

Supplementary Material 1. Technical details of the NRE equipment (NRE Dozer, NRE Drill Rig and NRE Support Rig). Supplementary Material compiled after [1] - [6].

NRE equipment is innovative, remote-controlled, electric-powered equipment whose main function is the mechanized mining of precious metals from Ultra-Low mining profiles ranging from 0.9 to 1.7 meters. The NRE Fleet consists of three machines (Figure S1):

- a) NRE Dozer;
- b) NRE Drill Rig;
- c) NRE Support Rig.



Figure S1. NRE Fleet [1].

The NRE Dozer is a very low-profile remote-controlled machine with the aim of increasing safety and productivity in material handling operations. The NRE Dozer is designed to work in stopping widths from 0.9 m and has the ability to work in reef inclinations of up to 25°. The main purpose of the NRE Dozer is to push ore from a blasted panel into the advanced strike drive (ASD). The NRE Dozer can also be used to perform cleaning backlog ore/sweepings, roadway cleaning, and panel entrance

(holing) cleaning [1]. Its robust design, small dimensions, small turning radius, low noise level, and lack of gaseous emissions make this machine the most suitable tool for underground applications (Figure S2).

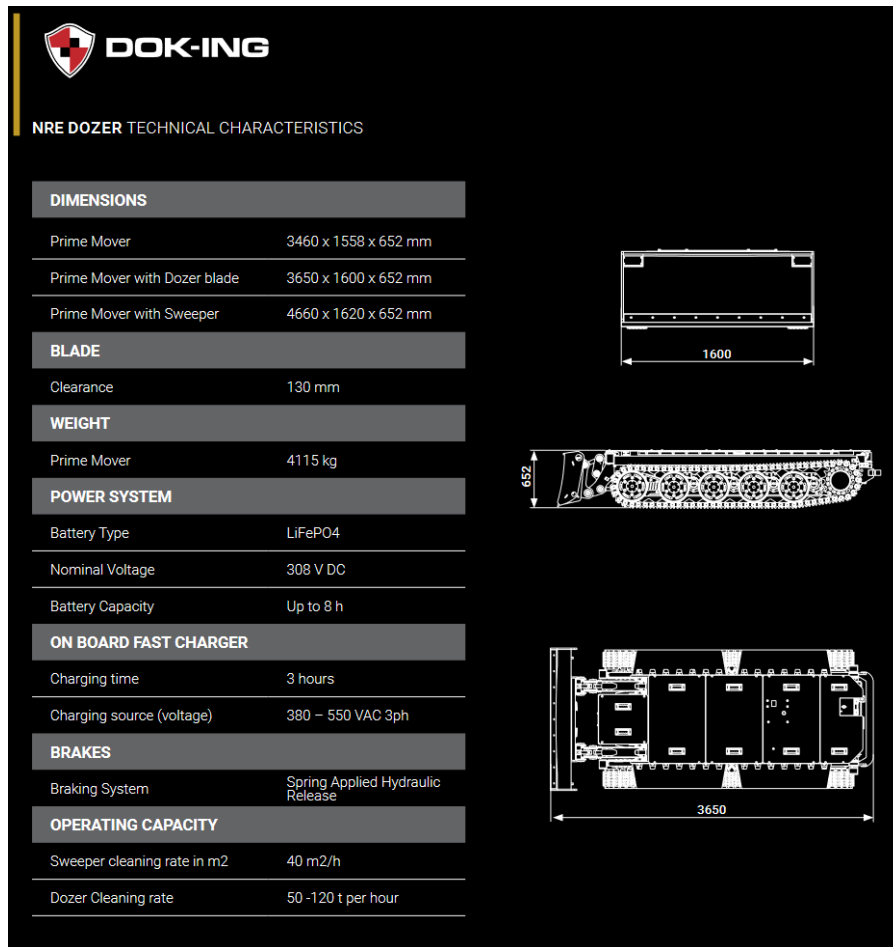


Figure S2. NRE Dozer [4].

The purpose of the NRE Drill Rig is to drill the panels in order to prepare them for blasting. The operator can perform all of the functions from a safe operating distance. Its robust design, small dimensions, low noise level, and lack of gaseous emissions make this machine the most suitable tool for underground applications. The NRE Drill Rig is battery power-driven and operated by remote control. The NRE Drill Rig is designed to work in stopping widths from 0.9 to 1.7m and can work in reef inclinations of up to 22°. The NRE Drill Rig has a three-drill drifter configuration, allowing three face holes to be drilled simultaneously. Its lightweight and wireless remote control operation allows the operator to remain at a safe operating distance during the production process (Figure S3) [1].



NRE DRILL RIG TECHNICAL CHARACTERISTICS

DIMENSIONS	
Prime Mover	4150 x 1976 x 745 mm
Toolset	4600 x 1995 x 790 mm
GROUND CLEARANCE	
Clearance	130 mm
WEIGHT	
Prime Mover	10000 kg
Toolset	4000 kg
POWER SYSTEM	
Battery Type	LiFePO4
Battery Pack Nominal Voltage	346 V
Working off the electrical grid via trailing cable	380 – 550 VAC 3ph
ON BOARD FAST CHARGER	
Charging time	1 h
Charging source	380 – 550 VAC 3ph
DRILLING SYSTEM	
Drifters type	Hydraulic
Drifters power	15kW each.
Drifters per tool	3

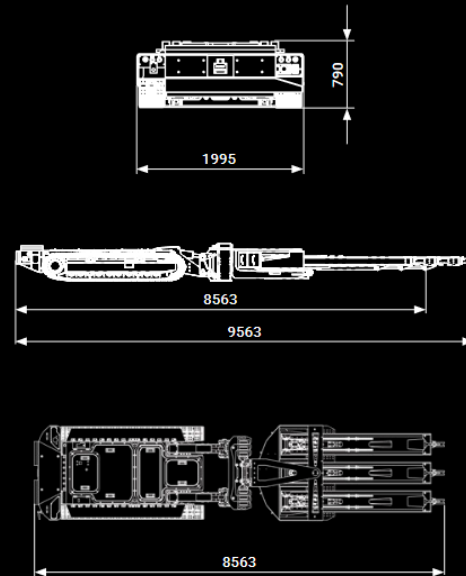


Figure S3. NRE Drill Rig [5].

The purpose of the NRE Support Rig is to install self-drilling roof bolts (SDRs) to the hanging walls of narrow reef stopes. It is possible for an operator to perform all functions from a safe operating distance. Its robust design, small dimensions, low noise level, and lack of gaseous emissions make this machine the most suitable tool for underground applications. The NRE Support Rig is battery power-driven and operated by remote control. The NRE Support Rig is designed to work in stopping widths from 0.9 to 1.7m and can work in reef inclinations of up to 22°. The NRE Support Rig has a dual tool configuration, allowing two bolts to be drilled, installed, and resin-injected simultaneously. Its lightweight, wireless remote control allows the operator to remain at a safe operating distance during the production process (Figure S4) [4] [5] [6].

NRE SUPPORT RIG TECHNICAL CHARACTERISTICS

DIMENSIONS	
Prime Mover	4150 x 1976 x 745 mm
Toolset	2185 x 1950 x 793 mm
Tool Width (single)	935 mm
GROUND CLEARANCE	
Clearance	130 mm
WEIGHT	
Prime mover	10 000 kg
Toolset	3000 kg
POWER SYSTEM	
Battery Type	LiFePO4
Battery Pack Nominal Voltage	346 V
Working off the electrical grid via trailing cable	380 – 550 VAC 3ph
ON BOARD FAST CHARGER	
Charging time	1 h
Charging source	380 – 550 VAC 3ph
SUPPORT TOOL CHARACTERISTICS	
Number of tools	2
Type of drilling	Rotary drilling
Maximum drill thrust force	40 kN
Support cycle (2 bolts, 1.6 m ea.)	8 min

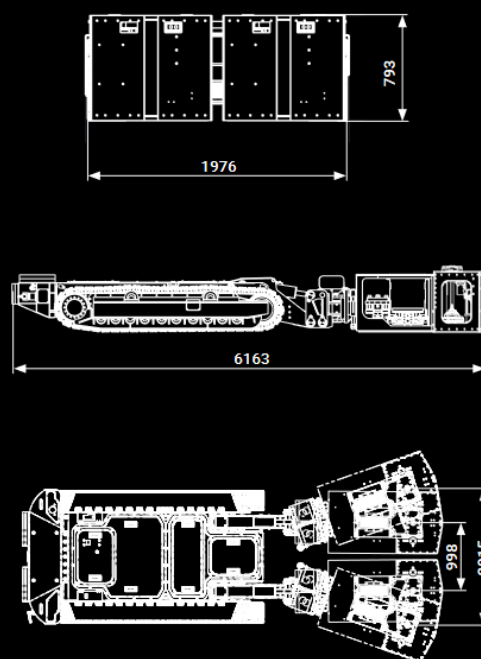


Figure S4. NRE Support Rig [6].

References

- [1] Bohanek, V.; Petro, L.; Borojević Šoštarić, S. Narrow Reef Mining (NRM)—Innovative Mining Technology for Narrow, Sub-Horizontal PGE Ore Bodies. *Materials Proceedings* 2023, 15, 9. <https://doi.org/10.3390/materproc2023015009>
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- [4] DOK-ING Ltd. (2022). NRE Dozer. Retrieved February 1, 2026, from <https://dok-ing.hr/underground-mining/nre-dozer/>
- [5] DOK-ING Ltd. (2022). NRE Drill Rig. Retrieved February 1, 2026, from <https://dok-ing.hr/underground-mining/nre-drill-rig/>
- [6] DOK-ING Ltd. (2022). NRE Support Rig. Retrieved February 1, 2026, from <https://dok-ing.hr/underground-mining/nre-support-rig/>