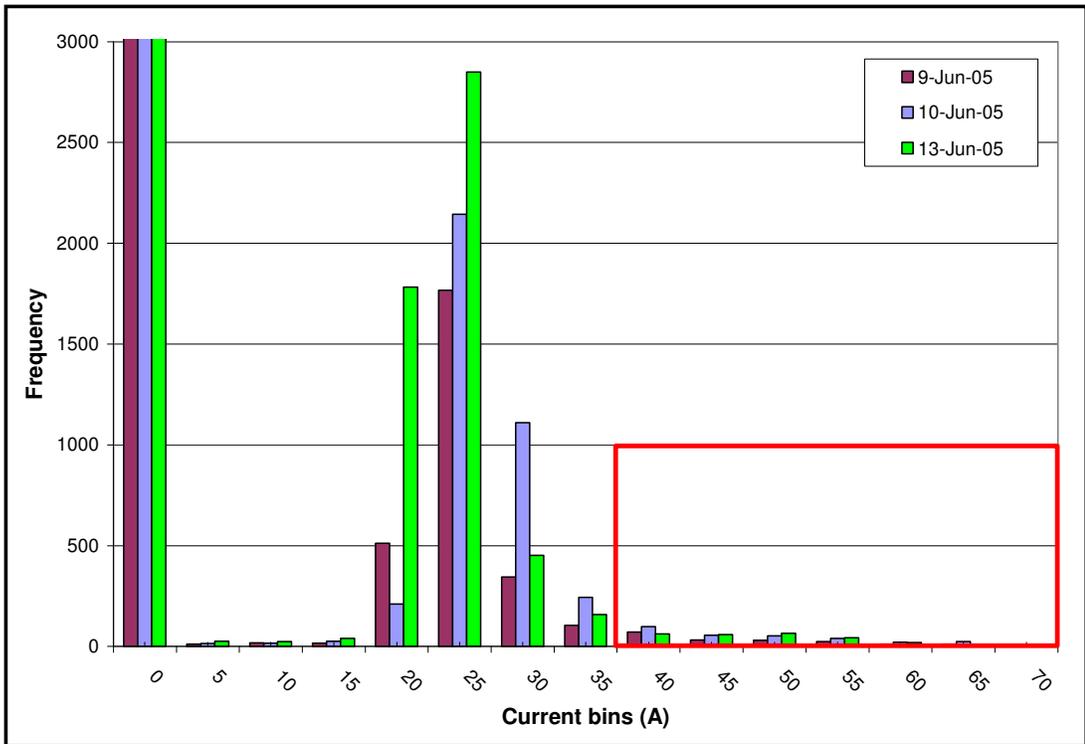


Figure K.2-8: Histogram for current consumed by a RH gathering head motor.

K.2.2 SECTION 51

K.2.2.1 Morning shifts

Table K-7: Data for the total consumption of a LH gathering head motor in section 51.

| | 29-Jun-05 | 30-Jun-05 |
|----------------------------------|-----------|-----------|
| Tonnes/CM/Shift | 1305 | 1740 |
| % Time of shift producing | 14.79% | 19.44% |
| % of Production time underloaded | 92.46% | 92.38% |
| % of Production time overloaded | 7.54% | 7.62% |

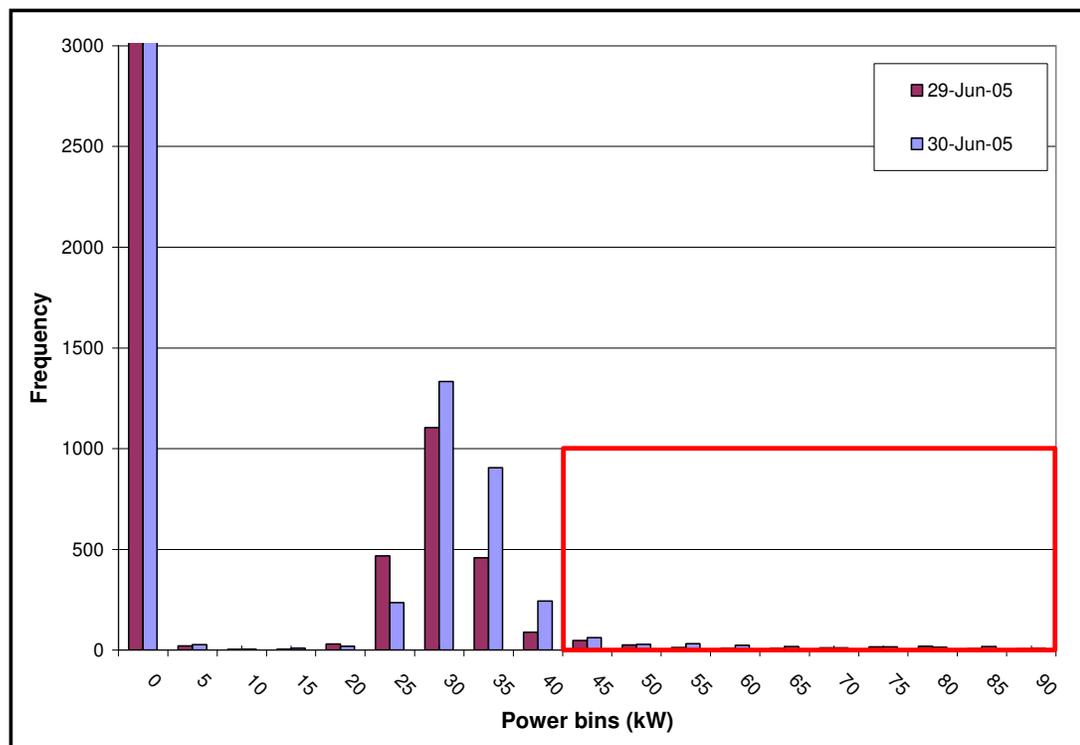


Figure K.2-9: Histogram for power consumed by a LH gathering head motor.

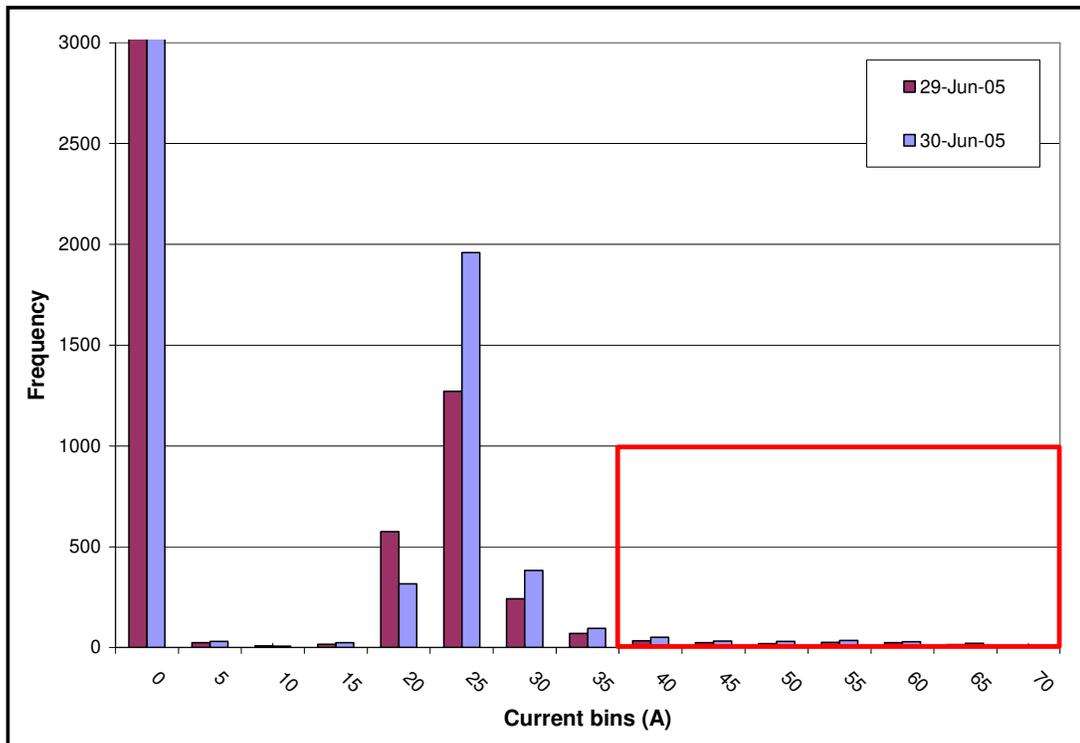


Figure K.2-10: Histogram for current consumed by a LH gathering head motor.

Table K-8: Data for the total consumption of a RH gathering head motor in section 51.

| | 29-Jun-05 | 30-Jun-05 |
|----------------------------------|-----------|-----------|
| Tonnes/CM/Shift | 1305 | 1740 |
| % Time of shift producing | 14.89% | 20.68% |
| % of Production time underloaded | 93.01% | 93.03% |
| % of Production time overloaded | 6.99% | 6.97% |

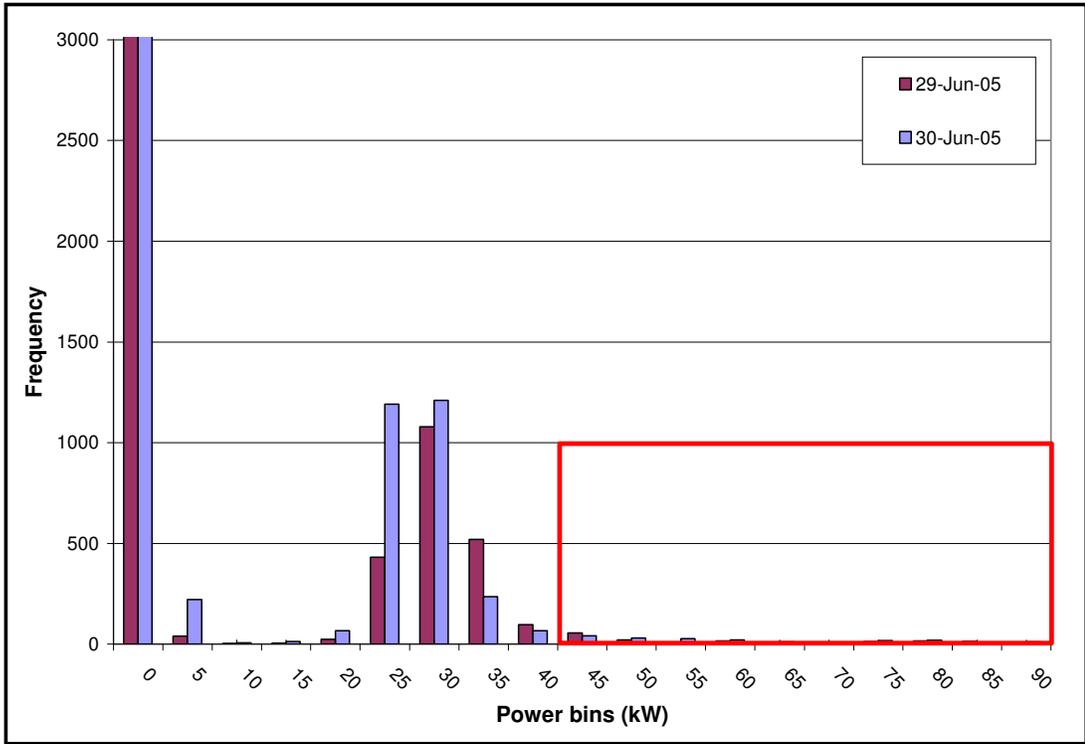


Figure K.2-11: Histogram for power consumed by a RH gathering head motor.

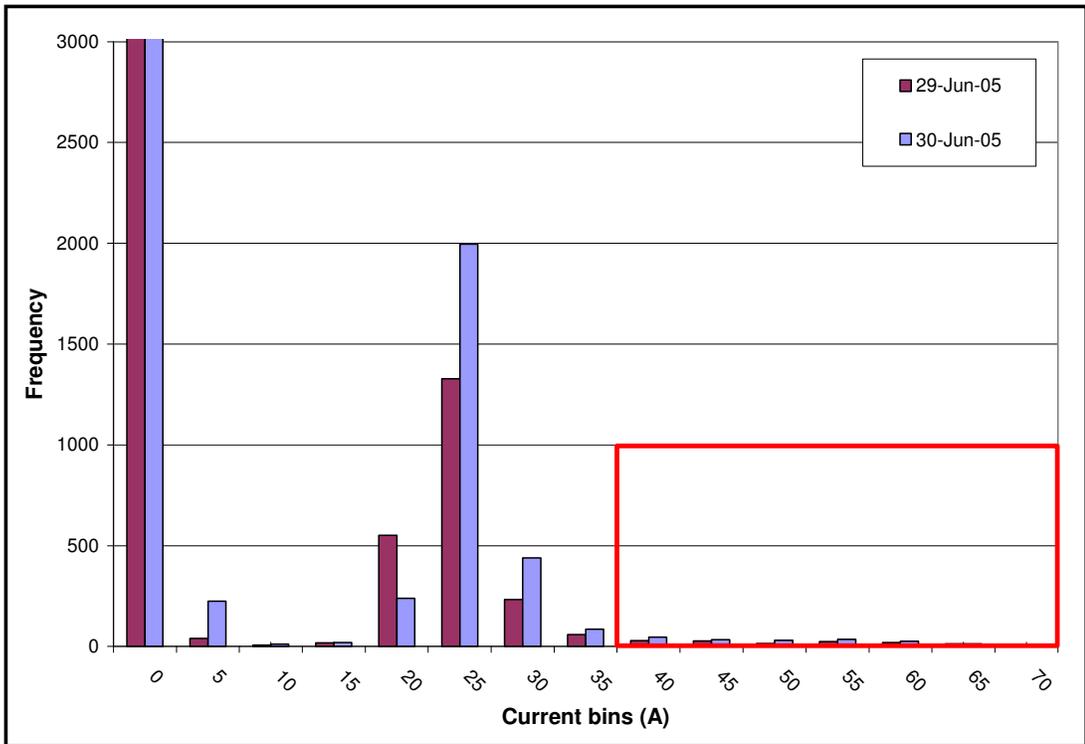


Figure K.2-12: Histogram for current consumed by a RH gathering head motor.

K.2.2.2 Afternoon shifts

Table K-9: Data for the total consumption of a LH gathering head motor in section 51.

| | 29-Jun-05 | 30-Jun-05 |
|----------------------------------|-----------|-----------|
| Tonnes/CM/Shift | 2175 | 2320 |
| % Time of shift producing | 23.50% | 26.59% |
| % of Production time underloaded | 90.60% | 92.03% |
| % of Production time overloaded | 9.40% | 7.97% |

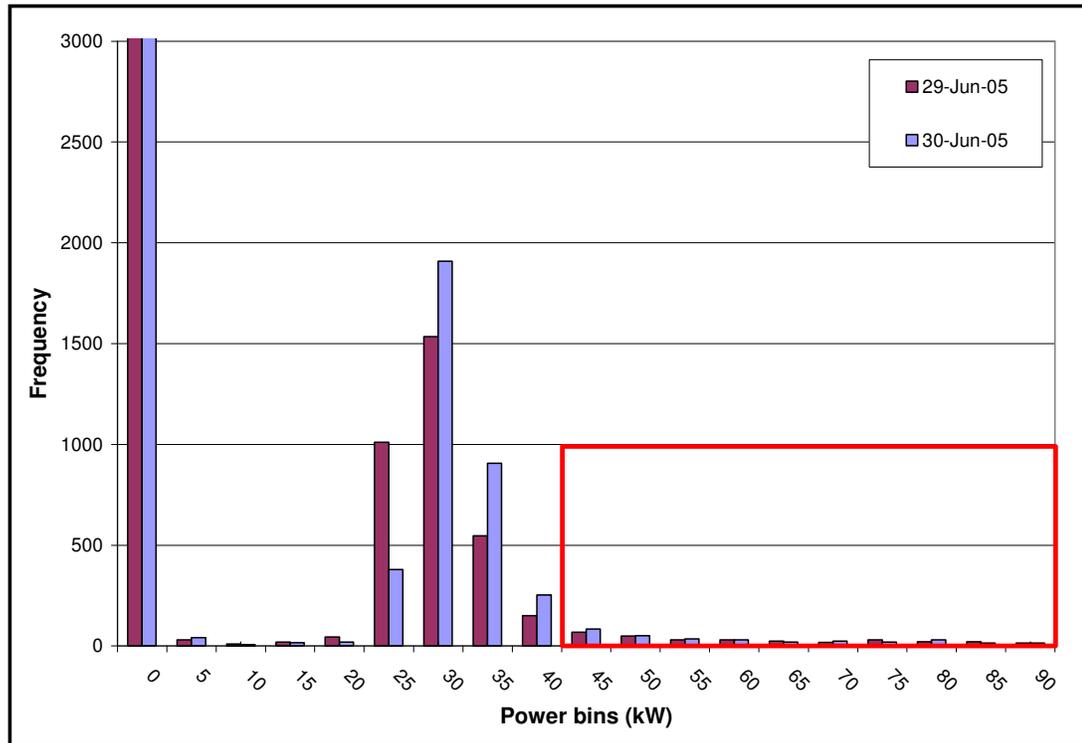


Figure K.2-13: Histogram for power consumed by a LH gathering head motor.

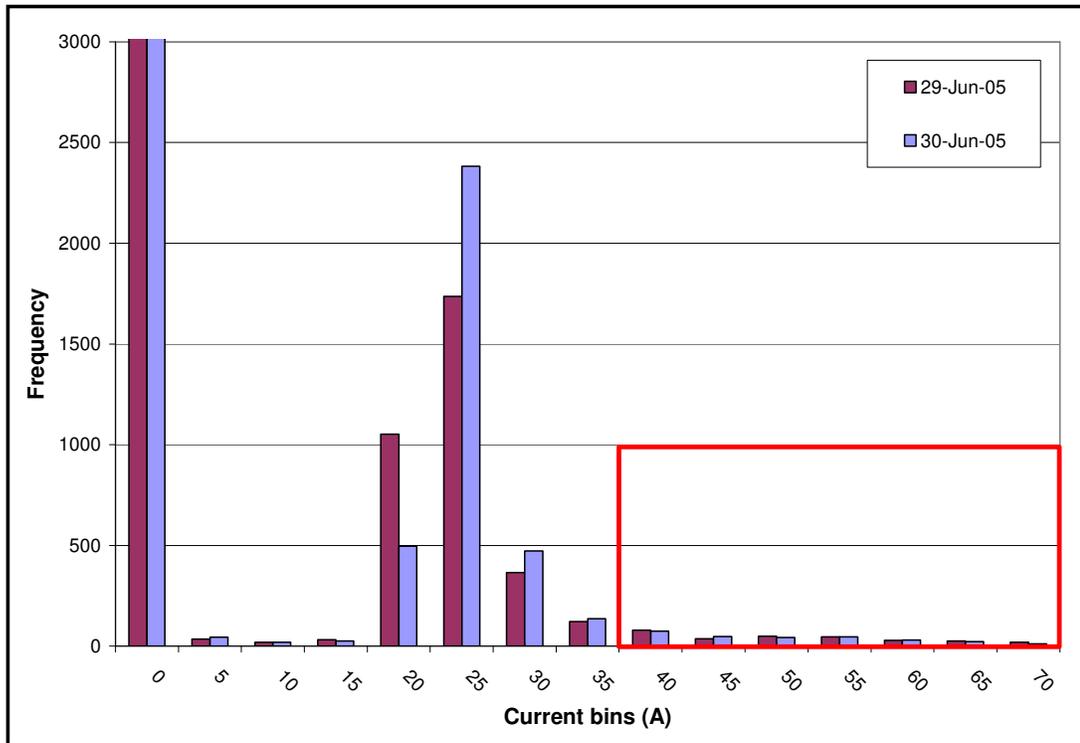


Figure K.2-14: Histogram for current consumed by a LH gathering head motor.

Table K-10: Data for the total consumption of a RH gathering head motor in section 51.

| | 29-Jun-05 | 30-Jun-05 |
|----------------------------------|-----------|-----------|
| Tonnes/CM/Shift | 2175 | 2320 |
| % Time of shift producing | 23.74% | 29.00% |
| % of Production time underloaded | 91.01% | 93.14% |
| % of Production time overloaded | 8.99% | 6.86% |

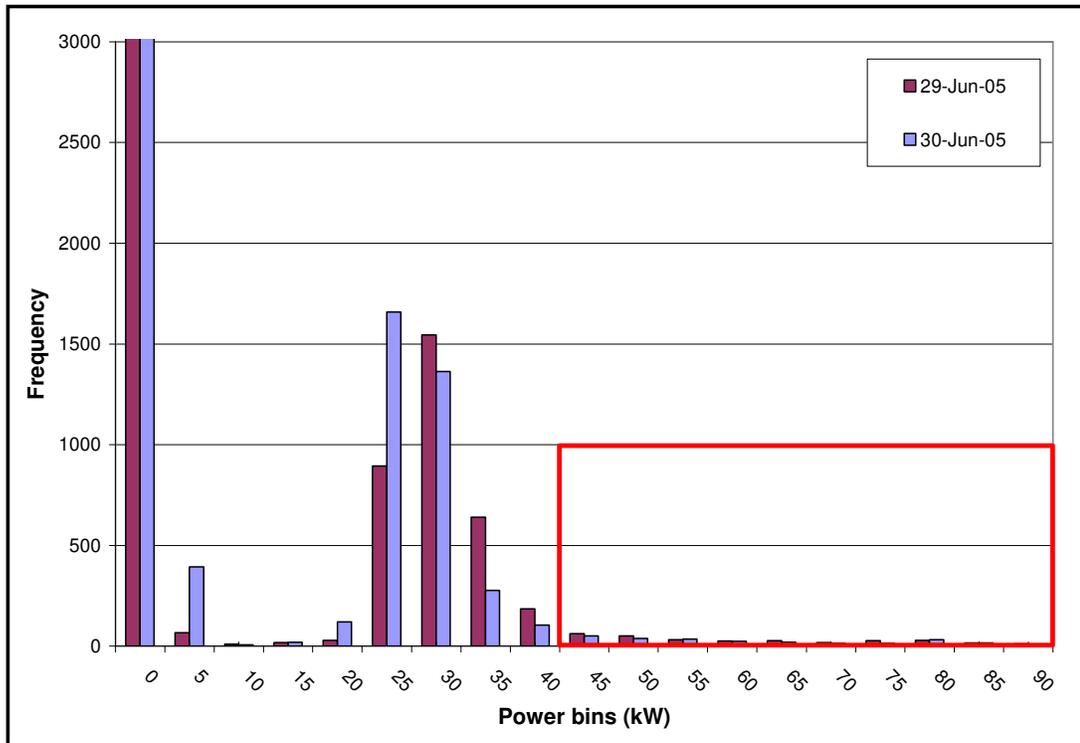


Figure K.2-15: Histogram for power consumed by a RH gathering head motor.

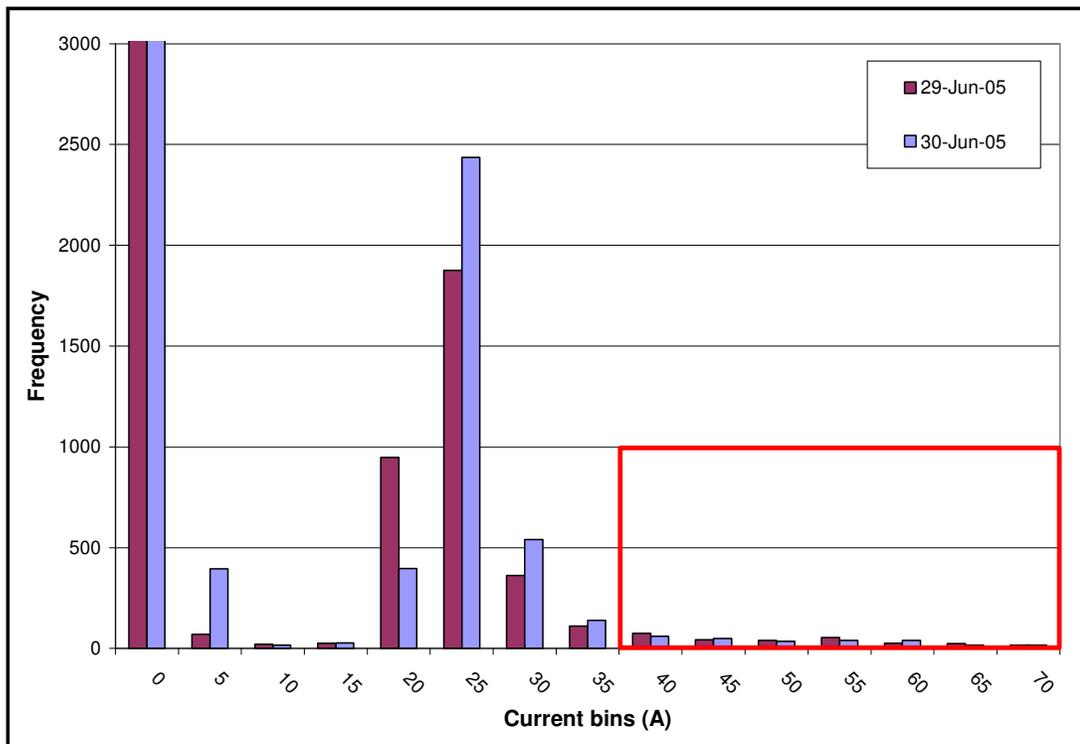


Figure K.2-16: Histogram for current consumed by a RH gathering head motor.

K.2.3 FLASHCARD RECORDER

K.2.3.1 Morning shifts

Table K-11: Data for the total consumption of a LH gathering head 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 | 23.45% | 9.96% | 11.23% | 16.24% |
| % of Production time underloaded | 97.38% | 96.17% | 92.45% | 90.98% |
| % of Production time overloaded | 2.62% | 3.83% | 7.55% | 9.02% |

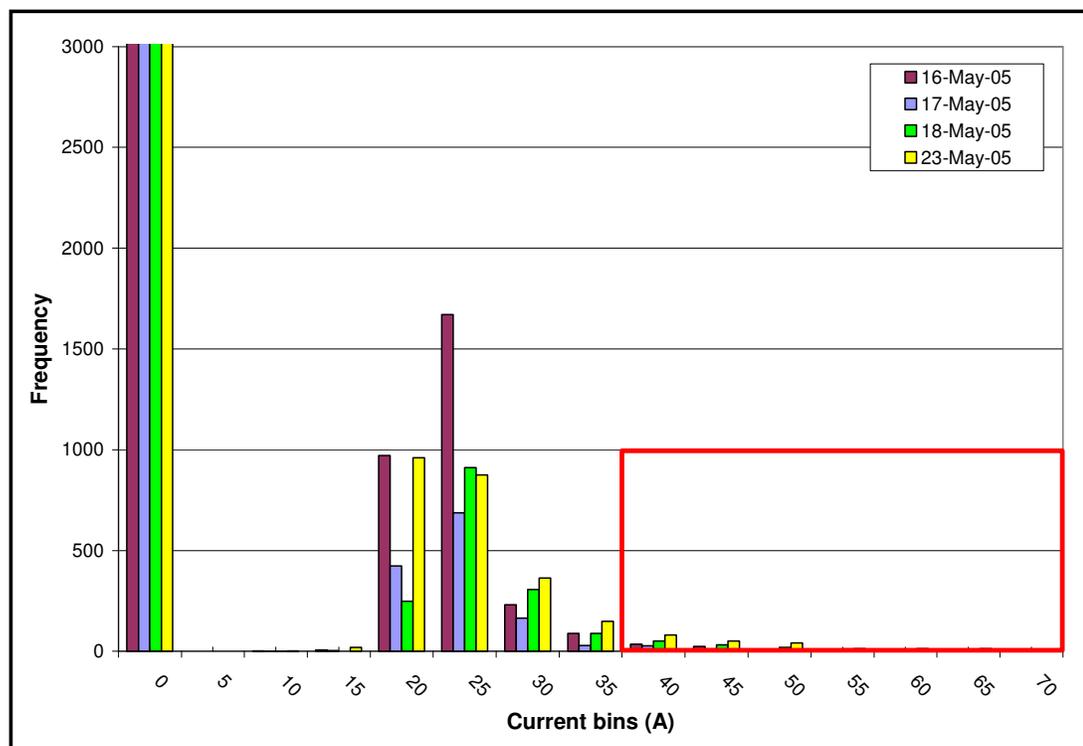


Figure K.2-17: Histogram for current consumed by a LH gathering head motor.

Table K-12: Data for the total consumption of a RH gathering head 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 | 23.45% | 9.97% | 11.23% | 16.24% |
| % of Production time underloaded | 97.34% | 96.32% | 93.04% | 91.25% |
| % of Production time overloaded | 26.56% | 3.68% | 6.96% | 8.75% |

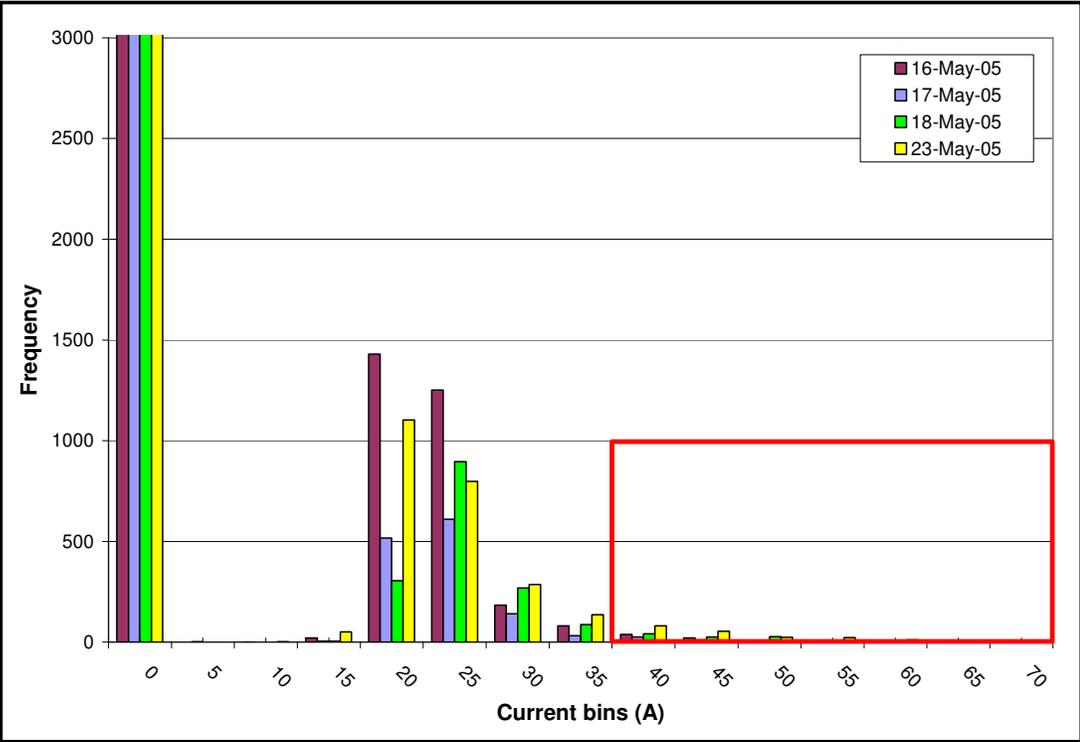


Figure K.2-18: Histogram for current consumed by a RH gathering head motor.

K.2.3.2 Afternoon shifts

Table K-13: Data for the total consumption of a LH gathering head 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 | 18.59% | 21.26% | 26.46% | 19.41% |
| % of Production time underloaded | 94.41% | 93.86% | 97.67% | 88.62% |
| % of Production time overloaded | 5.59% | 6.14% | 2.33% | 11.38% |

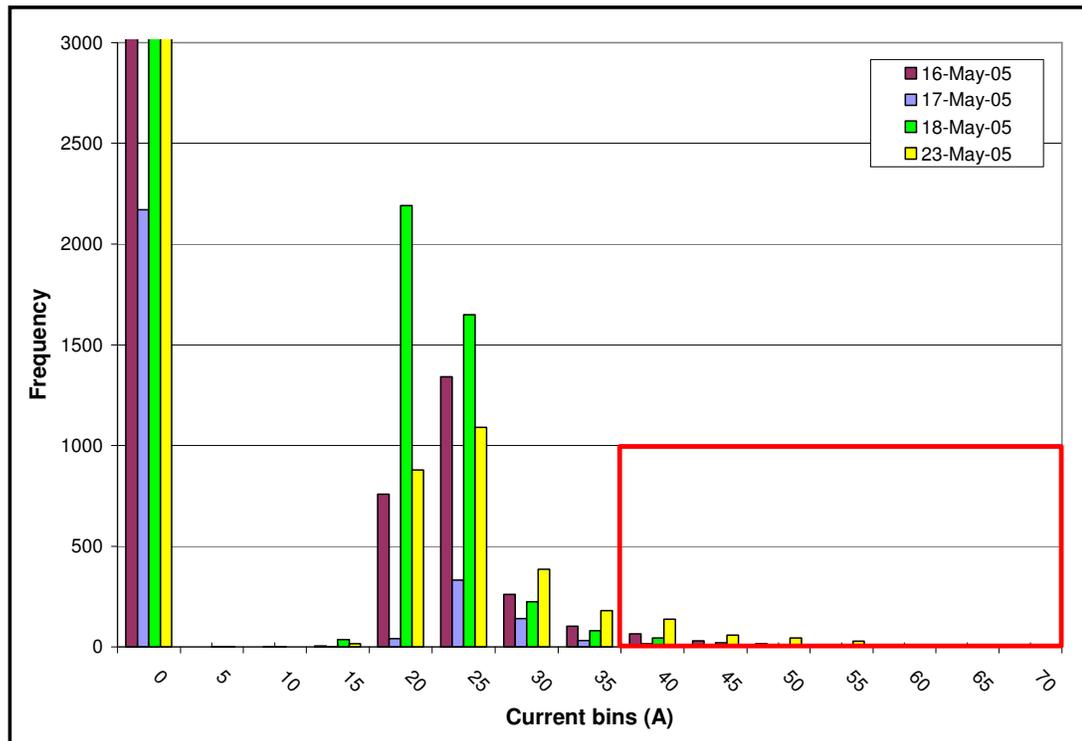


Figure K.2-19: Histogram for current consumed by a LH gathering head motor.

Table K-14: Data for the total consumption of a RH gathering head 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 | 18.59% | 21.26% | 26.46% | 19.41% |
| % of Production time underloaded | 94.22% | 94.03% | 97.57% | 89.59% |
| % of Production time overloaded | 5.78% | 5.97% | 2.43% | 10.41% |

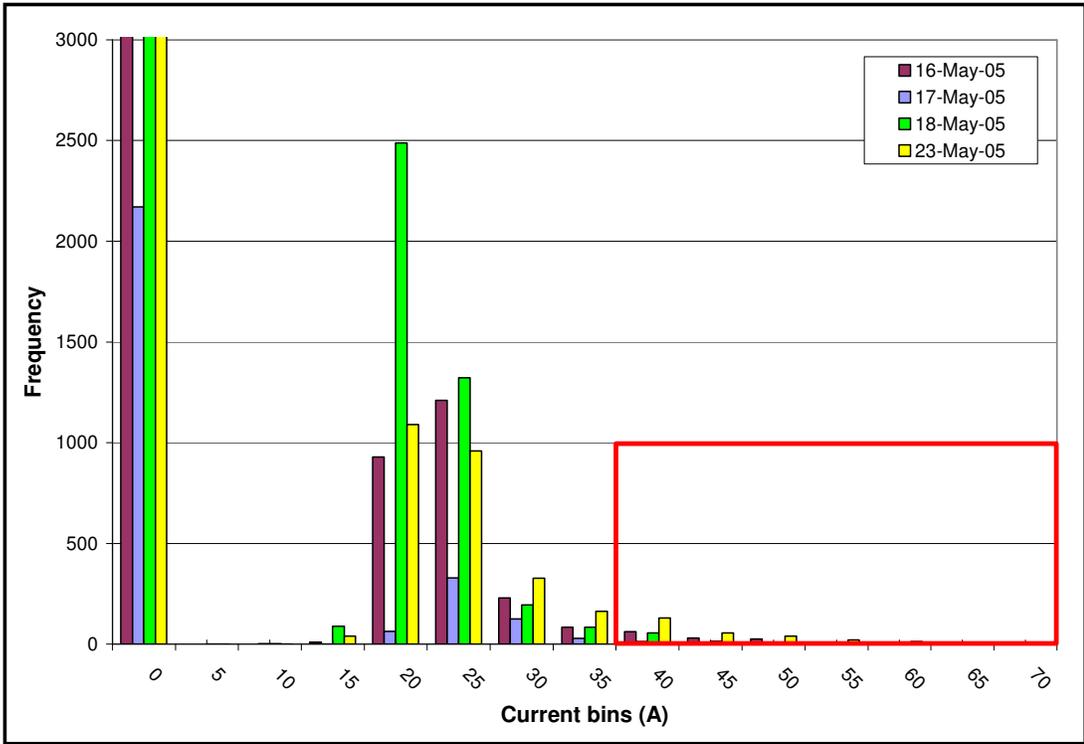


Figure K.2-20: Histogram for current consumed by a RH gathering head motor.

K.3 THERMAL CAPACITY

The next section focuses on the temperature of the windings of the gathering head 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.

K.3.1 SECTION 21

K.3.1.1 Morning shifts

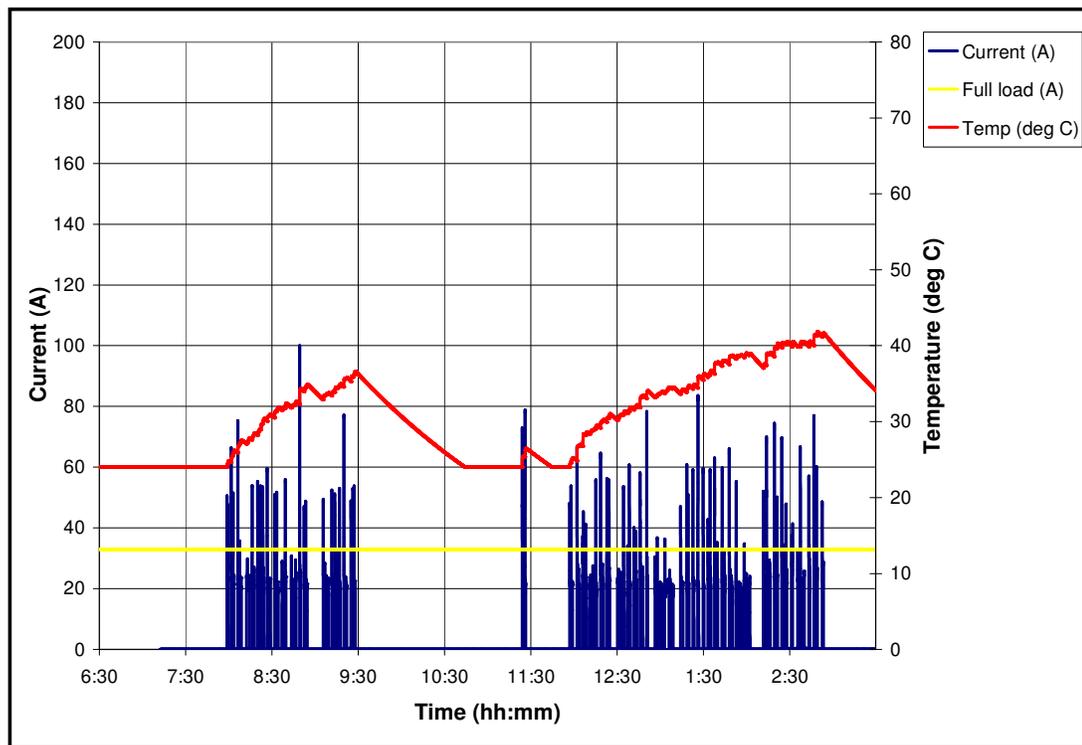


Figure K.3-1: Load current and motor temperature for a LH gathering head motor – 9 June 2005.

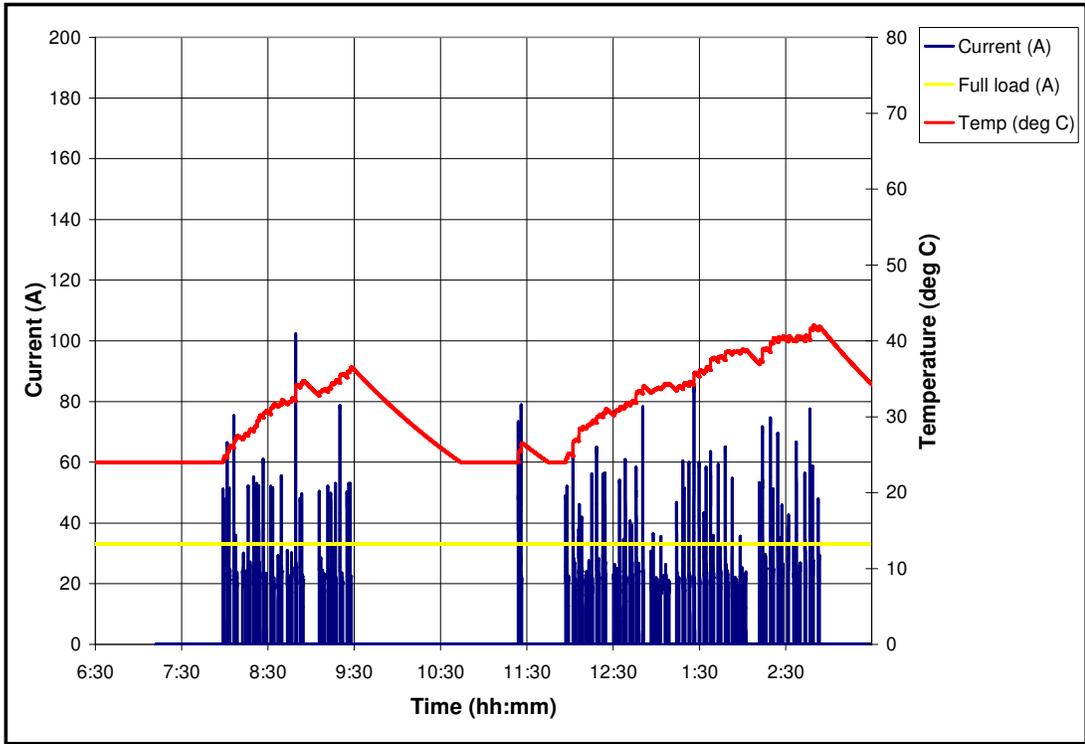


Figure K.3-2: Load current and motor temperature for a RH gathering head motor – 9 June 2005.

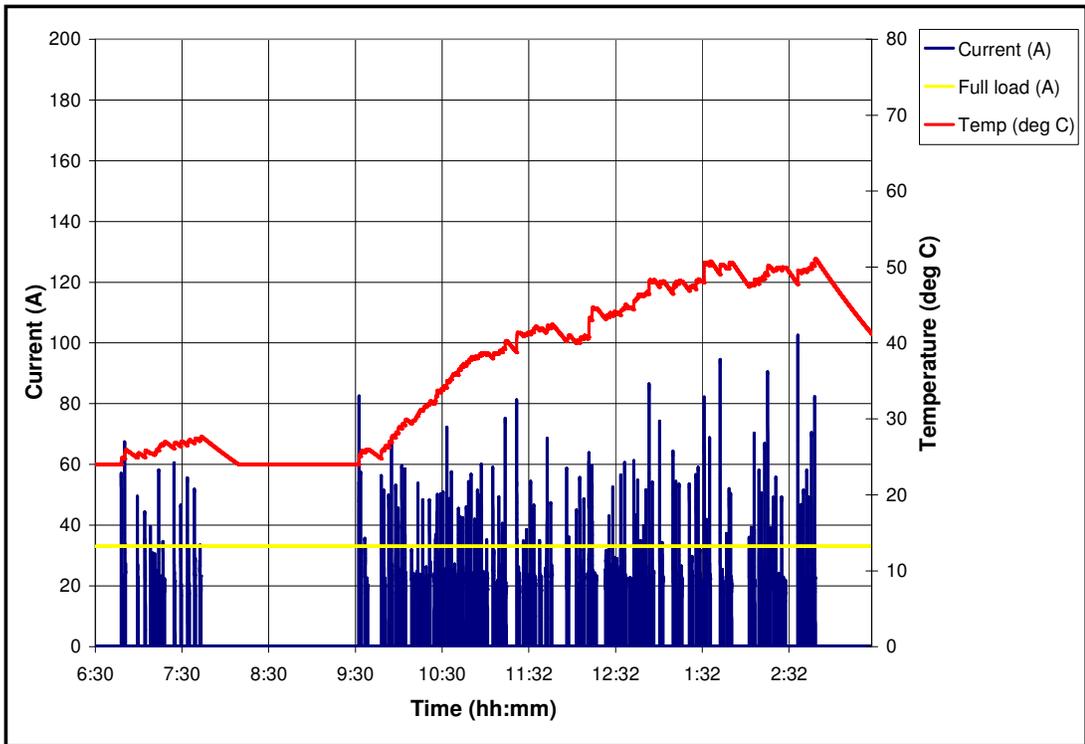


Figure K.3-3: Load current and motor temperature for a LH gathering head motor – 10 June 2005.

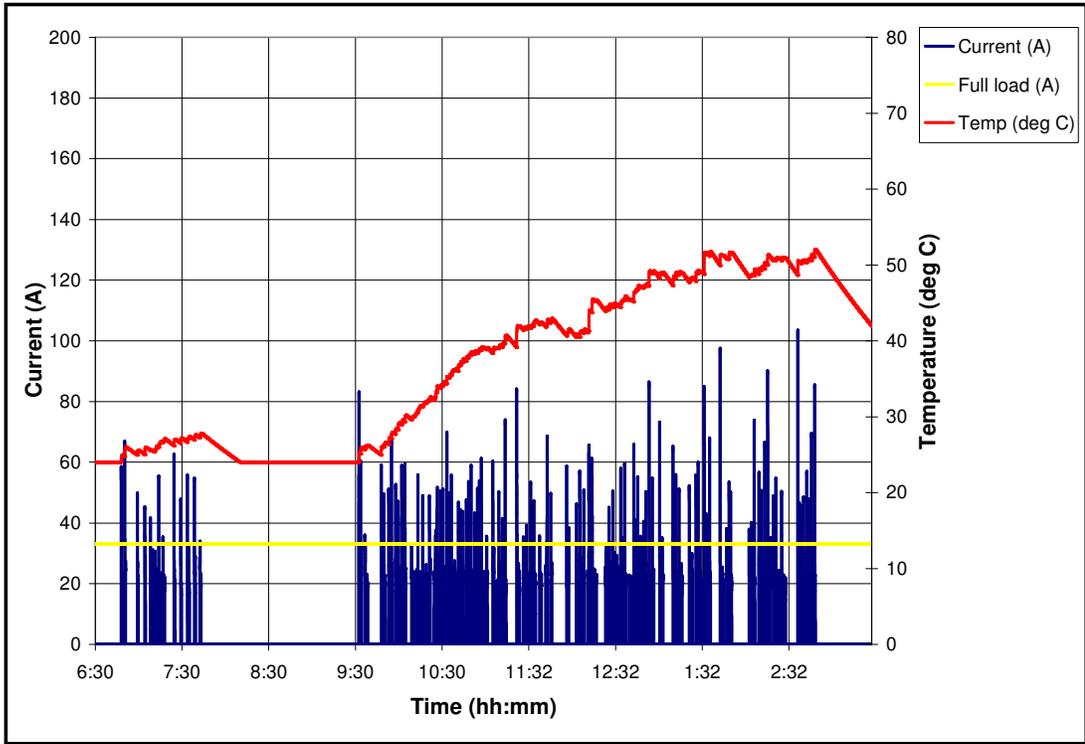


Figure K.3-4: Load current and motor temperature for a RH gathering head motor – 10 June 2005

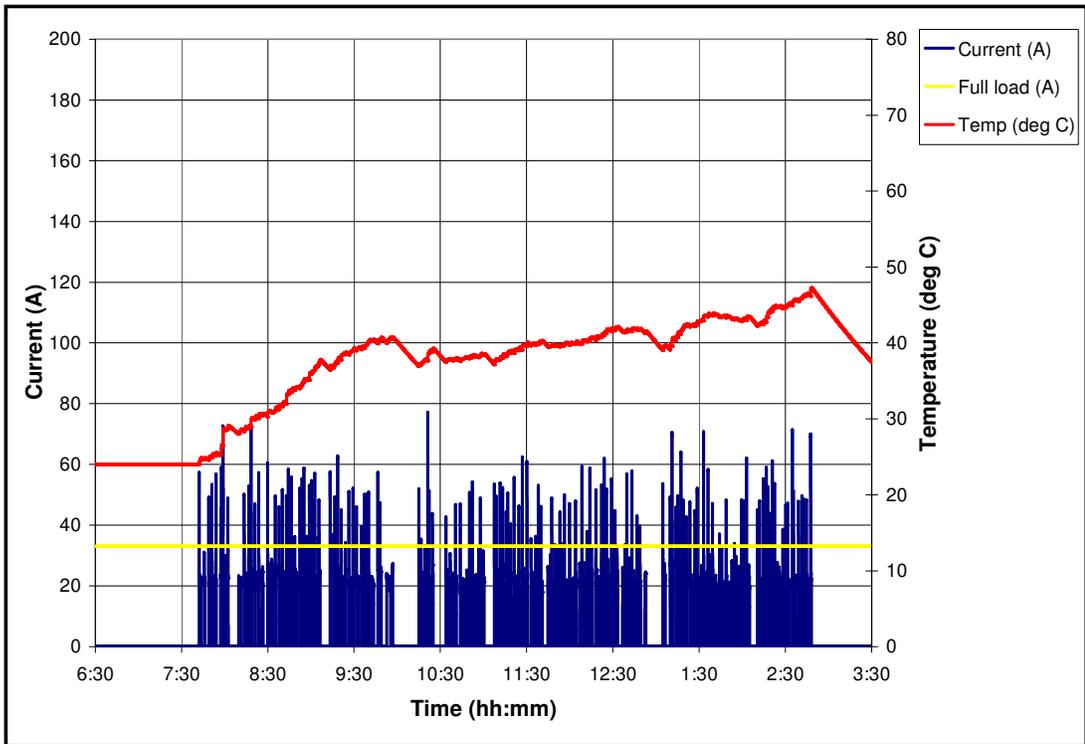


Figure K.3-5: Load current and motor temperature for a LH gathering head motor – 13 June 2005.

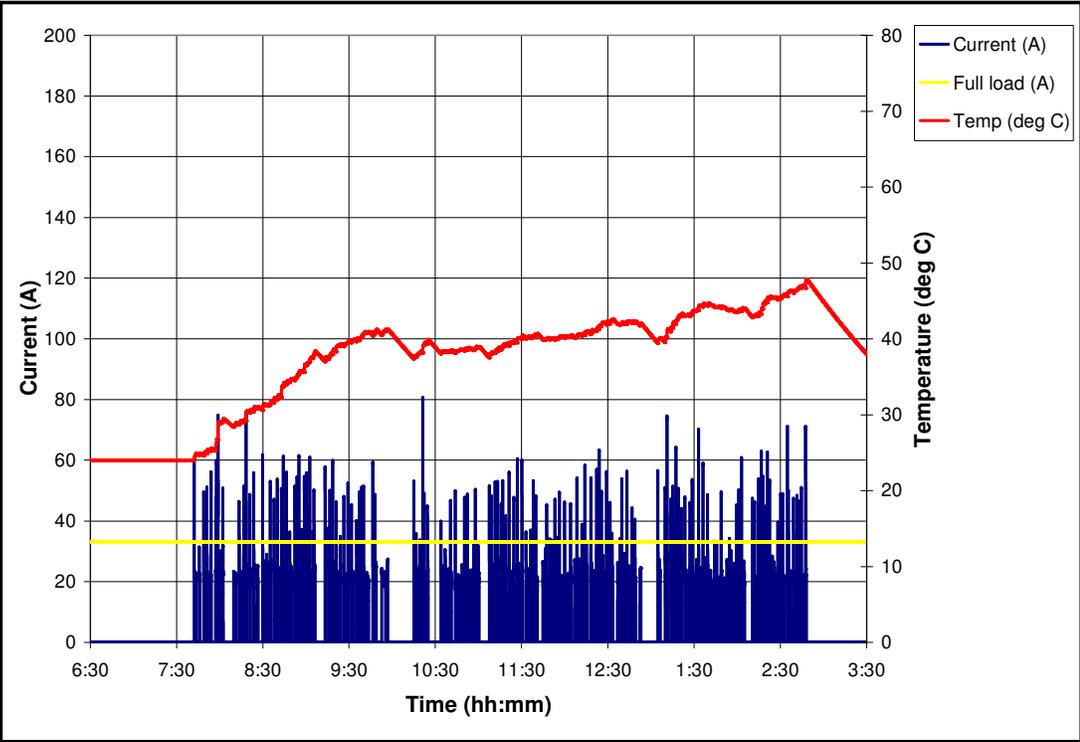


Figure K.3-6: Load current and motor temperature for a RH gathering head motor – 13 June 2005

K.3.1.2 Afternoon shifts

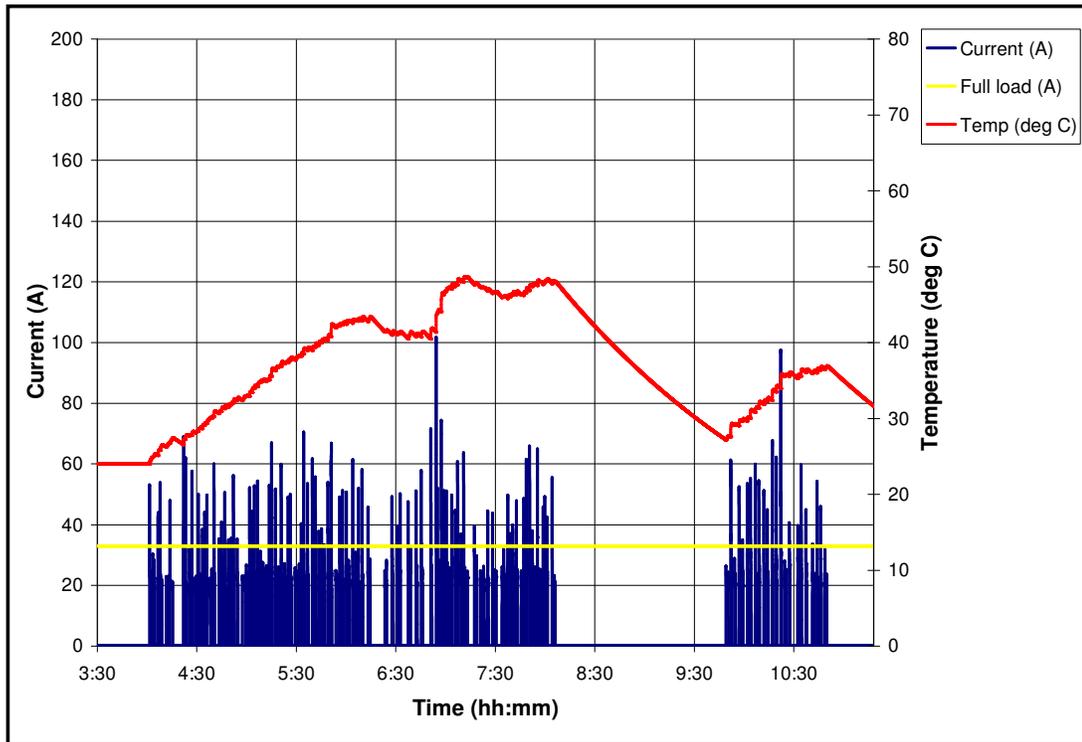


Figure K.3-7: Load current and motor temperature for a LH gathering head motor – 9 June 2005.

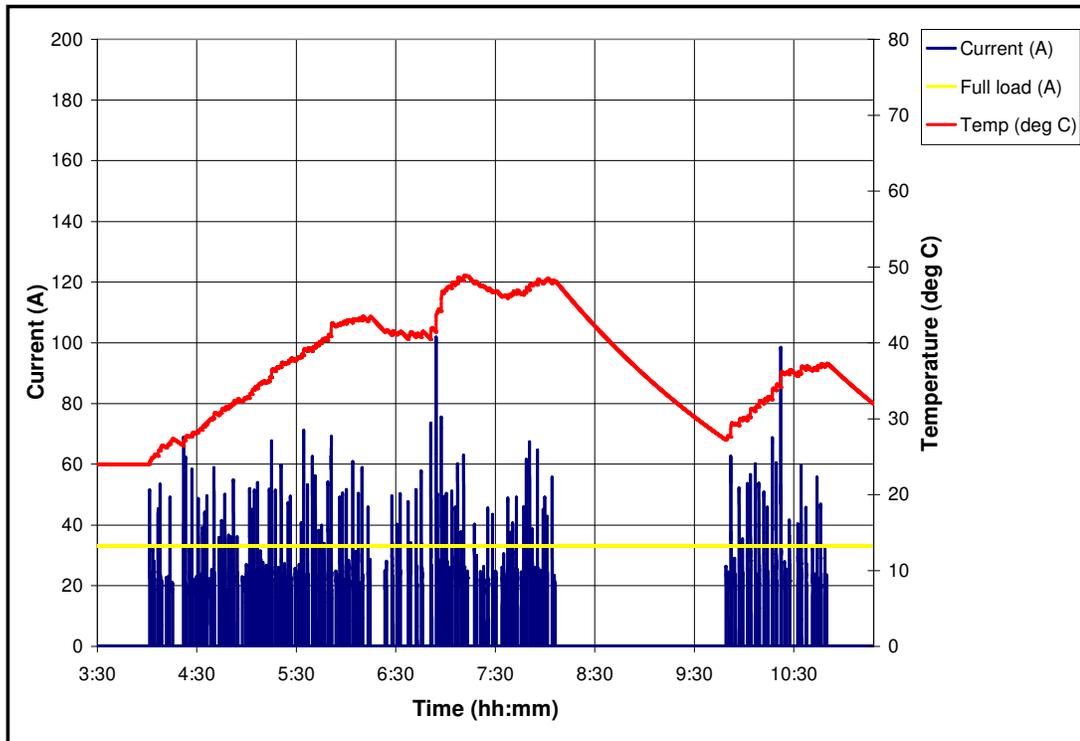


Figure K.3-8: Load current and motor temperature for a RH gathering head motor – 9 June 2005.

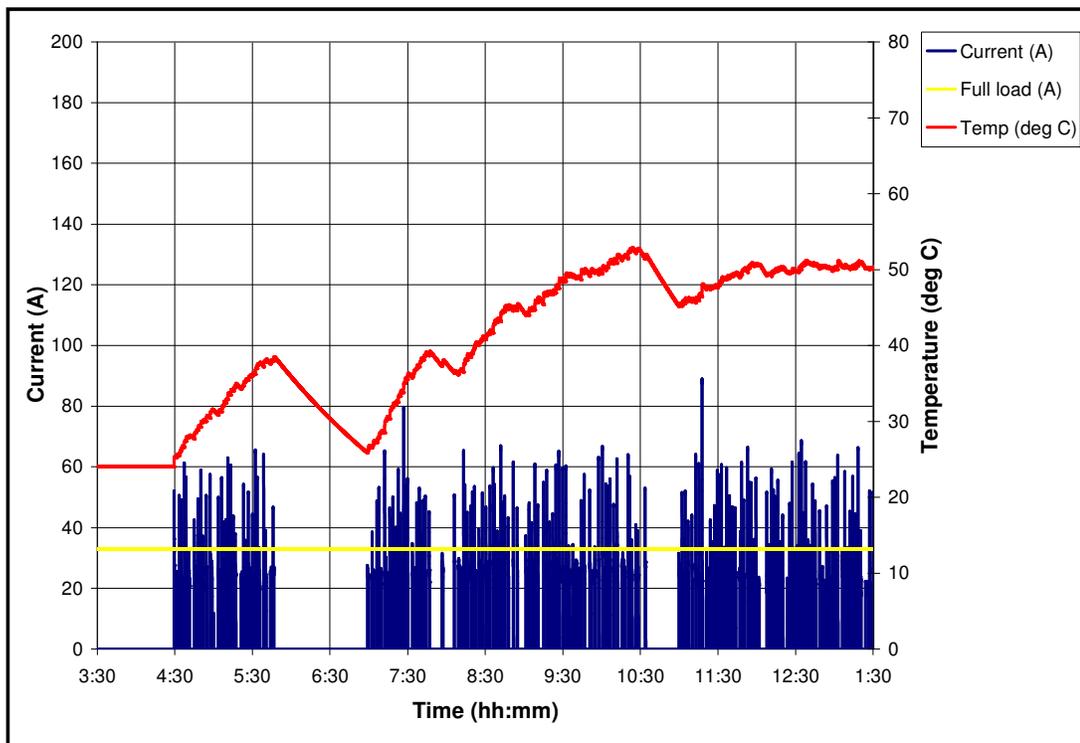


Figure K.3-9: Load current and motor temperature for a LH gathering head motor – 10 June 2005.

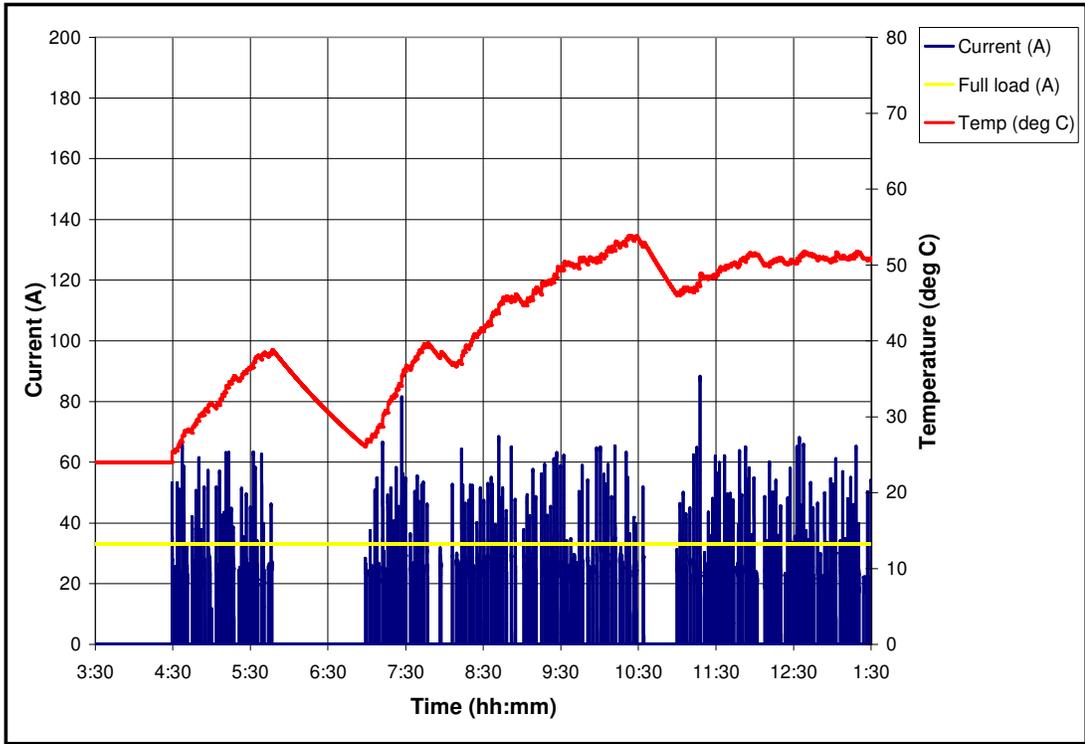


Figure K.3-10: Load current and motor temperature for a RH gathering head motor – 10 June 2005.

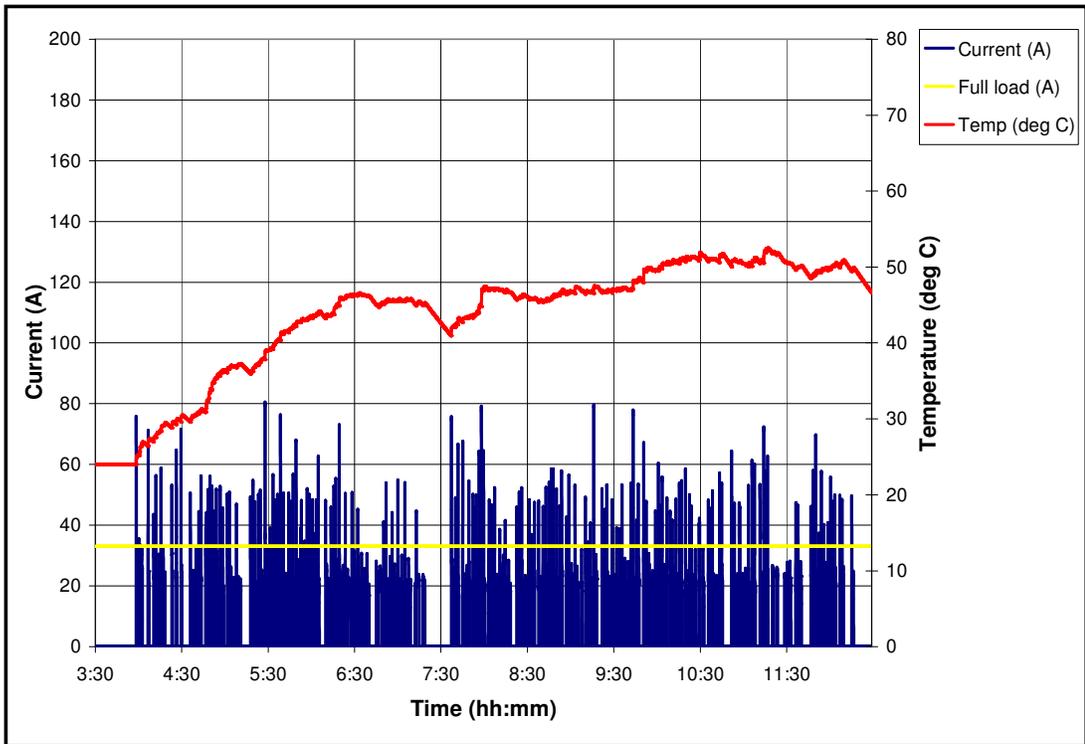


Figure K.3-11: Load current and motor temperature for a LH gathering head motor – 13 June 2005.

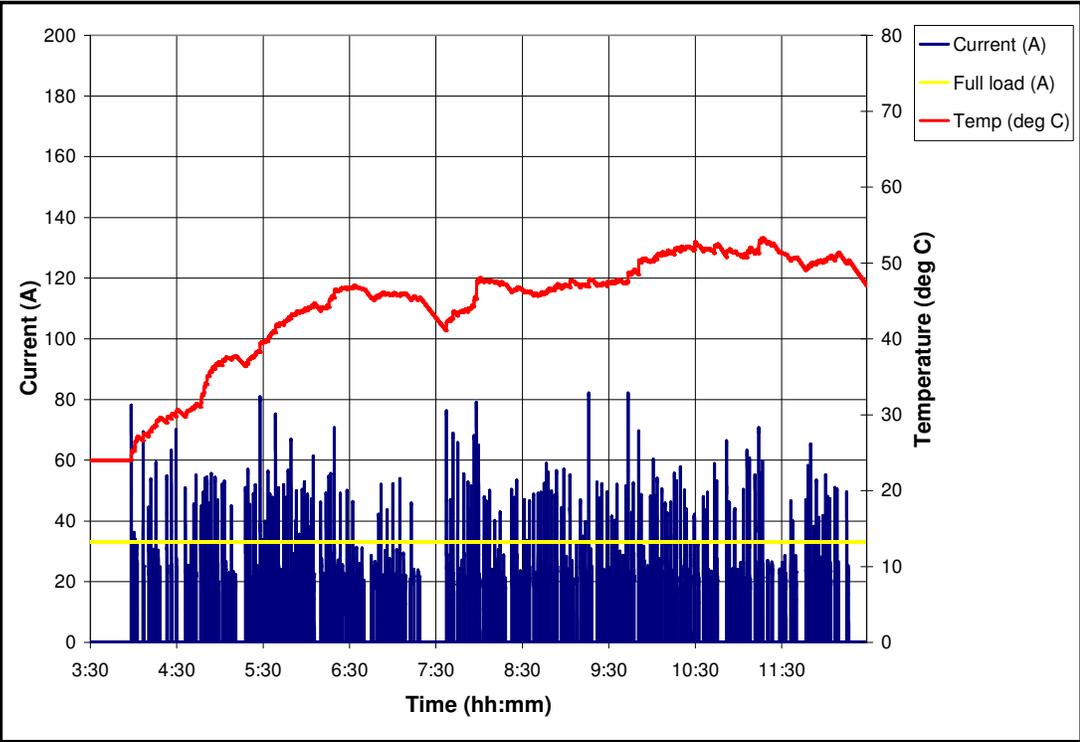


Figure K.3-12: Load current and motor temperature for a RH gathering head motor – 13 June 2005

K.3.2 SECTION 51

K.3.2.1 Morning shifts

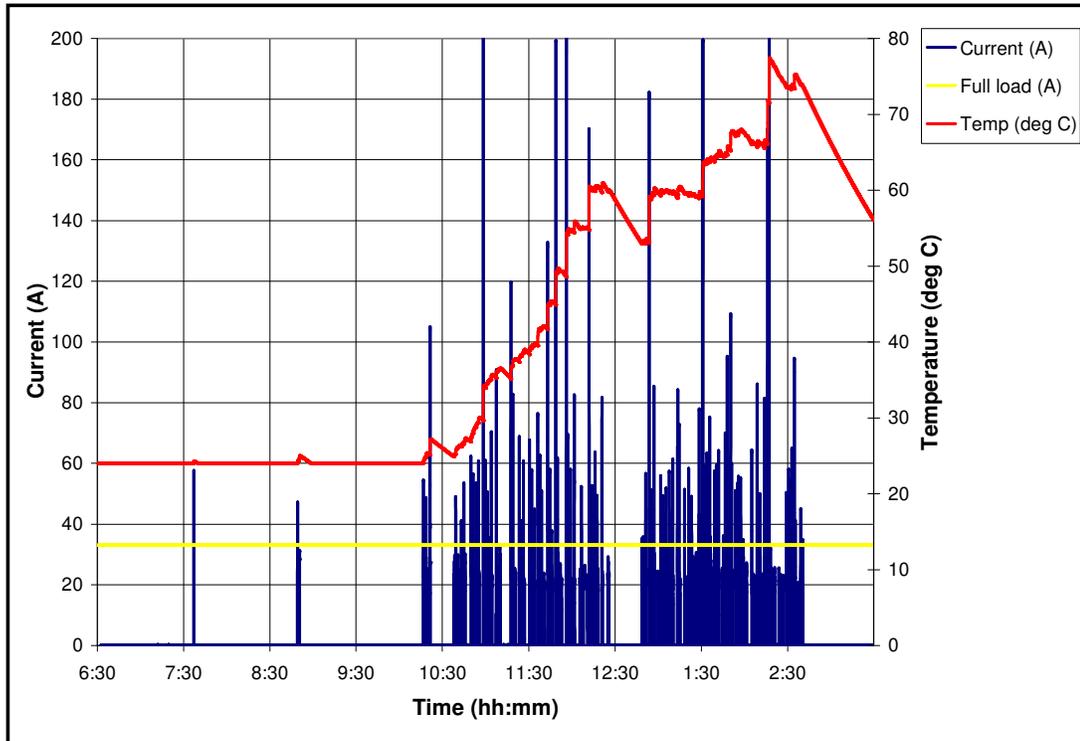


Figure K.3-13: Load current and motor temperature for a LH gathering head motor – 29 June 2005.

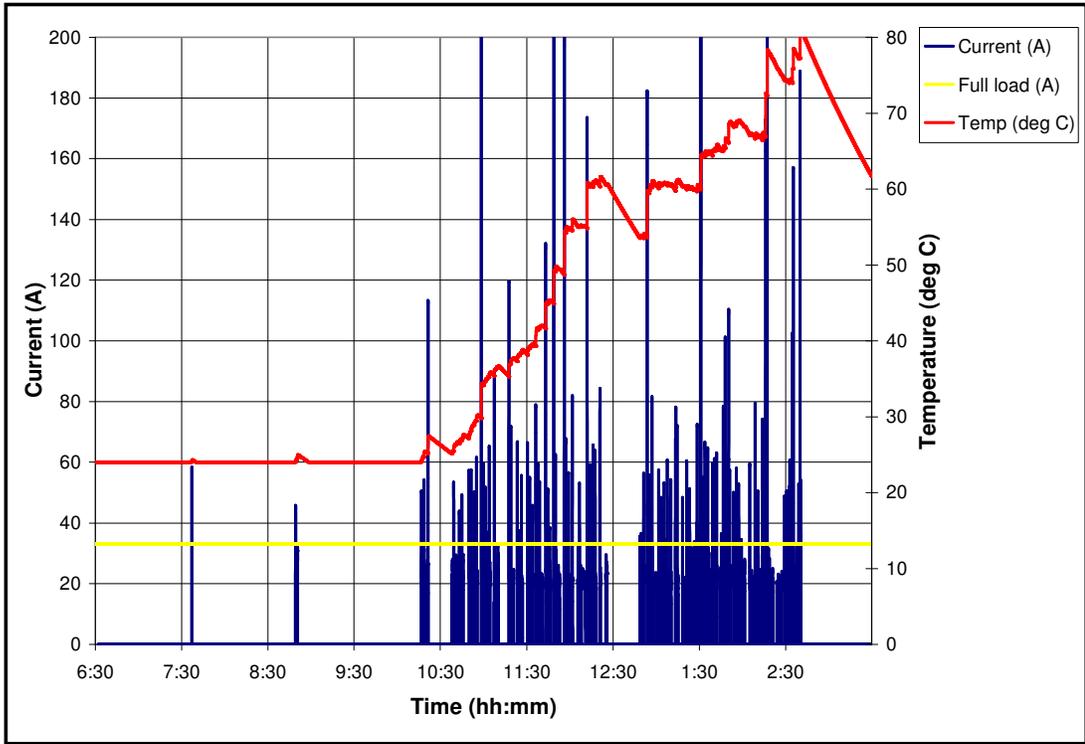


Figure K.3-14: Load current and motor temperature for a RH gathering head motor 29 June 2005.

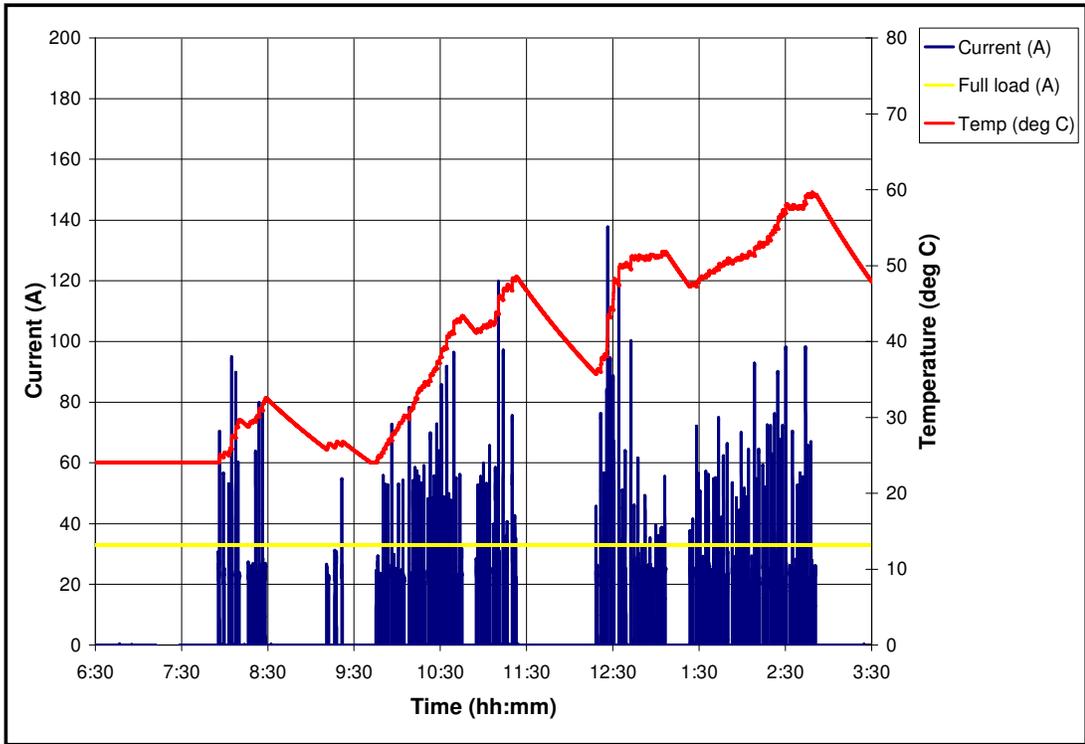


Figure K.3-15: Load current and motor temperature for a LH gathering head motor – 30 June 2005.

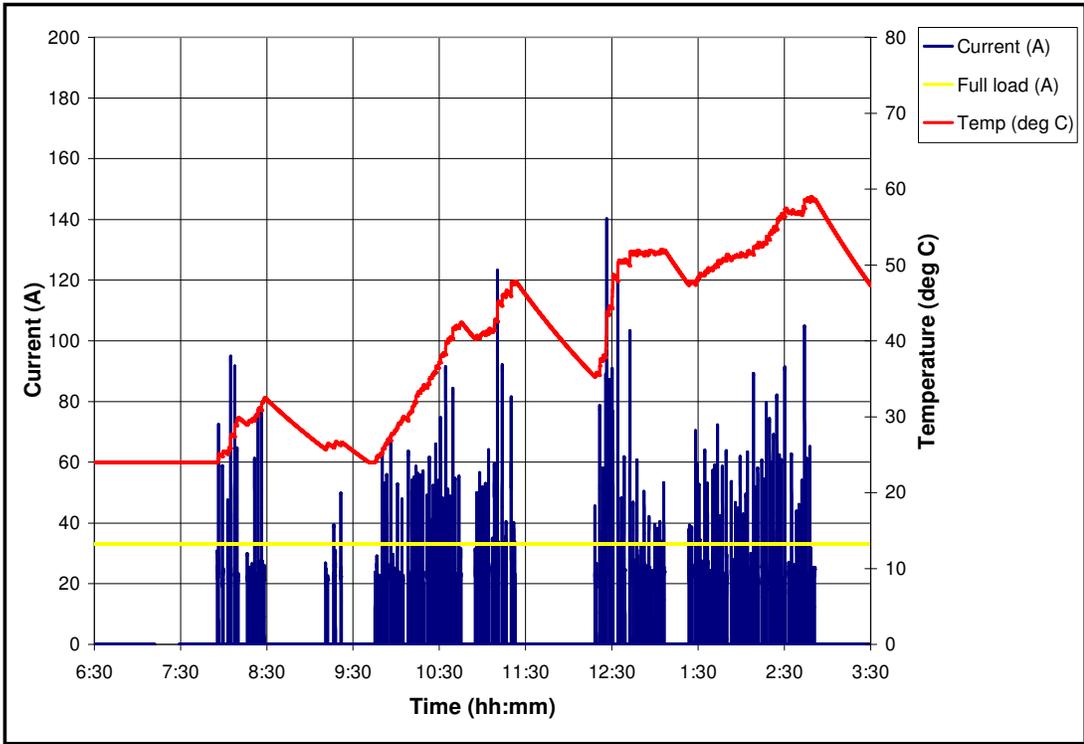


Figure K.3-16: Load current and motor temperature for a RH gathering head motor – 30 June 2005

K.3.2.2 Afternoon shifts

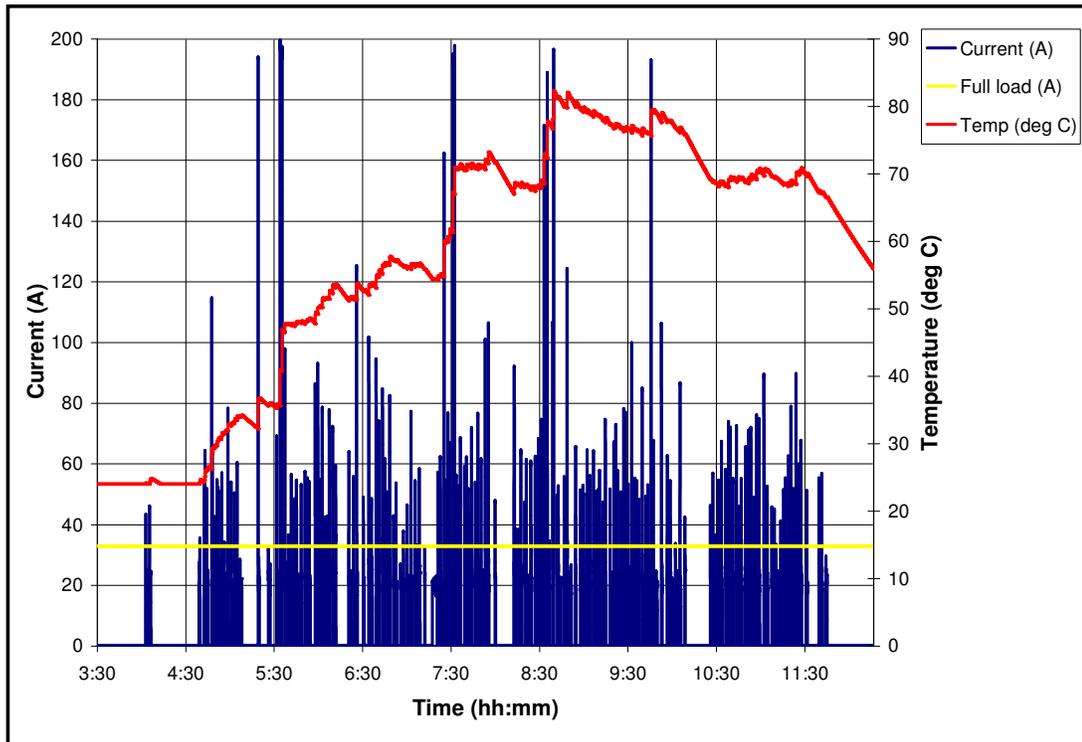


Figure K.3-17: Load current and motor temperature for a LH gathering head motor – 29 June 2005.

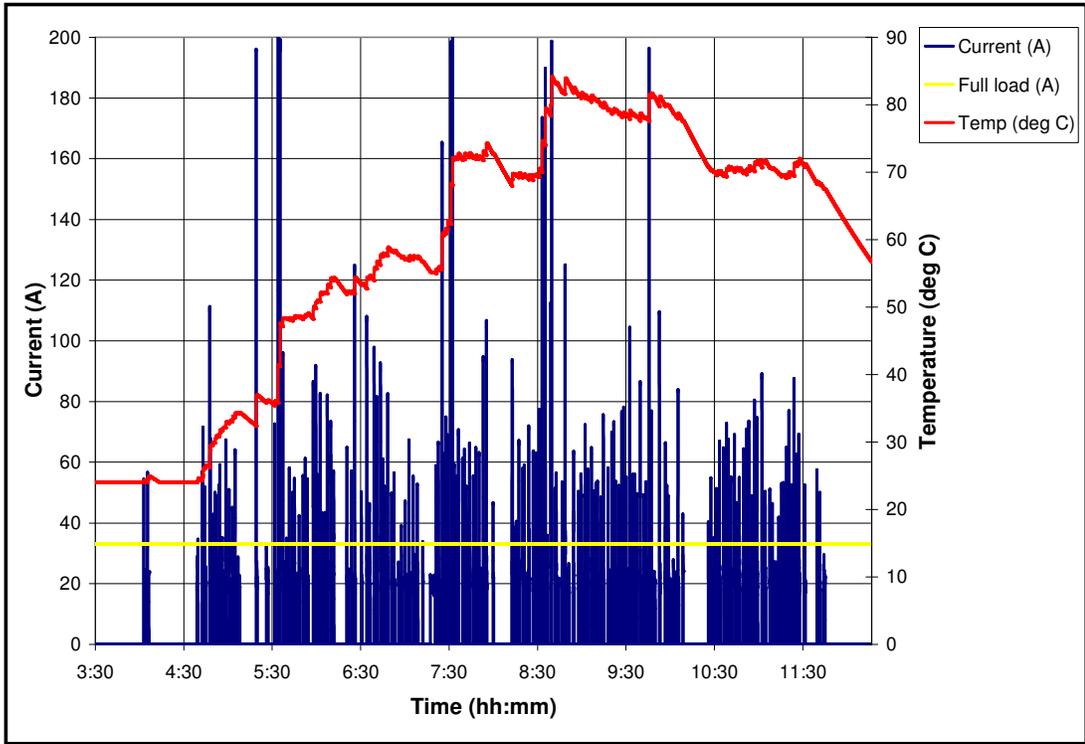


Figure K.3-18: Load current and motor temperature for a RH gathering head motor – 29 June 2005.

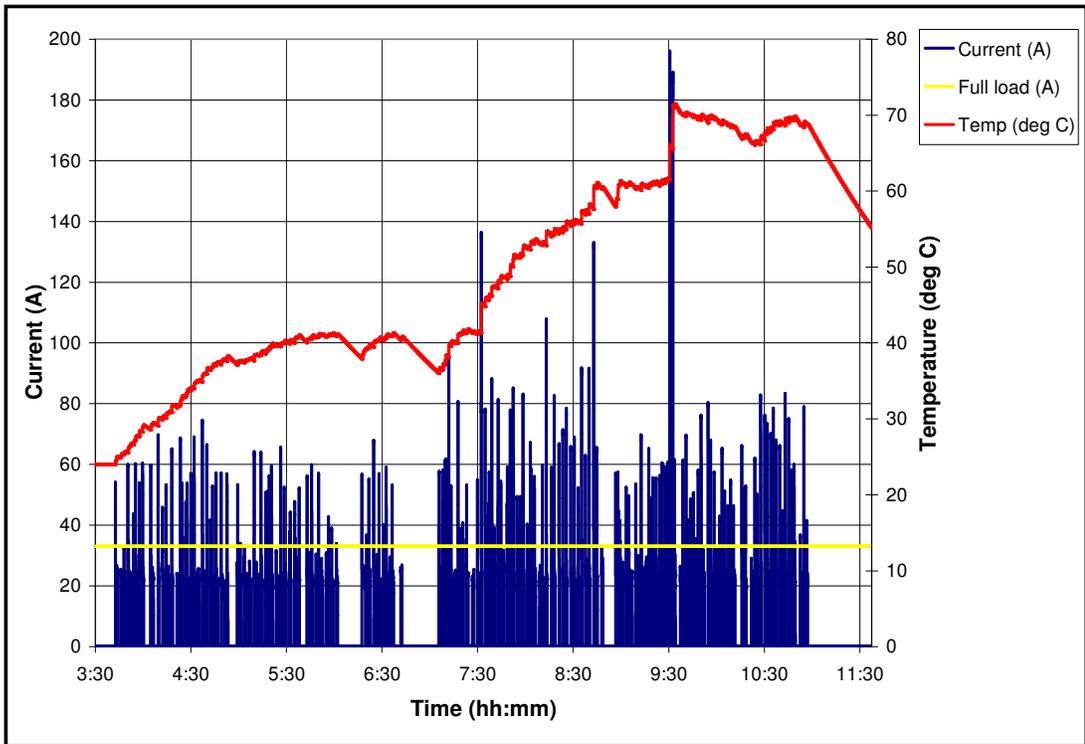


Figure K.3-19: Load current and motor temperature for a LH gathering head motor – 30 June 2005.

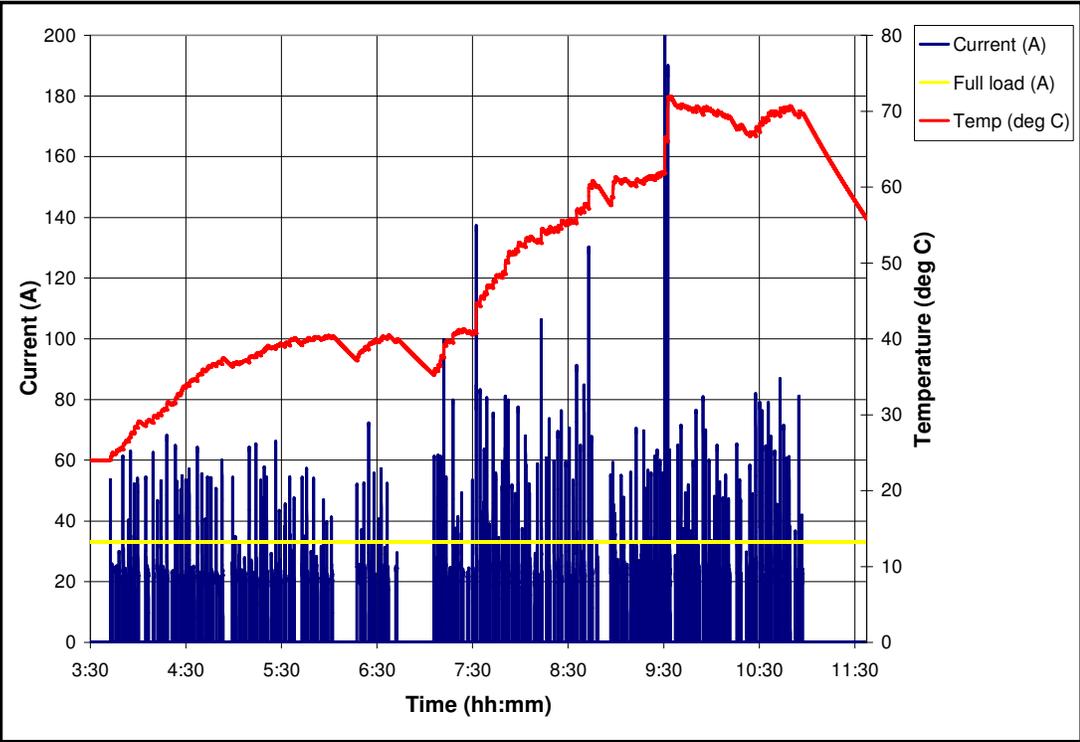


Figure K.3-20: Load current and motor temperature for a RH gathering head motor – 30 June 2005.