

APPENDIX W

MINE ELECTRICAL SYSTEM

Appendix W

Mine Electrical System

Electrical Power System

Power was supplied to the mine by a 46,000 volt alternating current (Vac) service drop from the American Electric Power utility company. The voltage was transformed from 46,000 Vac to 12,470 Vac by two 10 mega-volt amperes (MVA) three-phase transformers, located in the substation near the south portals. The secondary side of each transformer was grounded through 25 ampere grounding resistors. Gang-operated disconnect switches and lightning arrestors were installed on the primary and secondary side of each transformer.

Power was supplied from the substation to various underground locations by five separate 4/0 American Wire Gauge (AWG), 15 kilovolt (KV) shielded mine power cables (See Figures AC-1, AC-2 and AC-3). Each cable was protected by a vacuum circuit breaker (VCB) installed in the substation. A color code was used by the mine electricians to differentiate the five high-voltage distribution circuits used underground. According to electrical maps in use at the time of the accident, the "violet" circuit supplied power to the longwall section. The "red" circuit provided power for the HG 22 and TG 22 development sections, several conveyor belt drives, and areas of the mine near the Ellis Portal. The "blue" circuit supplied power to the Barrier Section and other loads located in the North Mains area of the mine. The "green" circuit provided power to various conveyor belt drives, pumps, and other assorted equipment, located outby the longwall section. The "orange" circuit supplied power to the south side of the mine. All of the high voltage circuits, except for the "orange" circuit, entered the underground area of the mine through the No.3 entry of the North Portal. The "orange" circuit entered the mine through the No.3 entry of the South Portal. Inspections made of all these circuits determined that each was equipped with devices that could provide short circuit protection, overload protection, grounded-phase protection, undervoltage protection, and ground wire monitoring.

The violet, red, and green 12,470 Vac circuits ran through a series of high voltage circuit breakers and feed-throughs (power boxes) prior to and after entering the explosion area. Several circuit breakers on each circuit tripped during the mine explosion. All three circuits were routed into the explosion area from the Old North Mains track entry into the North Glory Mains track entry. From there they were routed into Headgate 1 North, HG 22, and TG 22. All three circuits had damage at various locations. Damage was observed along the Headgate 1 North, HG 22, and TG 22 entries, but the first occurrence of damage was observed along the North Glory Mains, when traveling inby.

The "red" circuit served primarily as a power supply for the development section belt lines and for the continuous mining section equipment in the explosion area. This circuit made a final split at crosscut 7 of the HG 22 Panel. From there, it

terminated at the 2,500 kilo-volt amperes (KVA) section power center for the HG 22 section and terminated at the 2,250 KVA section power center for TG 22 section. Both of these power centers supplied 995 Vac and 480 Vac power to mining equipment in the face areas.

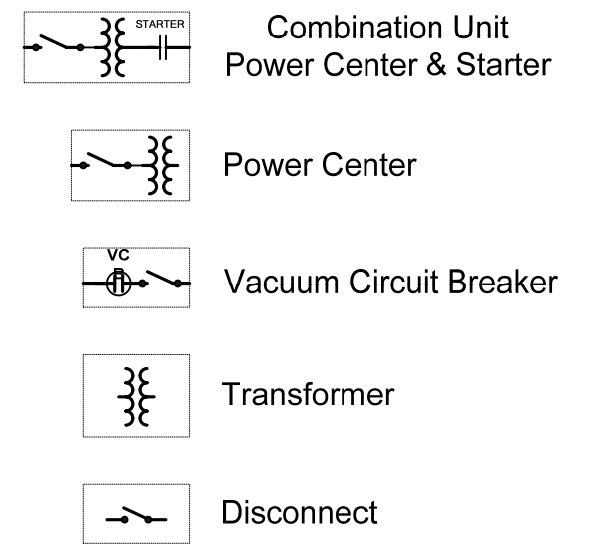
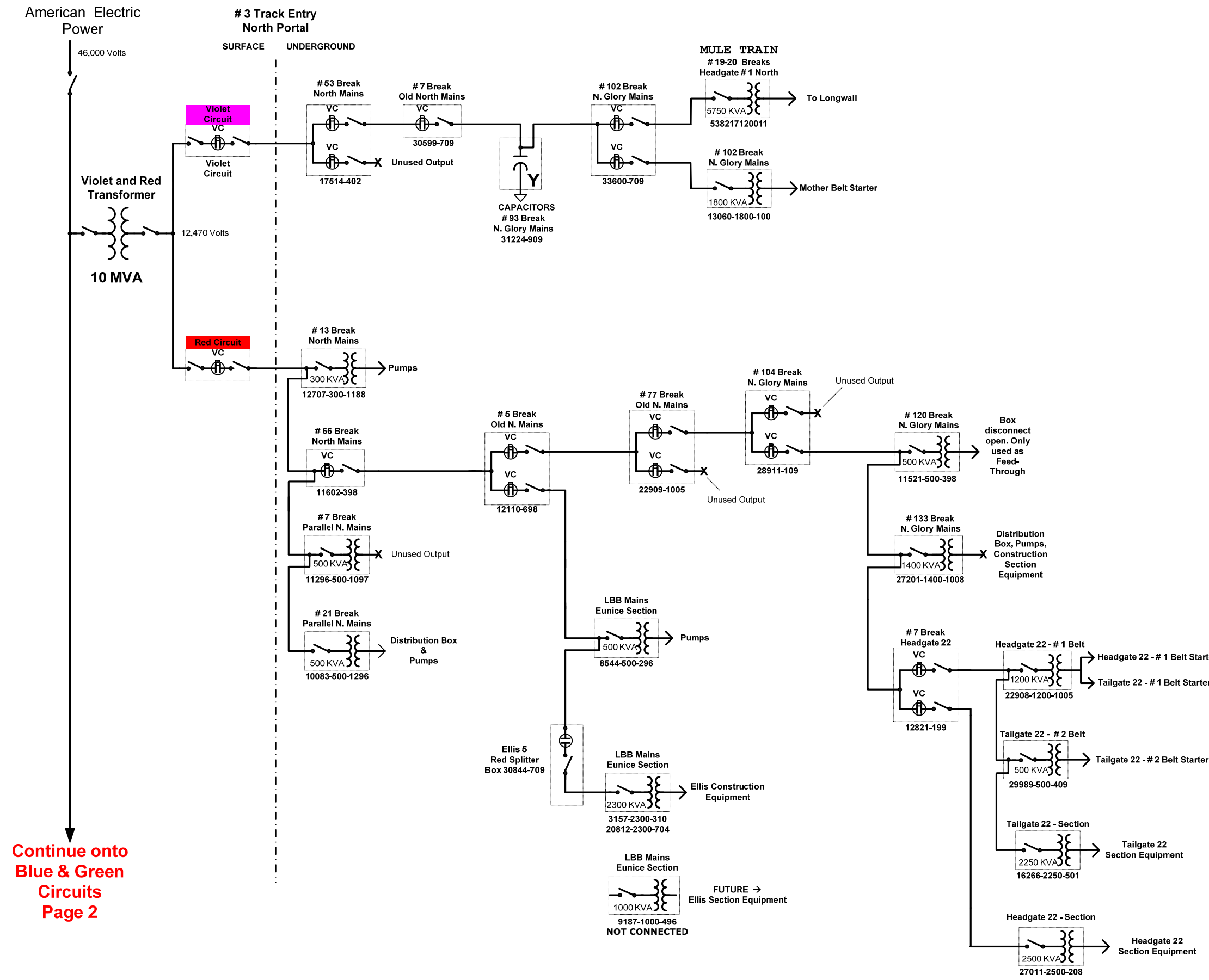
The “green” circuit served primarily as a power supply for the North Glory Mains conveyor belts inside the explosion area. This circuit ended at crosscut 105 of the North Glory Mains, where it supplied the No. 7 North belt conveyor.

The circuit providing power to Headgate 1 North was designated as the “violet” circuit. The “violet” circuit was dedicated totally for the longwall section equipment and the longwall conveyor belt. From the surface sub-station at the UBB Portal, 12,470 Vac was provided to the longwall section power center, located in the track entry outby the longwall face at the mule train. The 5,750 KVA longwall power center reduced the voltage to 4,160 Vac and 480 Vac for utilization on the longwall section. 4,160 Vac was provided from the power center to the longwall starter box located at the mule train.

Longwall Section

The 4,160 Vac, longwall starter controlled power to the shearer, face conveyor motors, crusher motor, and stageloader motors. Power was delivered to these longwall components through cables, which were routed from the longwall starter along a monorail system in the belt entry. 480 Vac was provided from the section power center to the headgate controller (gate box). This cable was also routed along the monorail system. The monorail system and several of the cables suspended from it were damaged heavily during the explosion.

The cable supplying 480 Vac to the headgate controller was a #6 AWG 3-conductor, type G-GC, and entered the controller through a permissible plug and receptacle. The grounding conductors in the cable were attached to the frame of the controller. The approved drawings for the controller showed the pilot circuit for the ground monitor connected to a normally closed contact on the emergency stop (e-stop) switch. The pilot circuit then connected to a terminating diode which was attached to the controller frame, completing the ground monitor circuit. Operating the e-stop switch should have opened the ground monitor pilot circuit and caused the circuit breaker at the power center to trip, de-energizing the 480 Vac circuit. However, the circuit was not properly wired when inspected after the explosion. A terminating diode was installed between the pilot wire on the back of the receptacle and the frame of the controller. This rendered the e-stop switch ineffective for tripping the 480 Vac power to the controller, although it would have de-energized the 4,160 Vac circuits. When installed as approved, the e-stop would have de-energized all power on the longwall face when depressed; however, by the manner in which this e-stop was installed, only the high-voltage motor and shearer circuits would have been de-energized, while all other circuits (e.g. lighting, methane monitors, etc.) would have remained energized.



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Circuits
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12,470 Volt Circuits

Violet & Red
Circuits
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EXPLOSION

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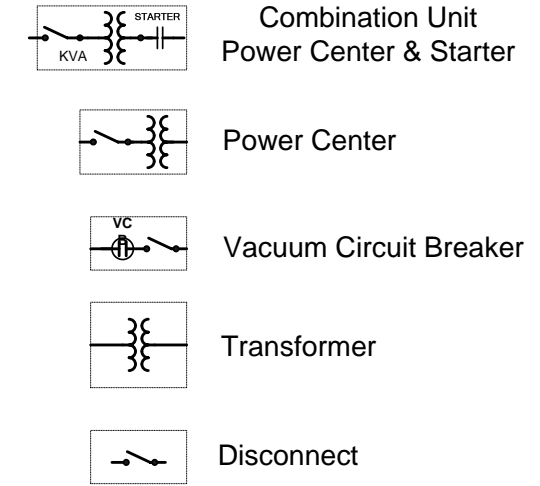
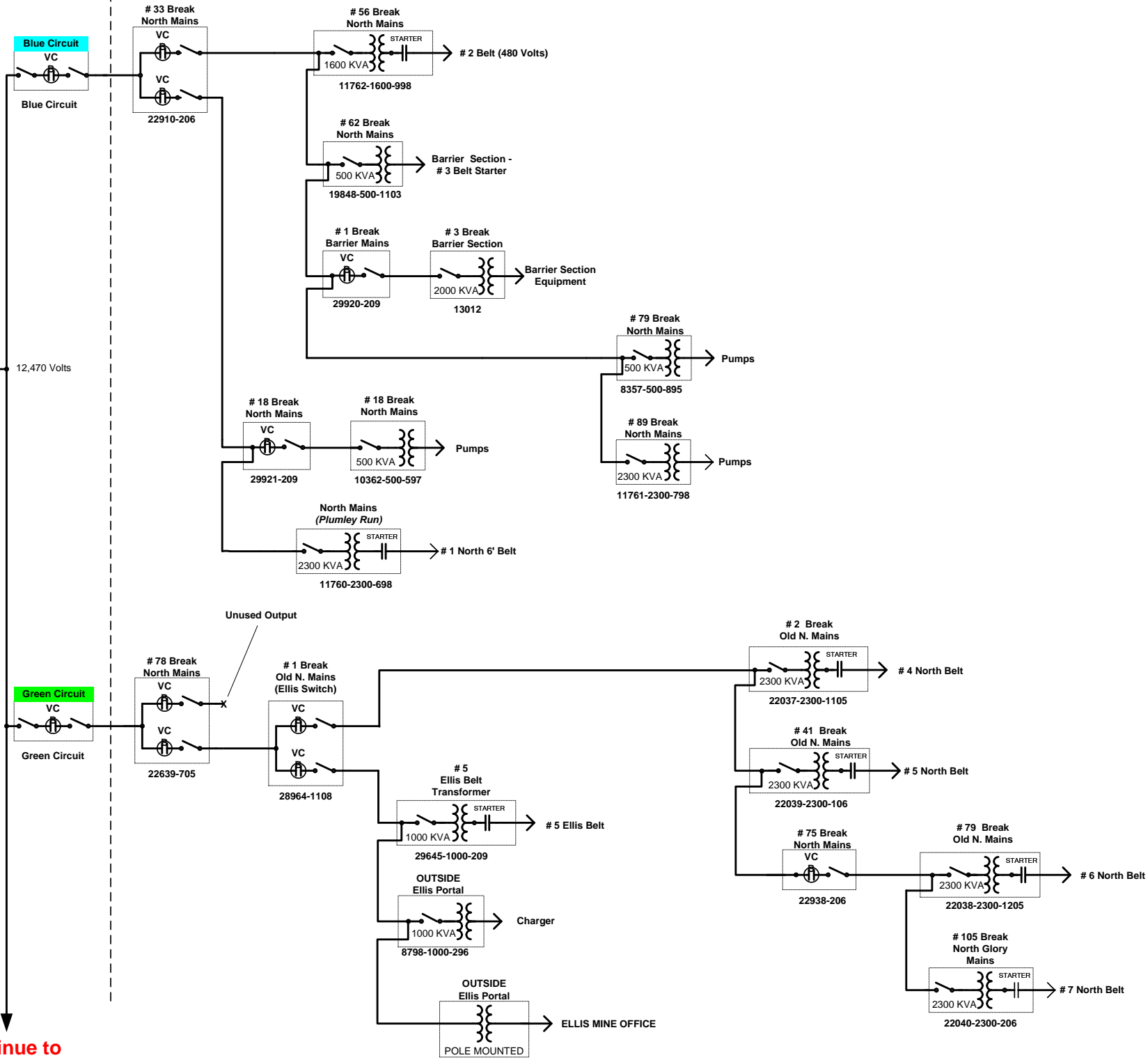
American Electric
Power
46,000 Volts

Blue, Green &
Orange
Transformer
10 MVA

12,470 Volts

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Orange Circuit
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3 Track Entry
North Portal
SURFACE UNDERGROUND

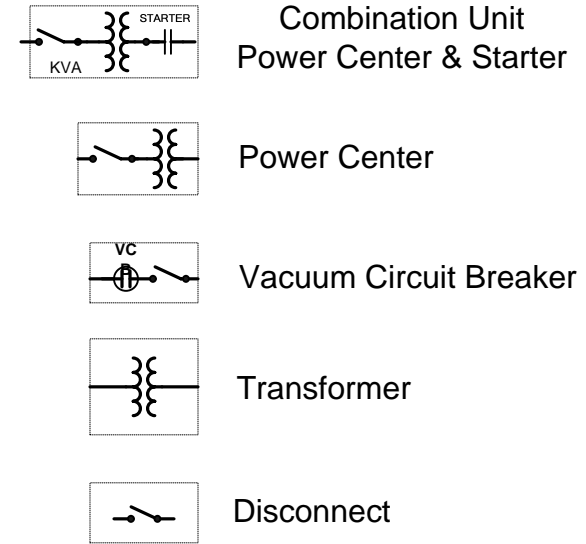
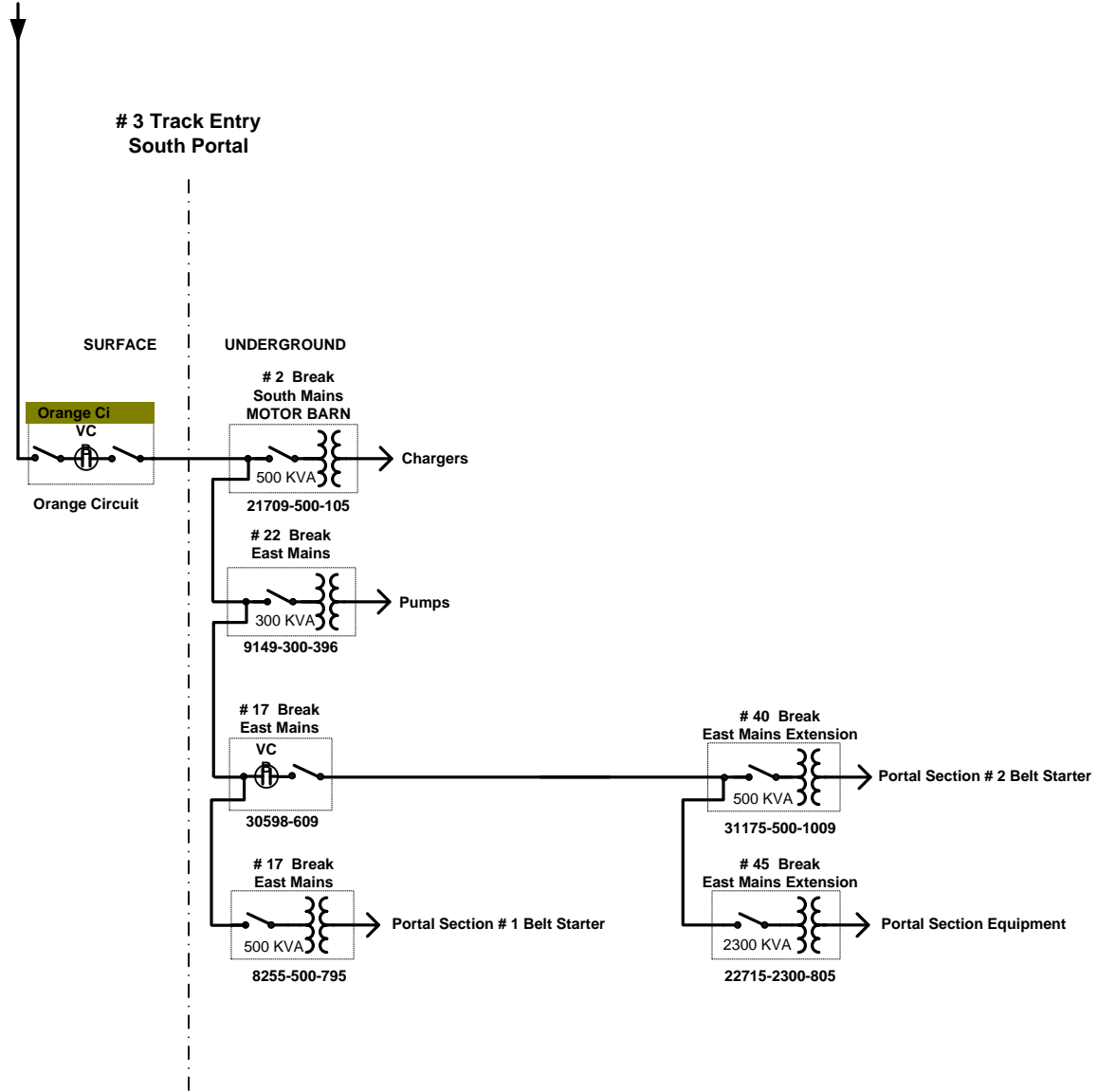


UBB - South
12,470 Volt Circuits

Blue & Green
Circuits
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Blue, Green, Orange
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