**Appendix. Supplementary data**

Table A1. Specifications of the test machines.

|  |  |  |
| --- | --- | --- |
| Characteristic | Value | |
| *Drill rig* | | |
| Model | SWDB165 (China) | |
| Drilling diameter (mm) | 152–178 | |
| Working temperature (°С) | -40°–40° | |
| Direction of drill (°) | 0 to -35 | |
| Maximum torque (N m) | 2100 | |
| Maximum feed force (reverse feed) (kN) | 45 | |
| Feed force in drilling (kN) | 7–20 | |
| Rotations per minute | 10–60 | |
| Drill rod diameter (mm) | 133 | |
| Drill rod length (m) | 8.5 | |
| Compressor model | DLQ 750XH CUM | |
| Maximum capacity (kW) | 246 | |
| Maximum pressure, *p* (MPa) | 1.38 | |
| Maximum airflow rate, *Q* (m3/min) | 21.2 | |
| *Air hammer* | | |
| Model | СОP64.2 | PV170M |
| Length (mm) | 1306 | 850 |
| Body diameter (mm) | 142 | 146 |
| Piston weight (kg) | 22,5 | 17,5 |
| Air distribution: valve/no valve | -/+ | -/+ |
| Back valve | + | + |
| *Drill bit* | | |
| Model | IRQL60 | KNSH170 |
| Drill hole diameter (mm) | 165 | 172 |
| Number of exhaust openings | 2 | 3 |
| Number of indenters/outside row | 20/10 | 28/10 |
| Diameter f indenters (mm) | 16 | 14 |
| Connection with air hammer | Spline joint | |
| Bit weight (kg) | 25.4 | 17.5 |
| *Air hammering parameters (rig tests)* | | |
| Model | СОP64.2\* | PV170M |
| Rated pressure (MPa) | 1.05 | 1 |
| Airflow rate (m3/min) | 9 | 10.3 |
| Blow energy (J) | 504 | 412 |
| Blow frequency (Hz) | 19.8 | 22 |
| Blow capacity (kW) | 10 | 9.06 |

\*According to the data from Secoroc down-the-hole equipment: Operators instruction and spare parts list down-the-hole hammers (Atlas Copco).