

**Operation and
Maintenance Manual
Model P400 and P600
Power Packs**

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Observe all safety precautions !

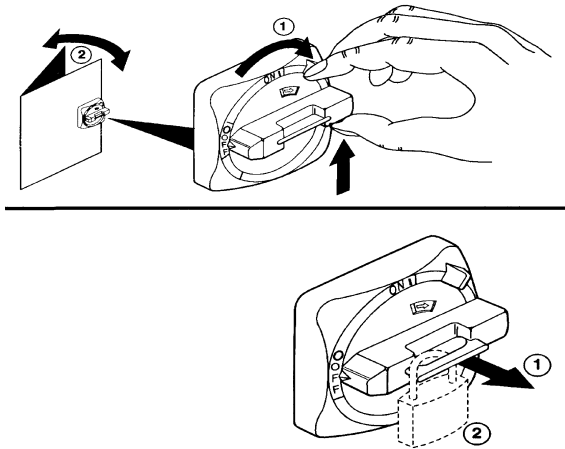
All personnel are to read and understand all guidelines related to the operation and safety of Equipment intended for the use of tunneling before attempting to operate or service the Akkerman Boring Equipment.

- 1) **Do not** attempt to make repairs or adjustments that you do not understand.
- 2) **High pressure hydraulics** are used on this equipment. Pressurized hydraulic oil can cause serious injury, be certain all lines, fittings and components are leak-free and serviceable.
- 3) **Keep** all guards and shields in place and serviceable at all times.
- 4) User's electrical distribution panel should be equipped with earth leakage circuit breaker (Ground Fault Circuit Interrupter) for personnel protection.
- 5) Do not attempt to make adjustments or repairs to hydraulic system components while in operation or until all pressure is released and electrical power is **Locked Out**.
- 6) **Lock Out** electrical power at the source before servicing any electrical components.
- 7) **Do not** make any alterations, modifications or changes to equipment which could in any way affect its original design.
- 8) **Keep** area clear of personnel when lifting or lowering equipment.
- 9) **Keep** all equipment properly maintained and adjusted. Shut down equipment before making repairs, connections or adjustments.
- 10) **In** the event of a malfunction, discontinue use of the equipment until the condition is repaired or corrected.
- 11) **Ensure** proper training for operators of this equipment.
- 12) **Provide** approved air analyzers and proper ventilation at all times for personnel in the tunnel
- 13) **Wear** approved personal protective equipment at all times during operation (safety glasses, ear plugs, etc.).
- 14) **Laser Guidance** systems emit harmful rays, observe operating instructions and precautions during use.
- 15) **Maintain** proper, approved fire suppression equipment at all times.

Electrical Lock-out

Lock-out electrical power at the source before making repairs or adjustments.

- 1) A suitable means of electrical lock-out must be provided at the user's power distribution panel.
- 2) All operators must be properly trained in lock-out procedures.
 - Electrical lock-out is defined as a means of disconnecting electrical power at the source and securing its isolation so as not to be reconnected unintentionally.



Electrical lock-out is operated by rotating the switch to the OFF position, pulling out tab #1 and securing its isolation with a lock to prevent turning to the ON position..

Emergency Stop

Interrupts hydraulic oil flow from all pumps.

Once depressed, the Emergency Stop switch interrupts hydraulic flow from all pumps as well as stopping rotation of the electrical motors after the stored energy has been released.

The latching style switches do not allow re-start of the system until the switch is reset to its normal operating position and the start switches are depressed.

Keyed lock latching switches are available.

The optional TBM Power and E-Stop assembly provides E-Stop functions as well as 110 VAC circuit interruption of tunnel power within its 6 pin cord.

Additional Series E-Stop switches can be placed in line to provide E-Stop at user defined locations up to 100 feet away from the model P400 or P600 power units.

Test each Emergency Stop switch for proper operation at the start of each operating shift.

Hydraulic Fluids

Maintain clean oil

Fill hydraulic oil reservoir with clean, filtered ISO-46 compatible hydraulic oil only.

Maintain level, solid foundation under Power Pack.

Keep filled above minimum oil level.

Do not exceed 150 degrees Fahrenheit during operation.

Change return filter elements when indicated.

Avoid contact with hydraulic oil.

Avoid spills.

Dispose of used oil properly.

Dissipate stored pressure before service of hydraulic fittings, components, etc.

Moving Parts

Keep all guards in place

Keep all guards in place and well maintained.

Avoid pinch points.

Lock out equipment before removing guards for service.

Electrical Equipment

Authorized personnel only.

Refer to authorized service personnel for electrical service and repairs.

Death or serious injury can result from contact with high voltage power conductors.

Disconnect and Lock-Out power at the source before attempting to make repairs or adjustments to electrical equipment.

Use replacement fuses with the same type and ratings only.

Test Emergency Stop switches for proper operation at the start of each shift.

Keep enclosure covers securely in place at all times.

Start-up Procedure

- 1)** Power Pack must be on a level, solid foundation.
- 2)** Check hydraulic oil level and fill as necessary.
- 3)** Install heat exchanger drain plug.
- 4)** Connect (15 GPM minimum) water source to heat exchanger.
- 5)** Be certain that pump suction quick disconnect fittings are securely connected.
- 6)** Open pump suction valves.
- 7)** Move all output supply valve handles to the OFF position.
- 8)** Turn OFF main power source, test to ensure no voltage is present and make high voltage connections to the input power disconnect switches (DS-1..DS-4).
- 9)** Reinstall the terminal shields over the input lines.
- 10)** Close and securely fasten the enclosure cover.
- 11)** Connect the control pendant(s) to the local control junction box.
- 12)** Install shorting pin plug on any unused local control junction box pendant receptacles.
- 13)** Install shorting pin plug on any unused local control junction box series E-Stop receptacles.
- 14)** Turn ON all circuit breakers in the local control junction box.
- 15)** Close and securely fasten the enclosure cover.
- 16)** Turn ON the main power source and Disconnect switches (DS-1..DS-4).
- 17)** Unlatch all E-Stop switches.
- 18)** Jog the 5-HP motor and check for proper rotation. If the rotation is incorrect, disconnect and LOCK-OUT the power source, test to ensure no voltage is present then reverse two of the input power current carrying conductors (I.e.: Red and Black) then repeat startup procedure.
- 19)** Start the 5-HP motor.
- 20)** Check pilot pressure gauge (High Pressure Pump only), reading should be approx. 350 PSI.
- 21)** Test each E-Stop switch for proper operation.
- 22)** Jog the 100-HP motors and check for proper rotation.

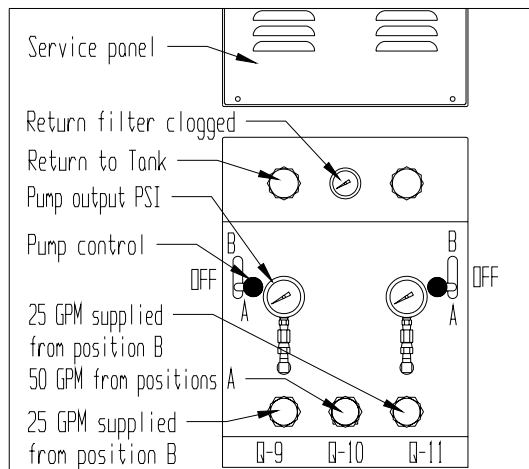
TBM Hydraulic Connections Procedure

For Single Feed supply to the TBM

- 1) Low pressure module 1, connect quick coupler Q-10 to the TBM inlet pressure hose and select position 'A' on left and right pump control valve handles to supply 50 GPM to the cutter head drive (refer to TBM hydraulic schematic).
- 2) Connect the TBM cutter head drive return line to the 'return to tank' port on Low pressure module 1.

For Dual Feed supply to the TBM

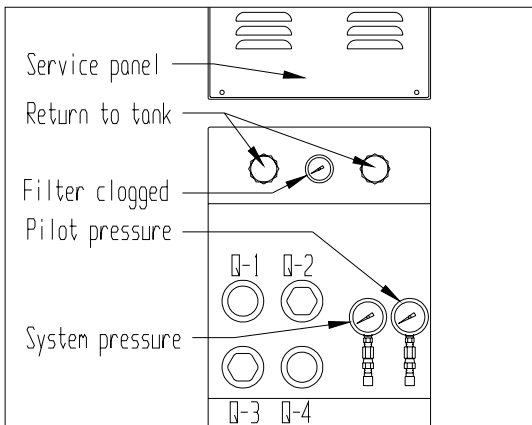
- 1) Switch TBM to Dual Feed supply (refer to TBM hydraulic schematic).
- 2) Low pressure module 1, connect quick coupler Q-10 to TBM inlet pressure hose and select position 'A' on left and right pump control valve handles to supply 50 GPM to the cutter head drive (refer to TBM hydraulic schematic).
- 3) Connect the TBM cutter head drive return line to the 'return to tank' port on Low pressure module 1.
- 4) Low pressure module 2, connect quick coupler Q-14 to TBM conveyor inlet pressure hose and select position 'B' on the right pump control valve handle to supply 25 GPM to the conveyor drive.
- 5) Connect the TBM conveyor return line to the 'return to tank' port on Low pressure module 2.



- Low pressure module 1. Coupler Q-10 combines flow from both pump control valves when they are in the A position. Coupler Q-9 is from left pump control B position and Q-11 is from the right pump control B position.

Jacking System Hydraulic Connections Procedure

- 1) Connect quick coupler Q-1 (refer to P-600 or P-400 hydraulic schematic) to cylinder(s) extend port. Use only hose rated for **8000 PSI working pressure**.
- 2) Connect quick coupler Q-2 to cylinder(s) retract port.
- 3) Connect quick coupler Q-3 to intermediate jacking station valve(s) pressure port. Use only hose rated for **8000 PSI working pressure**.
- 4) Connect quick coupler Q-4 to auxiliary functions.



- High pressure module 1

TROUBLE SHOOTING GUIDE

We at Akkerman Inc. have always maintained customer satisfaction as our highest priority.

Therefore we have compiled the following information to assist the user in the diagnosis of problems that may occur during operation of the Akkerman product line.

Listed in numerical order are descriptions of the symptom that may arise. Following the description will be a brief test procedure or a list of possible causes for the situation that has occurred.

This information has been compiled as the result of many years of satisfying technical service to our customers by our qualified service personnel. Should you need further assistance please contact one of our service personnel. Be prepared to give the machine model and serial number to ensure speedy, accurate results.

Service staff includes:

New product sales and service:

Robin Lorenzen. (800) 533-0386 extension 114
Steve Garbish. (800) 533-0386 extension 107

Product support specialists / Parts and service:

Steve Garbish. (800) 533-0386 extension 107
Dennis (Smurf) Vogt. (800) 533-0386 extension 117

Field service technicians:

Dave Crabtree
Lamont Andrews
Jay Howton

1) Pump Unit push cylinders stall at less than 500 PSI.

POSSIBLE CAUSES:

- Cylinder at full extension.
- Worn or damaged cylinder seals.
- Worn or damaged control valve seals.
- Cylinder piston relief leaking.
- Faulty pendant controller switch.
- Worn or damaged pump compensater.
- Worn or damaged hydraulic pump.

2) Pump unit cylinder(s) collapse when forward thrust is stopped or Intermediate Jacks are used.

POSSIBLE CAUSES:

- Pilot operated check valve leaking.
- Worn or damaged cylinder seals.
- Cylinder piston relief leaking.

3) Jacking pressure gauge pressure drops when forward thrust is stopped.

POSSIBLE CAUSES:

- Low cylinder load.
- Worn or damaged cylinder seals.
- Pilot operated check leaking.

4) 100 HP Motor will not start

POSSIBLE CAUSES:

- Circuit fuse heaters tripped.
- 150 amp fuse(s) blown.
- Faulty Start/Stop switch.
- Low oil level.
- Faulty low oil level switch or relay.
- Oil has reached over temperature.
- 5-HP pilot pressure pump not operating (High pressure module only).

5) No Pump Unit Motor will start

POSSIBLE CAUSES:

- Emergency stop switch is depressed.
- Main disconnect tripped or not turned ON.
- Generator or power supply faulty.
- Pendant controller not connected.
- Shorting pin plug not installed on unused pendant receptacle.
- Shorting pin plug not installed on unused E-stop receptacle
- Low oil level.
- 15 amp circuit breaker tripped.
- 6 amp circuit breaker tripped.
- Faulty low oil level switch, cable or relay.
- Faulty E-stop cable, switch or relay.
- Faulty 415 VAC to 110 VAC transformer.
- Head power cable disconnected or faulty.

6) Temperature gauge exceeds 150 degrees

POSSIBLE CAUSES:

- Heat exchanger water supply not adequate.
- Oil supply to heat exchanger turned off.
- 5-HP Circuit fuse heaters tripped.
- 15 amp circuit breaker tripped.
- Excessive hydraulic circuit pressure to boring machine.
- Hydraulic circuit disconnected causing a safety relief to be activated.
- Excessive ambient temperature.
- Excessive horsepower required by boring machine or jacking operation.
- Heat exchanger water passages plugged.

7) Power Unit Boring Head Supply will not produce 2800 PSI

TEST: Connect flow meter to outlet hose of supply valve (Q-10 or Q-15).

NOTE: Oil temperature should be approx. 120 degrees.

- 1) turn on left supply handle (facing pressure gauge).
test output flow at 0 PSI (approx. 25 GPM).
test output flow at 2000 PSI (approx. 24 GPM).
test output flow at 2700 PSI (approx. 22 GPM)

- 2) turn off left supply handle and turn on right handle.
test output flow at 0 PSI (approx. 25 GPM).
test output flow at 2000 PSI (approx. 26 GPM).
test output flow at 2700 PSI (approx. 22 GPM)

If flow specifications are close to the above, follow instructions in (CUTTER BAR STALLING) section of TBM operation manual.
If flow specifications are not close to the above, proceed as follows.

- 1) Replace control valve relief and repeat test.
- 2) Disconnect output hose from 1 pump section.
- 3) Connect flow meter to pump section (CAUTION do not shut off flow meter restriction valve at any time during test).
- 4) Repeat above test procedure to determine flow capacity.
- 5) Repeat procedure for 2nd pump section.

If flow specifications are now close to the above, replace control valve.
If flow specifications are not close to the above, replace pump.

8) Boring Head Supply gauge frequently reaches 2800 PSI

POSSIBLE CAUSES:

- Excessive pressure drop in tunnel supply lines.
- Too few cutter bar drive motors.
- Single feed supply to boring head should be changed to Dual feed supply.
- Incorrect cutter bar selected for ground condition.
- Pipe advancement rate too fast.
- Worn or damaged TBM inner drum thrust roller bearings.
- Worn or damaged TBM inner drum rollers.

9) Intermediate Jacks do not operate

Test: Select IJS position on Control pendant, Operate Stroke and read system pressure gauge.

Gauge reads 0-1000 PSI

POSSIBLE CAUSES:

- Faulty control switch.
- Worn or damaged control valve seals.
- Intermediate jack valve not in full on position.
- Intermediate jack valve previously operated not in full off position.

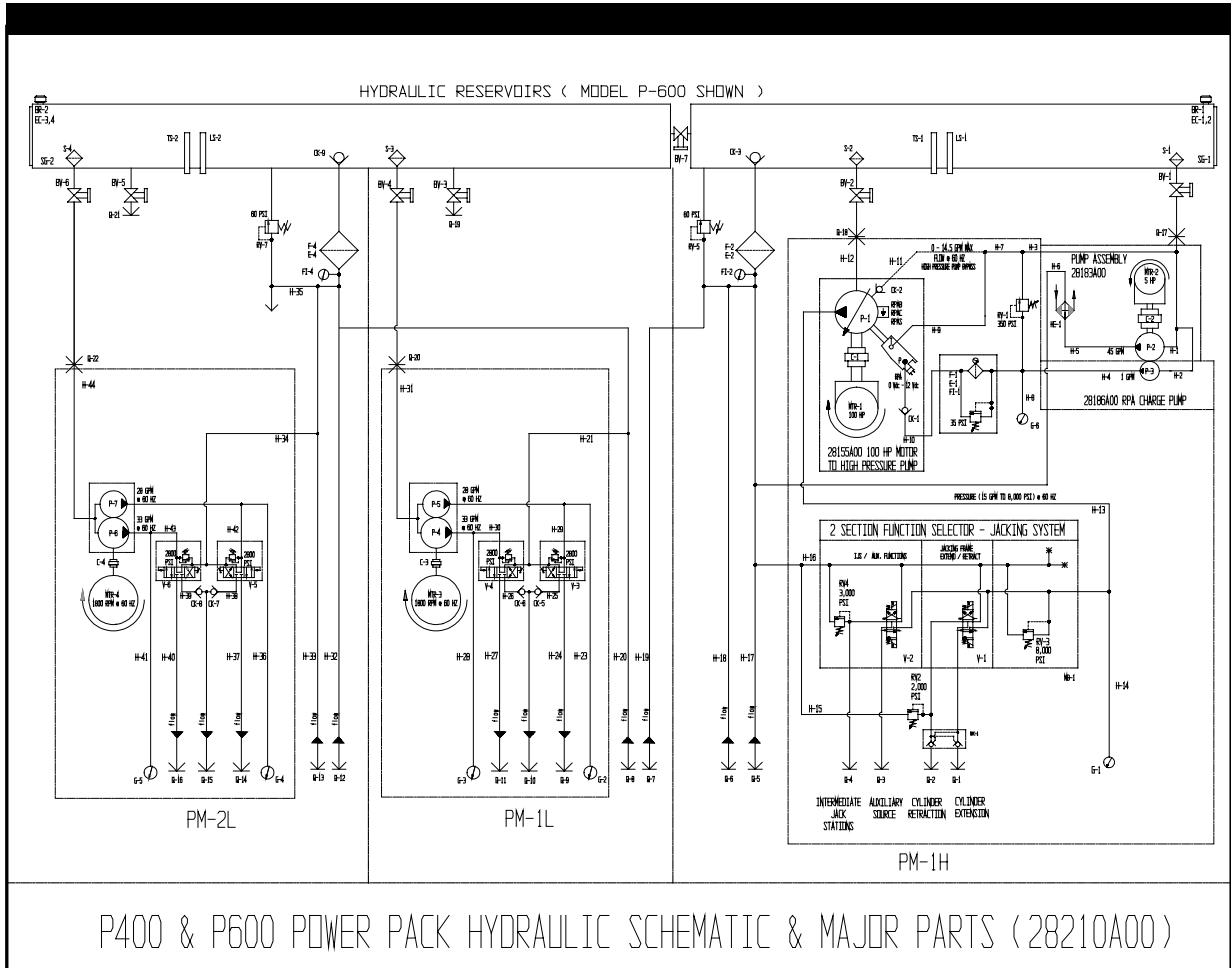
Worn or damaged intermediate jack valve seals.

10) Pump Unit motors start but no oil pressure available

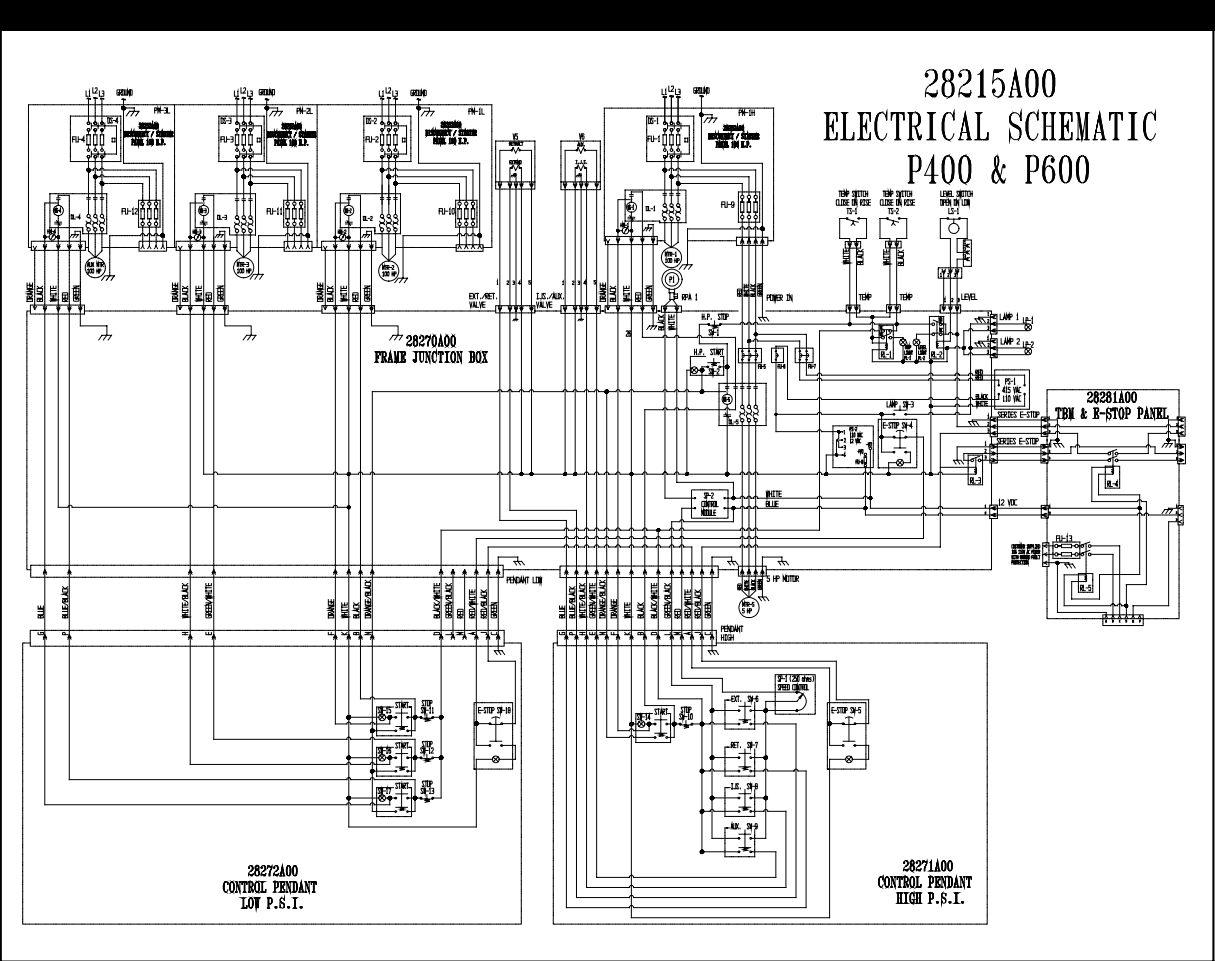
POSSIBLE CAUSES:

- Incorrect motor rotation.
- Low oil level.
- Closed pump suction valve.
- Control valve not turned on.
- Faulty control valve switch.
- Flow rate turned too low.
- Faulty SP-2 control module.
- Worn or damaged hydraulic pump.

Hydraulic Schematic



Electrical Schematic



Specifications

Capacities:

Oil:

Model P-400, 400 US gallons.

Model P-600, 600 US gallons.

Pumps:

2 Stage Gear, 28 Gpm @ 2800 Psi from each stage.

3 Stage Gear, 28 Gpm @ 2800 Psi from 2 stages and 12 Gpm @ 2800 Psi from 3rd stage.

PV-4020 Piston, 12 Gpm @ 8000 Psi.

PV-6033 Piston, 24 Gpm @ 8000 Psi.

Filtration:

RT-8, 10 Micron (8 elements).

Pilot, 10 Micron.

Weight:

P-600 Frame, 6880 Lbs (dry),

P-400 Frame, 5000 Lbs (dry).

100 Hp Low Pressure Module, 1670 Lbs.

100 Hp High Pressure Module, 1740 Lbs.

Heat Exchanger:

Oil over Water, Supplied with 45 Gpm hydraulic supply.