



Operation and Maintenance Manual

Enerpac Hydra Pac - Diesel Split Flow Pump (SFP-D)

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To reduce the risk of injury, users must read and understand this document before use.

ABOUT US

Enerpac is a global market leader in high pressure hydraulic tools, controlled force products, portable machining, on-site services and solutions for precise positioning of heavy loads. As a leading innovator with a 110-year legacy, Enerpac has helped move and maintain some of the largest structures on earth. When safety and precision matters, elite professionals in industries such as aerospace, infrastructure, manufacturing, mining, oil & gas and power generation rely on Enerpac for quality tools, services and solutions. For additional information, visit www.enerpac.com.



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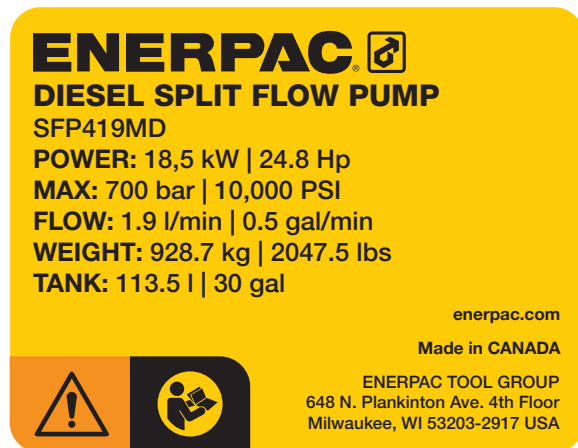


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WARRANTY

Refer to the Enerpac Global Warranty document for terms and conditions of the product warranty. Such warranty information can be found at www.enerpac.com.

NAMEPLATE



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1. Safety

Read all instructions carefully. Follow all recommended safety precautions to avoid personal injury as well as damage to the product and / or damage to other property. Enerpac cannot be responsible for any damage or injury from unsafe use, lack of maintenance, or incorrect operation. Do not remove warning labels, tags, or decals. In the event that any questions or concerns arise, contact Enerpac or a local Enerpac distributor for clarification.

Save these instructions for future use.

If you have never been trained on high-pressure hydraulic safety, consult your distributor or service center for information about Enerpac Hydraulic Safety Courses.

This manual follows a system of safety alert symbols, signals, words, and safety messages to warn the user of specific hazards. Failure to comply with these warnings could result in death or serious personal injury, as well as damage to the equipment or other property.



The Safety Alert Symbol appears throughout this manual. It is used to alert you to potential physical injury hazards. Pay close attention to Safety Alert Symbols and obey all safety messages that follow this symbol to avoid the possibility of death or serious injury.

Safety Alert Symbols are used in conjunction with certain Signal Words that call attention to safety messages or property damage messages and designate a degree or level of hazard seriousness. The Signal Words used in this manual are DANGER, WARNING, CAUTION, and NOTICE.

▲ DANGER Indicates a hazardous situation that, if not avoided, will result in death or serious personal injury.

▲ WARNING Indicates a hazardous situation that, if not avoided, could result in death or serious personal injury.

▲ CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate personal injury.

NOTICE Indicates information considered important, but not hazard related (e.g. messages related to property damage). Please note that the Safety Alert Symbol will not be used with the signal word.

1.1 Safety Precautions



Failure to observe and comply with the following precautions could result in death or serious personal injury. Property damage could also occur.

- Read and completely understand the safety precautions and instructions in this manual before operating the pump or preparing it for use. Always follow all safety precautions and instructions, including those that are contained within the procedures of this manual.

- Operating procedures will vary, depending on the system arrangement. Always read, follow, and completely understand all manufacturer's instructions when operating the powerpack and all other devices used with it. Follow all safety precautions contained in the manufacturer's manuals.
- Allow only trained and experienced personnel to supervise and perform procedures.
- Always wear appropriate personal protective equipment (P.P.E.) when operating hydraulic equipment. Be sure to wear eye protection, work gloves and protective clothing. Use of additional P.P.E. safety items such as dust mask, non-skid safety shoes, hard hat, and hearing protection (used as appropriate for the conditions) will reduce the chance of personal injuries. The use of these items may also be required by local regulations or laws.
- Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin. If oil is injected under the skin, see a doctor immediately.
- Do not pressurize disconnected couplers.
- Do not remove or disable the pump relief valve.
- Ensure all hydraulic components (hoses, fittings, couplers, etc.) are rated to a safe working pressure of 10,000 psi [700 bar].
- Never set a relief valve to a higher pressure than the maximum rated pressure of the pump. If ratings are different, relief valve setting should not exceed the setting of the lowest rated component. Higher settings may result in equipment damage and/or personal injury.
- The system operating pressure must not exceed the pressure rating of the lowest rated component in the system. Install pressure gauges in the system to monitor operating pressure. It is your window to what is happening in the system.
- Always be certain that hydraulic pressure is fully relieved and all operations are complete before disconnecting hydraulic hoses, loosening hydraulic fittings, or performing any disassembly or repair procedures.
- Always perform a visual inspection of the equipment before placing it into operation. If any problems are found, do not use it. Have the equipment repaired and tested by an Enerpac Authorized Service Center before it is returned to service.
- To minimize risk of personal injury keep hands and feet away from the equipment and workpiece during operation.
- Keep hands clear of moving parts and pressurized hoses.

- Use safe practices when bleeding a pressurized hose or coupler. Use only a specially designed coupler bleed tool such as an Enerpac CT-604 coupler bleed tool available through Enerpac Authorized Retailers.
- Do not use diesel pumps in an explosive atmosphere.
- Wear hearing protection. Sound level from motor may exceed 85 db(A).
- Hot surfaces inside. Contact may cause burn. Do not touch. Allow to cool before servicing.
- Inhalation Hazard. Do not breathe exhaust. Toxic gases or fumes may be present. Follow approved procedures before operating or servicing. Use adequate ventilation to maintain safe occupational exposure limits. Do not use inside a closed environment.

⚠ CAUTION

Failure to observe and comply with the following precautions could result in minor or moderate personal injury. Property damage could also occur.

- Be careful to avoid damaging hydraulic hoses. Avoid sharp bends and kinks when routing hydraulic hoses. Do not exceed the minimum bend radius specified by the hose manufacturer. Using a bent or kinked hose will cause severe back-pressure. Sharp bends and kinks will internally damage the hose, leading to premature hose failure.
- Do not drop heavy objects on hoses. A sharp impact may cause internal damage to hose wire strands. Applying pressure to a damaged hose may cause it to rupture.
- Do not lift hydraulic equipment by the hoses or couplers. Use only the designated carrying handles or lifting points.
- Keep hydraulic equipment away from flames and heat. Excessive heat will soften packings and seals, resulting in fluid leaks. Heat also weakens hose materials and packings.
- For optimum performance, do not expose hydraulic equipment to temperatures of 150°F [65°C] or higher. Protect all hydraulic equipment from weld spatter.
- Keep the front wheel brake engaged when the unit is stationary to prevent unintended movement.

NOTICE

Failure to observe and comply with the following precautions could result in property damage and/or void the product warranty.

- Immediately replace worn or damaged parts with genuine Enerpac parts. Enerpac parts are designed to fit properly and to withstand high loads. Non-Enerpac parts may break or cause the product to malfunction.

- Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Enerpac Authorized Service Center in your area.
- To help ensure proper operation and best performance, use of Enerpac oil is strongly recommended.

1.2 Residual Risks and Protective Measures

Observing the safety precautions indicated in these instructions minimizes the risks associated with using the **SFP-D Power Unit**, however residual risks remain with the use of any high-pressure hydraulic systems, and in the event of loss of control of a load while skidding or jacking.

Failure of any hydraulic components such as hoses, couplers, and fittings can potentially be fatal. Be mindful when the unit is active, and avoid standing in the line of force of any hydraulic components, **most notably the hydraulic couplers facing outward from the rear of the unit.** The unit is designed so that risks to the operator when occupying the workstation are minimized.

2. Compliance Statement(s)

2.1 United States Compliance

EPA 40 CFR Parts 1039 - for diesel engines.

2.2 State of California Proposition 65 Warning

The Diesel Spilt Flow Pumps (SFP-D) use hydraulic oil as the fluid medium. Hydraulic oils contain ethylbenzene, which may cause cancer and reproductive harm. Hydraulic oils need to be handled carefully, so that contact is avoided. A warning decal is affixed to each pump, informing the operator of these risks. For additional details, go to www.P65Warnings.ca.gov

2.3 CE Compliance

This product has been designed and manufactured in accordance with the essential requirements of applicable European Union legislation.

Compliance with the relevant requirements has been demonstrated through the application of the following EU Directives and harmonised standards:

- Regulation on Machinery 2023/1230,
- Outdoor Noise Directive 2000/14/EC.

3. Features and Components

3.1 General Information

This manual provides instructions on the setup, operation, maintenance, safety, and troubleshooting for the SFP-D Diesel Series of Hydraulic Power Unit **CARTS**. Before any operation involving the use or maintenance of the power unit, please read this operation manual carefully.

It is recommended that service work on the SFP-D be provided by an Enerpac authorized service center or a qualified and experienced technician. We recommend that only official SFP-D original spare parts are used for repair. Enerpac does not accept responsibility for damages caused by the use of unsuitable spare parts. Please contact the Enerpac Authorized Service Center if any problems occur during the operation of the SFP-D or if any spare parts are required for repair.

3.2 Machinery Description

Machinery Designation:

- SFP419MD
- SFP634MD
- SFP837MD

The SFP-D model number can be found on the unit's nameplates, as well as in the bottom right corner of the hydraulic schematic found in the appendices of this manual. For hydraulic schematics see Appendix 4.

The SFP-D Power Unit is a multi-circuit, synchronized flow, hydraulic power pack with a maximum operating pressure of 10,000 psi [700 bar] and is designed to work with most standard 10,000 psi [700 bar] double acting and single acting hydraulic cylinders (optional flow control valves are required when using with single-acting cylinders).

3.2.1 System Information

SFP-D Synchronous Power Systems are ideally suited for most jacking and skidding operations. Their operation is different than most conventional hydraulic pumps, so it is important to fully understand the basic functions detailed in this manual.

One of the keys to the synchronous function is the split-flow, check ball piston pump. This pump incorporates multiple independent pistons driven by a common shaft, which ensures that each piston generates the same flow rate. Because of the relative incompressibility of oil and the sealing ability of the check balls, the flow rate is virtually unaffected by pressure.

The outlet from each piston is connected to a separate circuit of the power unit that is controlled by a separate **CIRCUIT CONTROL VALVE**. In this way, each circuit will provide the same flow rate even if the pressure in one or more circuits is considerably different than the others. When jacking a load with an offset center of gravity, all jacks will extend at the same rate, but the pressure readings in each circuit may be different.

With double-acting jacks, the system works the same way on the retract stroke also, meaning that all cylinders will lower synchronously. This allows simultaneous jacking of all lift points without the usual end-to-end jacking. Of course, it is always possible to jack end-to-end if desired.

NOTICE When using single-acting Cylinders, jacking will be synchronous, but lowering will not. It will be necessary to ensure your load remains stable when retracting with single-acting jacks.

The **MASTER CONTROL VALVE** provides a dump function for all circuits. In its neutral position the open center allows all the oil flow to go directly to tank. Only when the **MASTER CONTROL VALVE** is shifted to ON position will any pressure develop in any of the circuits. This allows the user to select any or all of the circuits to use and open those **CIRCUIT CONTROL VALVES**, but nothing will happen yet because the oil is being dumped by the **MASTER CONTROL VALVE**. When the **MASTER CONTROL VALVE** is shifted ON, all of the chosen circuits will be activated at the same time. Because it is acting as a dump valve, the **MASTER CONTROL VALVE** should not be feathered as this could result in loss of synchronization; it should always be fully on or fully off.

If any fine adjustment or feathering of individual circuits is needed, the individual **CIRCUIT CONTROL VALVES** can be feathered or adjusted as necessary and will act completely independent from the other circuits. To make these kind of adjustments, shift the **MASTER CONTROL VALVE** first and then adjust each **CIRCUIT CONTROL VALVE** as required.

Another important feature of the SFP-D Power System is the **COUNTER BALANCE VALVE** present on each circuit. When Lowering the load the V2 Counter balance Valve which is a combination version of a Pilot-Operated Check Valve and a flow control valve, acts as a load-holding valve and flow control valve, on the pressure port line until an equal amount of return pressure is applied.

If a cylinder is under load, the Counter balance Valve will prevent any outflow of oil until a sufficient return pressure is applied, at which time it will open. **Note:** when using double-acting cylinders, it will control the lowering as a brake and the loaded cylinder will retract at about the same rate as if it were not under load. Again, the counter balance valve will control the retract rate of double-acting Cylinder only. It will be necessary to ensure your load remains stable when retracting with single-acting Cylinders.

3.2.2 The Workstation

All functions of the power unit can be accessed from the front of the unit, including:

- Starting and stopping engine
- RPM adjustment and tachometer
- Master Control Valve
- Individual Circuit Control Valves
- Individual Pressure Relief Valves
- V82 Valves
- V10E Valve (if equipped)
- Oil volume and temperature gauges
- Oil cooling fan

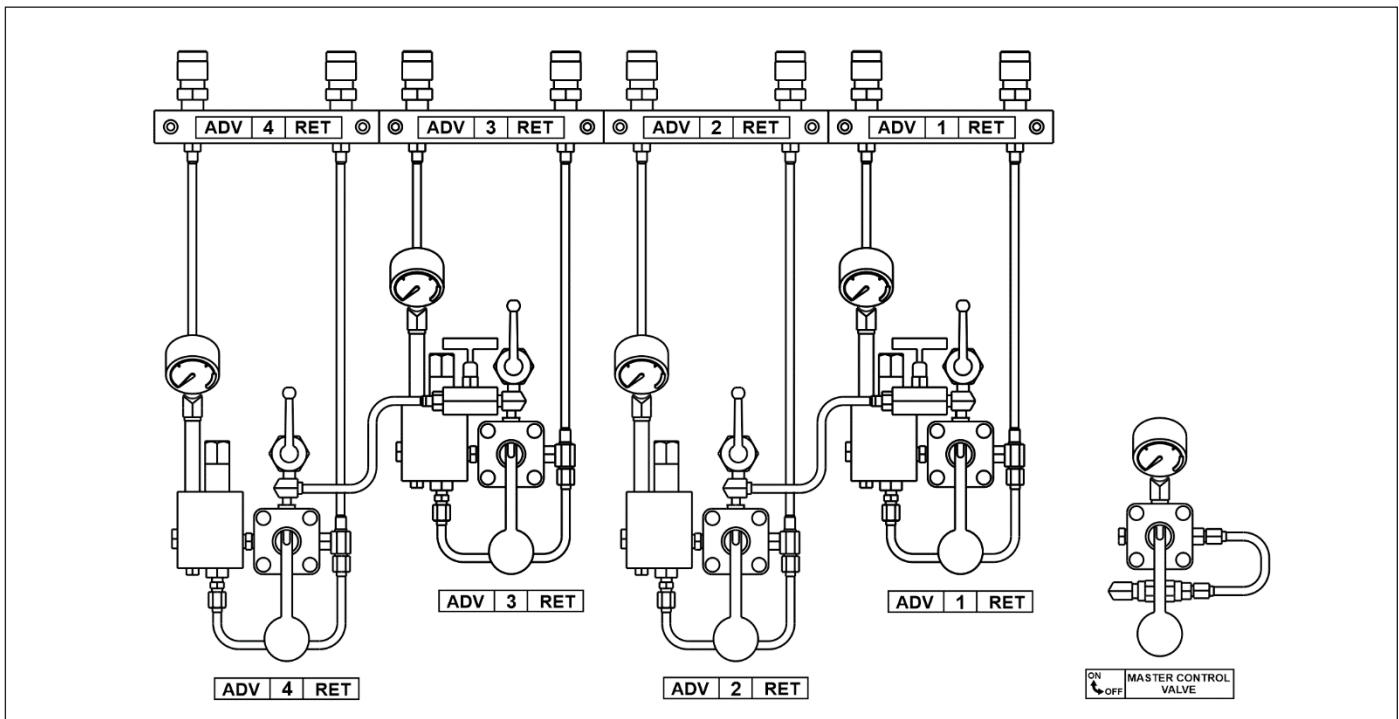


Figure 1: Operator Panel

NOTICE Above graphic shows set up for 4-Port . For 6 & 8-Ports, 2 & 4 additional banks are added respectively.

The operator can view and operate all functions from a standing position as well as maintain visibility over the top of the unit towards the work area. If it is not possible for the operator to see the work area, it is highly recommended to maintain radio or visual contact with a designated spotter who can relay or direct commands.

1. Enerpac VC4, 4-Way, 3-Position Circuit Control Valve
2. Enerpac V2 Counterbalance Valve
3. Enerpac V152 Adjustable Pressure Relief Valve
4. Enerpac V82 Shut-off Valve
5. Enerpac 0 – 15,000 psi Pressure Gauge

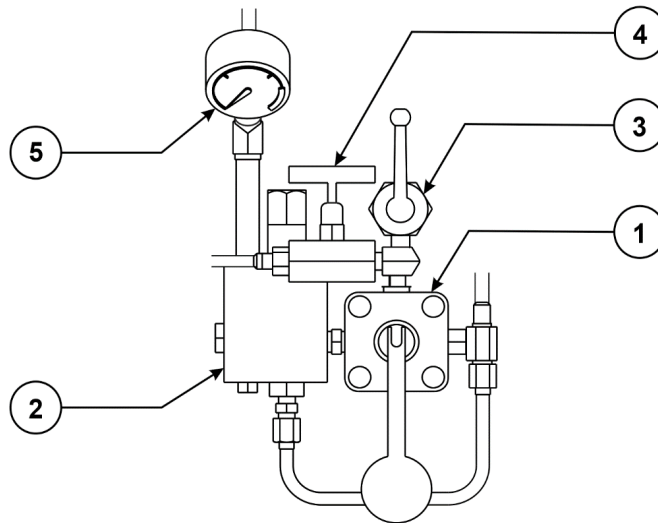


Figure 2: SFP-D Circuit Control Bank

See section 6.3 Spare Parts for links to purchase additional Circuit Control Bank parts from the Enerpac's website.

3.2.3 Engine Control Panel

The SFP-D Engine Control Panel is located on the front of the unit, above the engine. From this panel, the operator can start and stop the engine, adjust the RPM of the engine and shut down the engine in the case of an emergency.

1. Key Switch – OFF, RUN, START
2. Engine RPM Tachometer
3. Throttle Control Knob
4. Glow Plug Indicator Light
5. Engine Hours of Operation Display

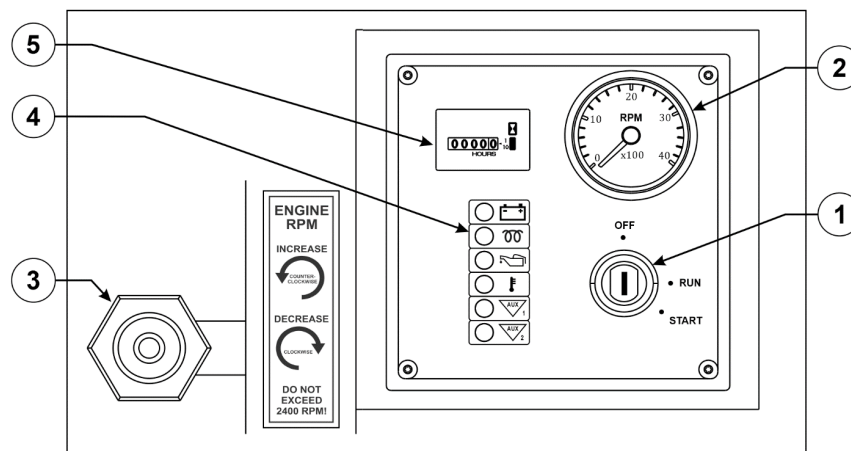


Figure 3: SFP-D Power Unit Engine Control Panel

3.2.4 Intended Use

The SFP-D power unit is designed to supply hydraulic oil under pressures up to 10,000 psi [700 bar] in a controlled manner to actuate single- or double-acting hydraulic cylinders or other hydraulic equipment synchronously or individually.

The number of individual circuits, maximum oil flow rate and other operating parameters are shown above in Section 3.2.3

3.2.5 Operator Training

The operator should be experienced in the safe operation of high-pressure 10,000 psi [700 bar] hydraulic jacking systems. The operator should also read and understand these Instructions in full prior to operating the system.

3.2.6 In Case of Breakdown

In case of equipment breakdown or other operational problems, cease operation immediately and take any necessary steps to secure equipment and protect surroundings and personnel. Depressurize hoses and all hydraulic components (use Enerpac coupler bleed tool as required), identify the problem. **Have a qualified high pressure 10,000 psi [700 bar] trained, hydraulics technician perform any required service work and/or replace any broken or defective components**

3.2.7 Airborne Noise Emissions

The maximum A-weighted sound power level of this equipment under full-load conditions at 10,000psi [700 bar] is **100 dB(A)**, based on measurements performed in accordance with ISO 3744-2010. As the sound power level at the workstation is greater than 70 dB(A), appropriate hearing protection is recommended for the operator of this equipment as well as any persons nearby.

3.2.8 Non-Ionizing Radiation

Operation of the SFP-D Power Unit does not produce non-ionizing radiation.

4. Technical Product Data

4.1 SFP-D Technical Table

Model	SFP419MD	SFP634MD	SFP837MD
Engine	24 HP KUBOTA Diesel	65HP KUBOTA Diesel	65 HP KUBOTA Diesel
Electric Start	yes	yes	yes
Liquid Cooled	yes	yes	yes
Pump	1x Dynex PF1000	1x Dynex PF2000	1x Dynex PF3000
Oil Reservoir	30 gal [115 L]	30 gal [115 L]	30 gal [115 L]
Fuel Tank	6 gal [23 L]	6 gal [23 L]	6 gal [23 L]
Flow / Outlet (gal/min)	0.5	0.9	0.97
Flow / Outlet (litres/min)	1.9	3.4	3.7
Master Control Valve	1 x Enerpac VC4	1 x Enerpac VC4	1 x Enerpac VC4
Circuit Control Valves	4 x Enerpac VC4	6 x Enerpac VC4	8 x Enerpac VC4
Pressure Relief Valves	5 x Enerpac V152	7 x Enerpac V152	9 x Enerpac V152
Pairing Valves	2 x Enerpac V82	3 x Enerpac V82	4 x Enerpac V82
Pressure Gauges	5 x Enerpac [15,000 psi]	7 x Enerpac [15,000 psi]	9 x Enerpac [15,000 psi]
Pressure Port Outlets	4 x CR400	6 x CR400	8 x CR400
Counterbalance Valves	4 x Enerpac V2	6 x Enerpac V2	8 x Enerpac V2
Return Port Outlets	4 x CR400	6 x CR400	8 x CR400
Approximate Weight	2050 lbs [930 kg]	2630 lbs [1195 kg]	2750 lbs [1250 kg]
Approximate Size (in)	84 x 42 x 56	104 x 42 x 56	104 x 42 x 56
Approximate Size (cm)	213 x 107 x 142	264 x 107 x 160	264 x 107 x 160

5. Operation

5.1 General Recommendations

These instructions apply only to the **SFP-D Power Unit**. The unit should be set up and operated only under the direction and supervision of experienced and qualified personnel.

The operator should be experienced in the safe operation of high-pressure hydraulic systems.

Use only with proper hydraulic fluids and hoses, and do not exceed 10,000 psi [700 bar].

NOTICE For starting in cold weather refer to **APPENDIX 1**.

5.2 Pre-Start Up Inspection

Prior to starting up the power unit, the following inspection should be performed:

- Check for any signs of worn or damaged parts. If found, repair or replace before use.
- Check for any signs of oil leaks. Fix any leaks before operating the power unit.
- **CAUTION** Ensure that shut off valves for Diesel or Propane fuel and hydraulic oil reservoir are in the **OPEN** position. Two diesel fuel valves are located at the front of the engine, and one hydraulic oil shut-off valve located near the bottom of the Hydraulic Reservoir. The **Propane** valve is on the propane tank if equipped.
- Check diesel fuel level, coolant level and engine oil level and colour. Top up fluids as needed.
- Check the hydraulic oil level and colour. Add oil to the reservoir if necessary. If the oil appears cloudy, there could be an air or water in the system and the power unit should be serviced before use.
- Ensure that all **V82 Valves** are in fully **CLOSED**, unless pairing ports for increased flow rate.
- For single-acting cylinder applications, ensure **V10E** valves are in the fully open position before starting.
- Make sure all **CIRCUIT CONTROL VALVES** are all in the **NEUTRAL** (center) position, and the **MASTER CONTROL VALVE** is in the **ON** position.

5.3 Diesel Engine Start Up

1. Turn electric start key switch on the Engine Control Panel to **RUN** position. All indicator lights will illuminate. After a couple of seconds, all the indicators will turn off except for the Glow Plug On indicator.
2. When the **Glow Plug** On indicator turns **OFF**, turn the electric start key switch to the **START** position to turn on engine.
3. After engine starts, all indicator lights should go off.
4. Open the throttle up a little bit by turning the Throttle Control Knob **COUNTERCLOCKWISE** to increase engine speed to between 1000 and 1500 rpm. (Maximum rpm 2400).
5. To turn off engine, lower the engine rpm to 900 then turn the key to the **OFF** position.

The power unit is now ready for jacking and or skidding operations.

5.4 Recommendations and Cautions

1. After starting, allow the unit to warm-up for at least 5 minutes- especially in cold weather- before engaging in lifting or skidding. (Engine is equipped with a block heater for severe weather conditions).
2. To increase the engine rpm, turn the Throttle Control Knob **COUNTERCLOCKWISE**. To decrease the engine rpm, turn the Throttle Control Knob **CLOCKWISE**.
3. For normal skidding and jacking operations, set the engine speed to between 1800 and 2400rpm. **Do not exceed 2400 rpm** on Diesel and Propane units as this can cause damage to the pump.
4. Run cylinders for two complete extension and retraction cycles before any loading to purge air from the system to ensure proper operation. Whenever hoses and cylinders are first connected.
5. If the hydraulic oil temperature rises above **65 °C (~150°F)**, turn on the oil cooling fan. The switch for the cooling fan is located on the frame leg of the Power Unit, above the Hydraulic Oil reservoir.
6. **Do not allow the oil temperature to exceed 55°C (~130°F)**. This can result in rapid deterioration of oil performance.

5.5 Pressure Setup

1. Connect hydraulic hoses to the **ADVANCE (ADV)** ports of circuits requiring a pressure setting change. Ensure all hoses are the same diameter and do not leak oil from the couplers. All hose couplers should have their protective dust caps secured and hose ends should not point at any personnel when under pressure.
2. To adjust the pressure of the **V152 EXTERNAL RELIEF VALVE**, unlock the wing nut locking device of the **V152 VALVE**, then turn the adjusting lever of the V152 clockwise to increase pressure or counter-clockwise to decrease pressure.
3. To set the pressure of the circuit:
 - a. Shift the **MASTER CONTROL VALVE** to the **ON** position.
 - b. Working with one circuit at a time, shift the **CIRCUIT CONTROL VALVE** to the **ADVANCE (ADV)** position. Note the pressure on the circuit pressure gauge.

NOTICE Do not run any circuit in this position for longer than 5 minutes. This will cause the hydraulic oil temperature to rise and could damage component seals and cause the hydraulic oil to degrade. Hydraulic oil temperature should be kept at maximum 150 °F or 65 °C.

Adjust the lever of the **V152 VALVE** clockwise to increase pressure or counter-clockwise to decrease pressure.

- c. Shift the **CIRCUIT CONTROL VALVE** to **RETRACT (RET)** position. This will relieve the pressure in circuit.
 - d. Shift the **CIRCUIT CONTROL VALVE** to the **ADVANCE (ADV)** position and note the pressure reading on the circuit pressure gauge.
 - e. If the desired pressure has not been reached, repeat steps d) through f).
 - f. Once the desired set-point has been achieved, tighten the wing nut locking device and proceed to the next circuit.
4. Once all circuits have been set to their new pressure set-points, shift the **MASTER CONTROL VALVE** to the **OFF** position. At this point, normal jacking and skidding operations can resume.

CAUTION Pressure adjustment must not exceed 10,000 psi [700 bar]. Recommended maximum operating pressure should be 8,000 PSI. The valves offer repeatability accuracy of $\pm 3\%$ and an adjustment range of 800-10,000 psi (55-700 bar).

NOTICE **MASTER CONTROL VALVE** should always be maintained in the off center, neutral position when pressure is not required.

CAUTION The **V152** external pressure relief valve situated under the table top is the main system safety valve and must not be adjusted.

Refer to Enerpac literature supplied for more technical information.

5.6 Control Valve Operating Instruction

NOTICE The figures below depict a 4-circuit power unit layout, however the same directions apply to all 4-, 6-, and 8-circuit SFP-D synchronous power units. Valves will be numbered 1-4, 1-6 or 1-8 as appropriate.

CAUTION Always ensure the **MASTER CONTROL VALVE** is in the **OFF** position when not in use.

5.6.1 Jacking

5.5.1.1. Double-Acting Cylinder Setup Mode

1. All **CIRCUIT CONTROL VALVES**, and **MASTER CONTROL VALVE** must be in **NEUTRAL** (center) **OFF** position prior to start up.

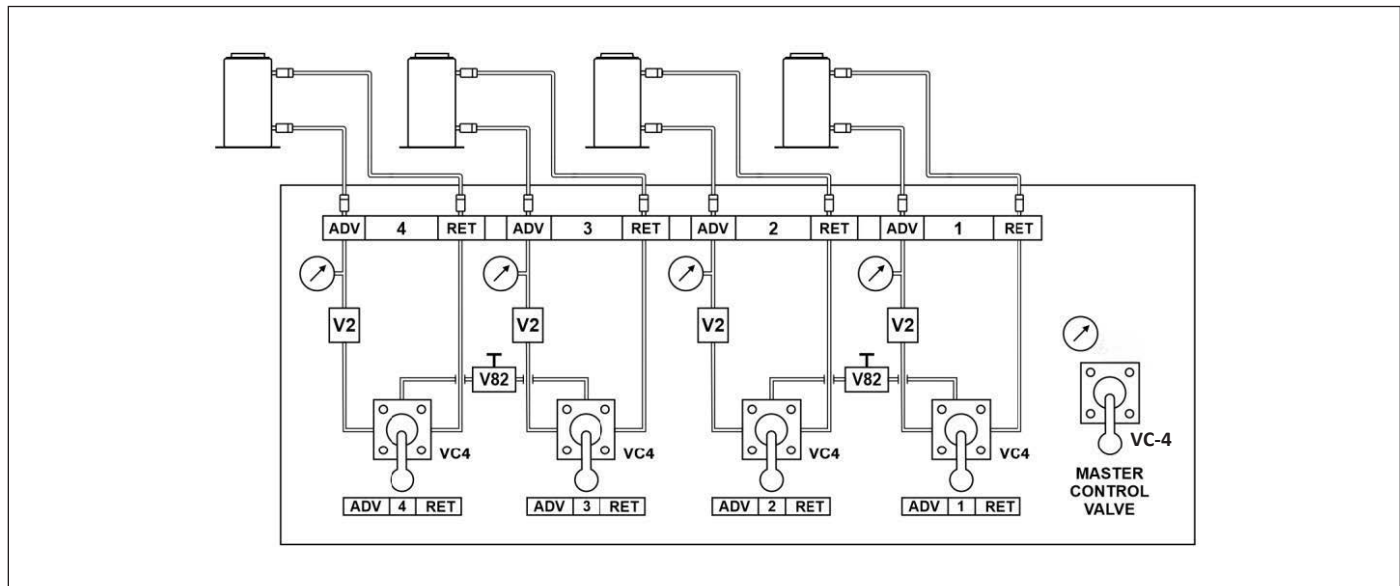


Figure 4: Initial Control Setup for Double-Acting Cylinders

2. **V82 Valves** must be closed.
3. Ensure that all pressure gauges are reading zero. (If not, refer to Troubleshooting).
4. Connect cylinders to the coupler manifold with appropriate 10,000 psi [700 bar] rated hydraulic hoses. Connect the bottom port of each Cylinder to the **ADVANCE PORT (ADV)** and the top port of the Cylinder to the **RETURN PORT (RET)**. Ensure that all couplers are fully engaged and hand-tight, otherwise the hose check valves will not open and the cylinders will not function properly.
5. Start engine (see Section 5.2 & 5.3 for power unit start up instructions).

5.5.1.2. Synchronization Mode

1. Shift the **MASTER CONTROL VALVE** to the left (**ON**) position. This puts pressure to the individual **CIRCUIT CONTROL VALVES**.

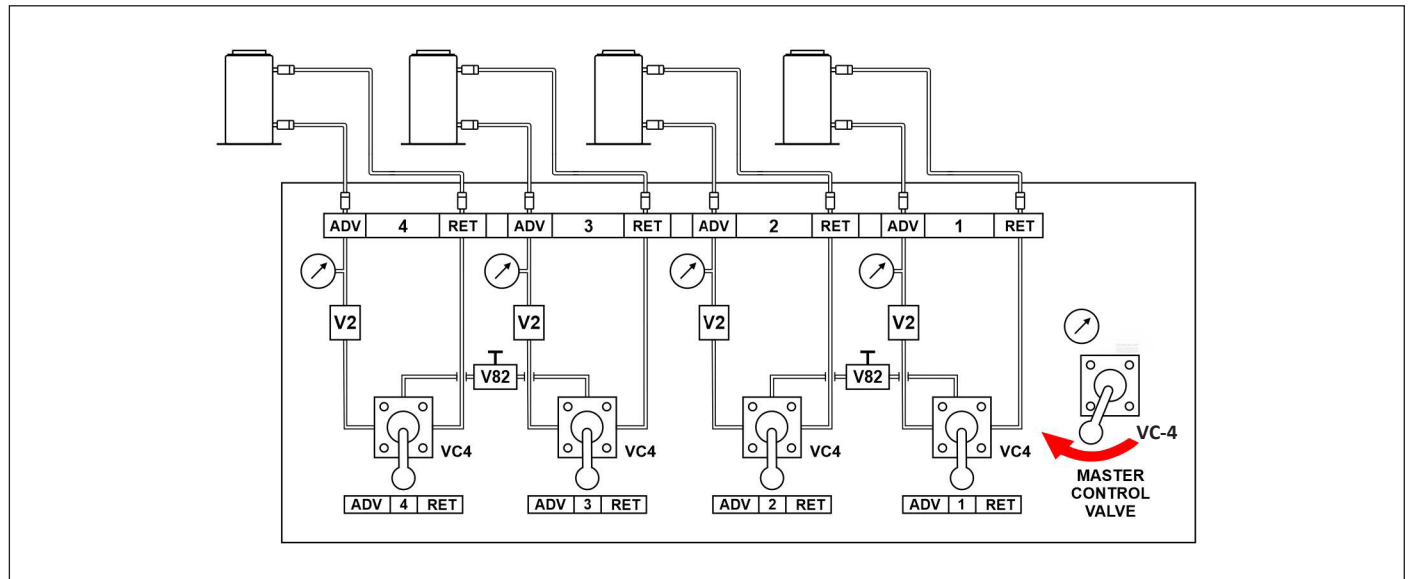


Figure 5: Synchronizing Double-Acting Cylinders

2. Shift each **CIRCUIT CONTROL VALVE**, one at a time, to the left (**ADV**) position.

NOTICE You can use any or all of the circuits as required.

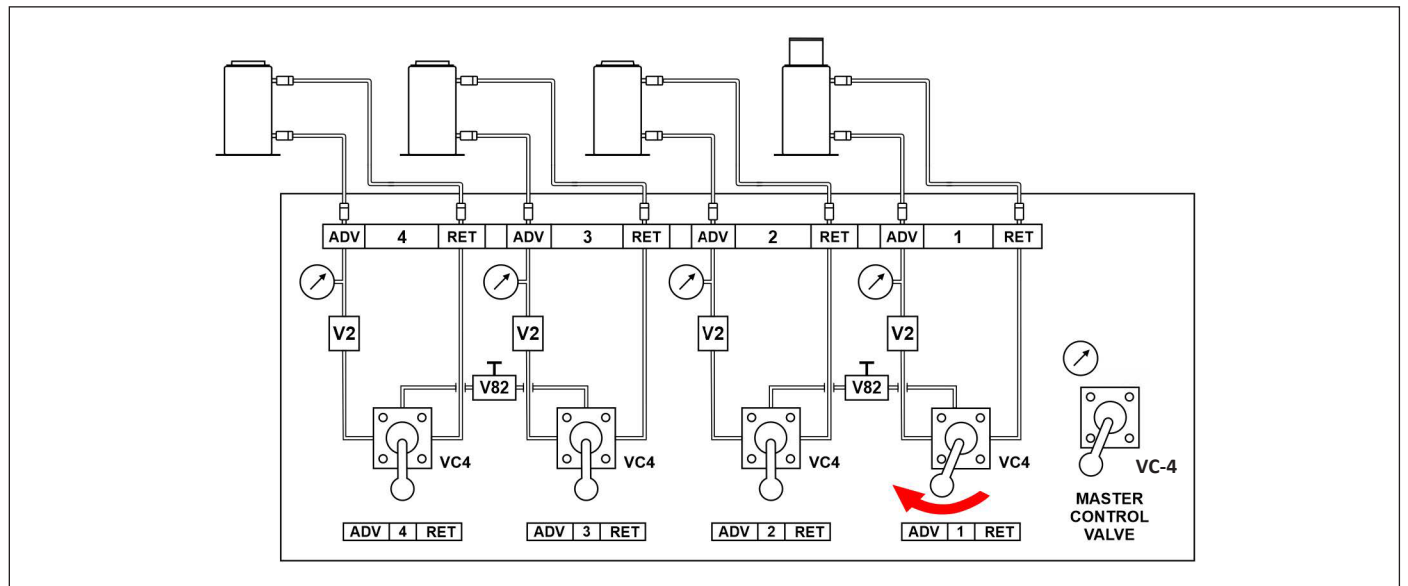


Figure 6: Cylinder Synchronizing Sequence

3. Advance the corresponding cylinder until it just makes contact with the load, allowing 500-1000 psi [35 - 70 bar) to develop in the circuit, then return the **CIRCUIT CONTROL VALVE** to the **NEUTRAL** (center) position.

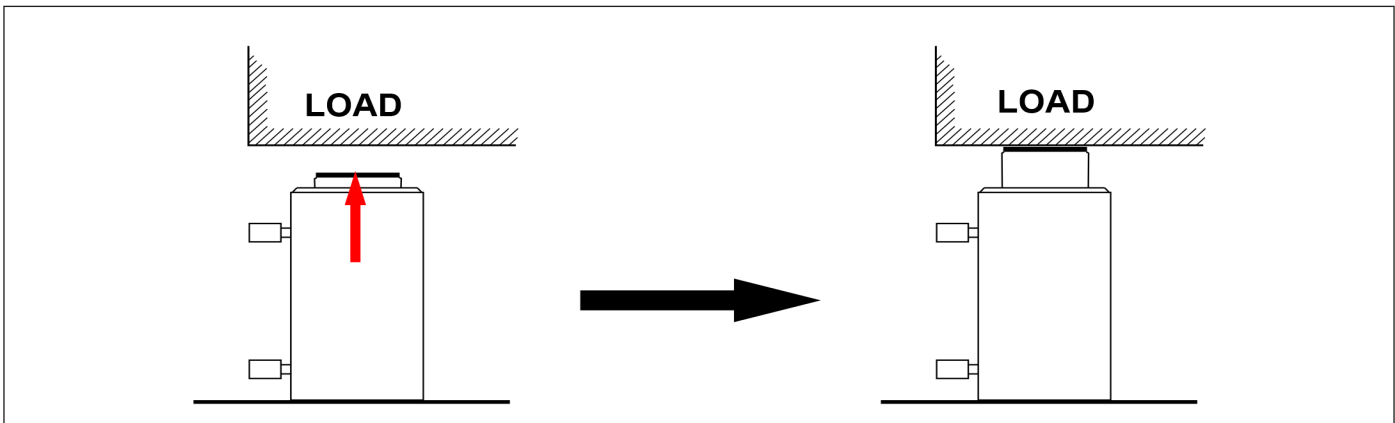


Figure 7: Cylinder Rod Contact with Load for Synchronous Lifting

4. Repeat this process for each of the lift points.
5. Ensure all hydraulic cylinders are safely in position just contacting the load.
6. Shift the **MASTER CONTROL VALVE** to center (OFF) position.
7. The synchronous lift is ready to begin.

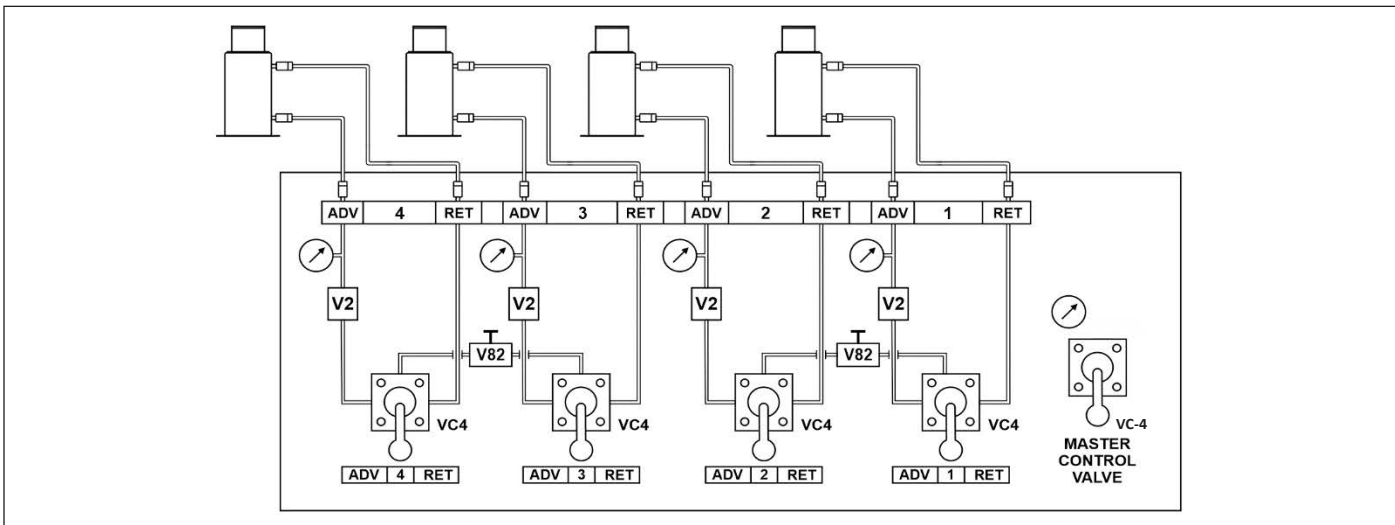
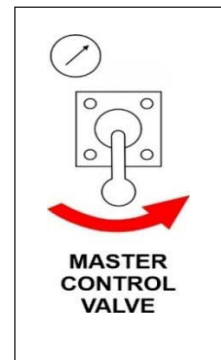


Figure 8: Cylinder ready for Synchronous Lifting

5.5.1.3. Lifting Mode

1. Shift required **CIRCUIT CONTROL VALVES** to left (**ADV**) position (Lifting Position).

NOTICE You can use any or all of the circuits as required.

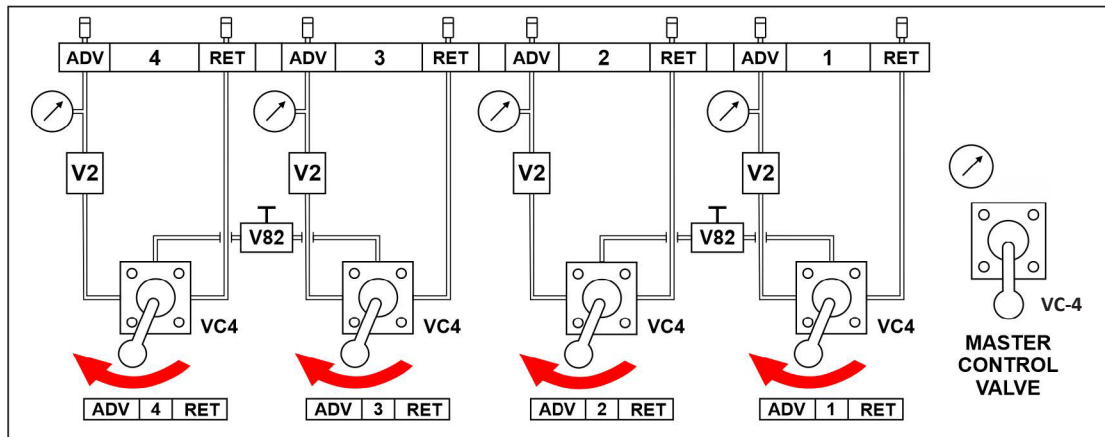


Figure 9: Shift Circuit Control Valves to ADV for Synchronous Lifting

2. When ready to lift, shift the **MASTER CONTROL VALVE** fully to the left (**ON**) position.
The system is in synchronous lift mode and will lift the load evenly throughout the cylinder stroke.

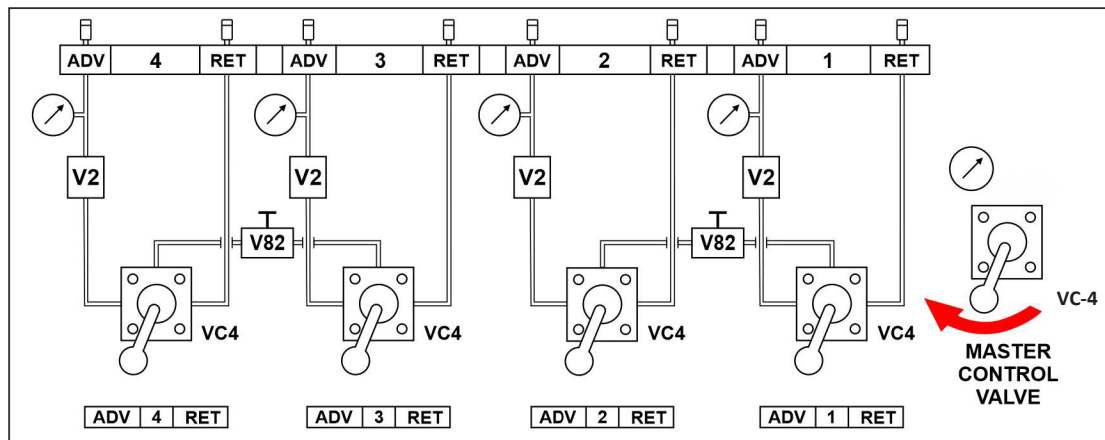


Figure 10: Shift Master Control to ON Position to Start Synchronous Lift

3. At any time, the lift can be stopped by shifting the **MASTER CONTROL VALVE** back to the center (**OFF**) position.
4. If a re-synchronization is required at any time refer to synchronization instructions above.

5.5.1.4. Lowering Mode

1. Shift **CIRCUIT CONTROL VALVES** to the right (**RET**) position.

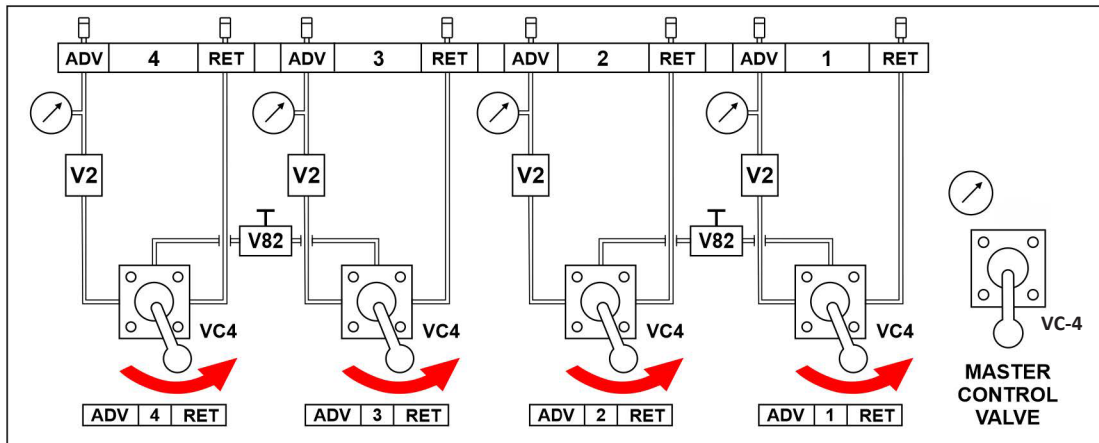


Figure 11: Shift Circuit Control Valves to RET for Synchronous Lowering (Power Down)

2. When ready to lower, shift the **MASTER CONTROL VALVE fully** to the left (**ON**) position.
The system is now in synchronous lower mode and will lower the load evenly.
Again, watch for lowering deviations and correct accordingly per the synchronization instructions above.

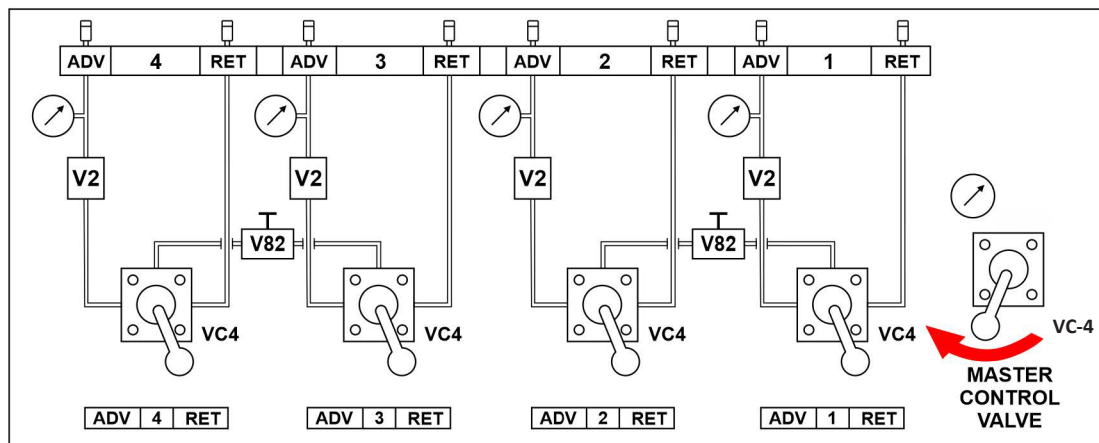


Figure 12: Shift Master Control Valve to ON to Start Synchronous Lowering

5.5.1.5. Small Adjustment Mode

If it becomes necessary at any time during raising or lowering to make small adjustments, it is possible to shift the **CIRCUIT CONTROL VALVES** either individually or together either up or down.

1. Start with all **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** in **NEUTRAL** (center) position.

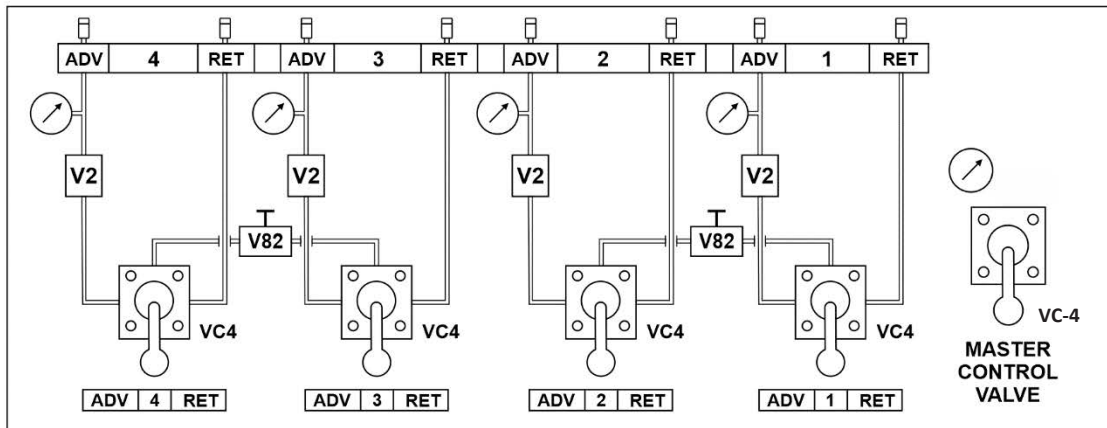


Figure 13: Figure 13: Initial Circuit Control Valve Setting for Small Adjustments

2. Shift **MASTER CONTROL VALVE** to the left (ON) position.

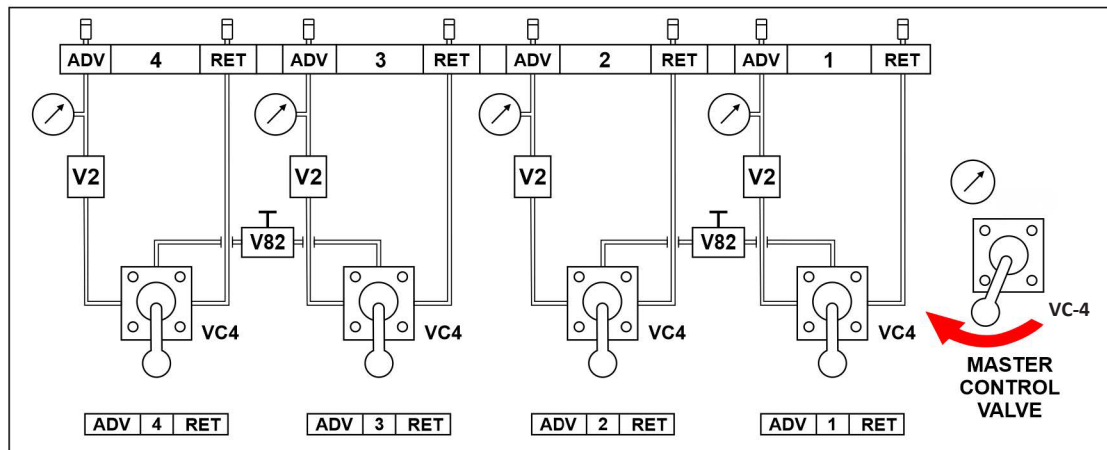


Figure 14: Shift Master Control Valve to the ON position to Shift Individual Control Valves

- Shift individual **CIRCUIT CONTROL VALVE(S)** as required to make adjustment.

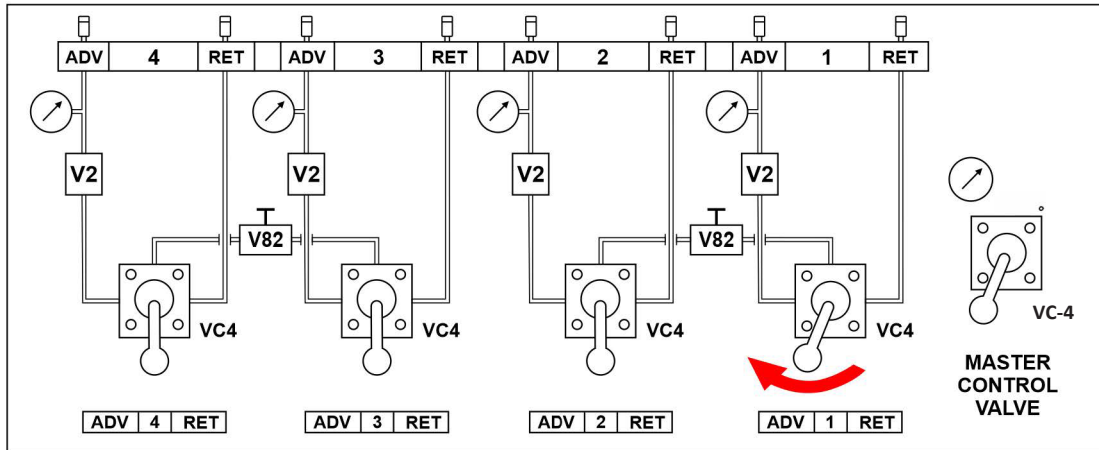


Figure 15: Shift CIRCUIT CONTROL VALVES individually to make Small Adjustments

- Return **MASTER CONTROL VALVE** to center (OFF) position after fine adjustments have been made.

CAUTION **MASTER CONTROL VALVE** should always be in center (OFF) position when the system is not in lifting or lowering operation.

5.5.1.6. Combining Ports

The SFP-D synchronous power units allow for the combining of ports to increase the flow rate to selected outlets while maintaining full synchronization. The number of usable ports is however reduced. Up to half of the circuits can be used with double the normal lifting or lowering speed by combining ports.

To double the advancing/retracting speed at a particular port:

- Fully open the **V82 VALVE** located between two **CIRCUIT CONTROL VALVES**.
- Connect the hydraulic hoses to the **CIRCUIT HOSE COUPLER PORTS** to be used.
- Shift the other (unused) **CIRCUIT CONTROL VALVES** to the right (**RET**) position. **DO NOT** attach any hoses to this valve. (Keep coupler dust cap in place here for safety).

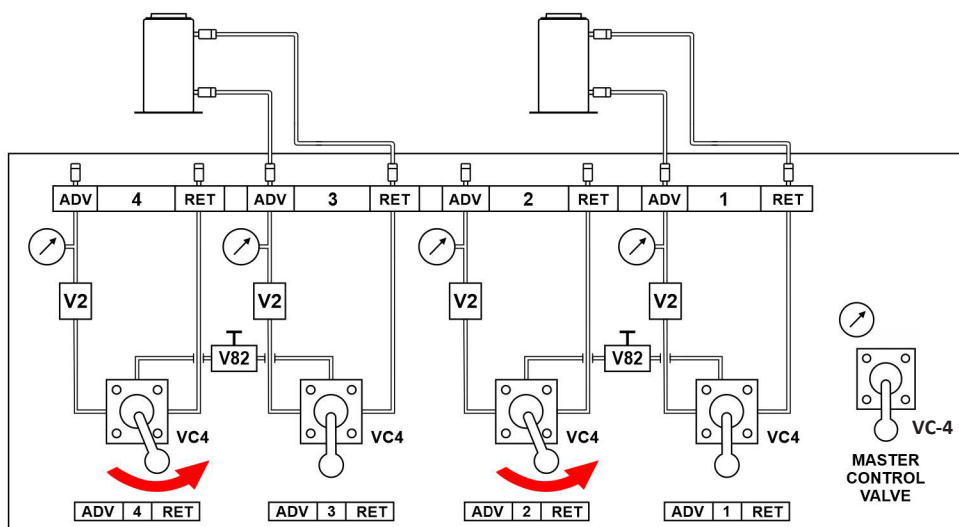


Figure 16: Combining Ports – Typical Setup

- Shift the **CIRCUIT CONTROL VALVES** (with the hoses attached) to the left or right as in the lifting or lowering modes above.
- Follow procedure outlined in Section 5.5.1.2 Synchronization Mode to synchronize the cylinders.
- When ready to lift/move, shift the **MASTER CONTROL VALVE** fully to the left (**ON**) position.

NOTICE At all other times the **V82 VALVES** must remain closed.

CAUTION When lifting with hydraulic cylinders it is always advised to follow the lifting/lowering with appropriate cribbing timber supports in the event of any type of failure. This is a standard recommended safety practice for all free lift applications.

5.5.1.7. Single-Acting Cylinder Setup Mode

- All **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** must be in **NEUTRAL** (center) position prior to start up.
- V82** must be closed.
- Install the **V10E FLOW CONTROL VALVES** in the **RETURN PORT (RET)** couplers as required.
- Connect the single-acting cylinders to the **V10E VALVE** coupler.

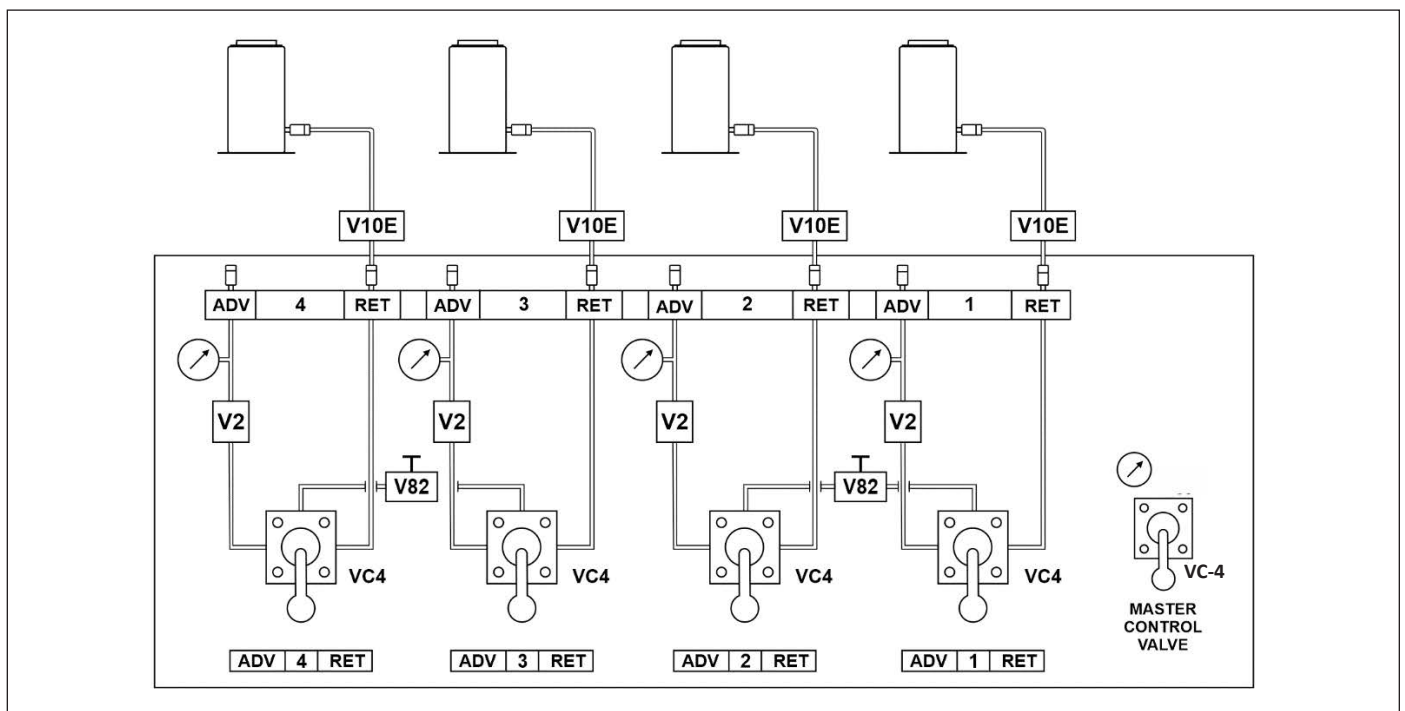


Figure 17: Initial Control Setup for Single-Acting Cylinders

- Ensure **V10E FLOW CONTROL VALVES** are fully closed.
- Ensure that all couplers are fully engaged and hand-tight, otherwise the hose check valves will not open up and the cylinders will not function properly.
- Follow procedure outlined in Section 5.5.1.2 Synchronization Mode to synchronize single acting cylinders. Note the **CIRCUIT CONTROL VALVES** will be shifted to the right (**RET**) to extend the cylinders.
- When synchronization of the cylinders is complete, shift all **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** to the **NEUTRAL** (center) position.
- The synchronous lift is ready to begin.

5.5.1.8. Lifting with Single-Acting Cylinders

1. Start engine (see 5.2 & 5.3 for Power Unit Start-Up).
2. Shift **CIRCUIT CONTROL VALVES** to the right (**RET**) position.

NOTICE You can any or all of the circuits as required.

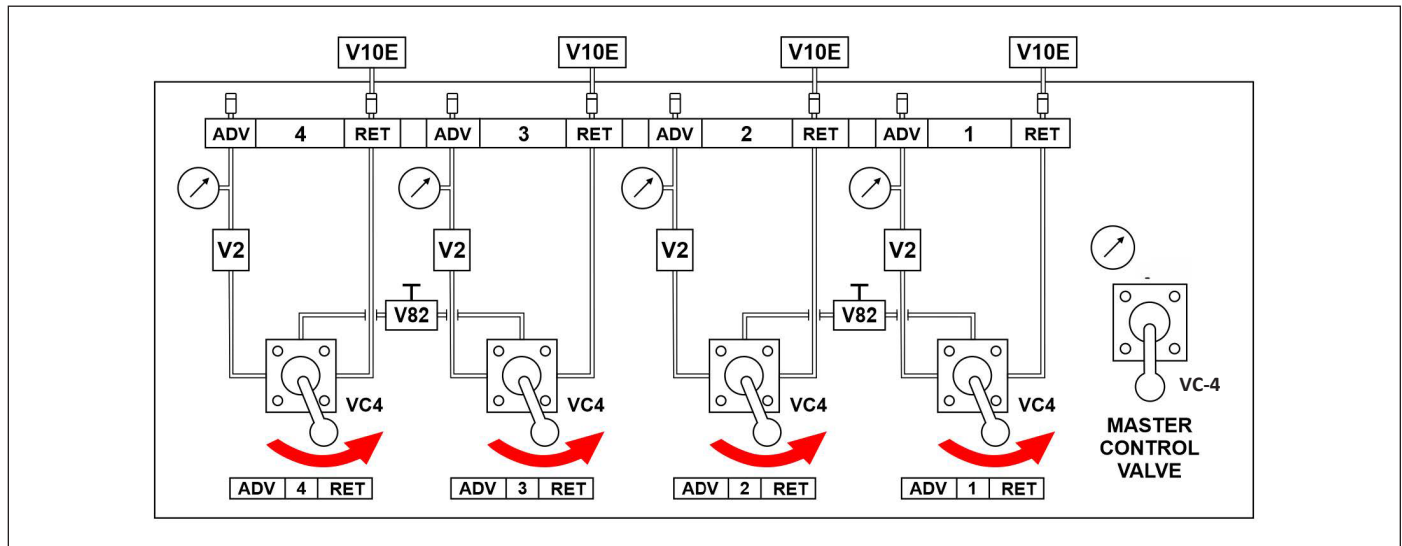


Figure 18: Shift **CIRCUIT CONTROL VALVES** to the right (**RET**) for synchronous lifting

3. Shift **MASTER CONTROL VALVE** to the left (**ON**) position.

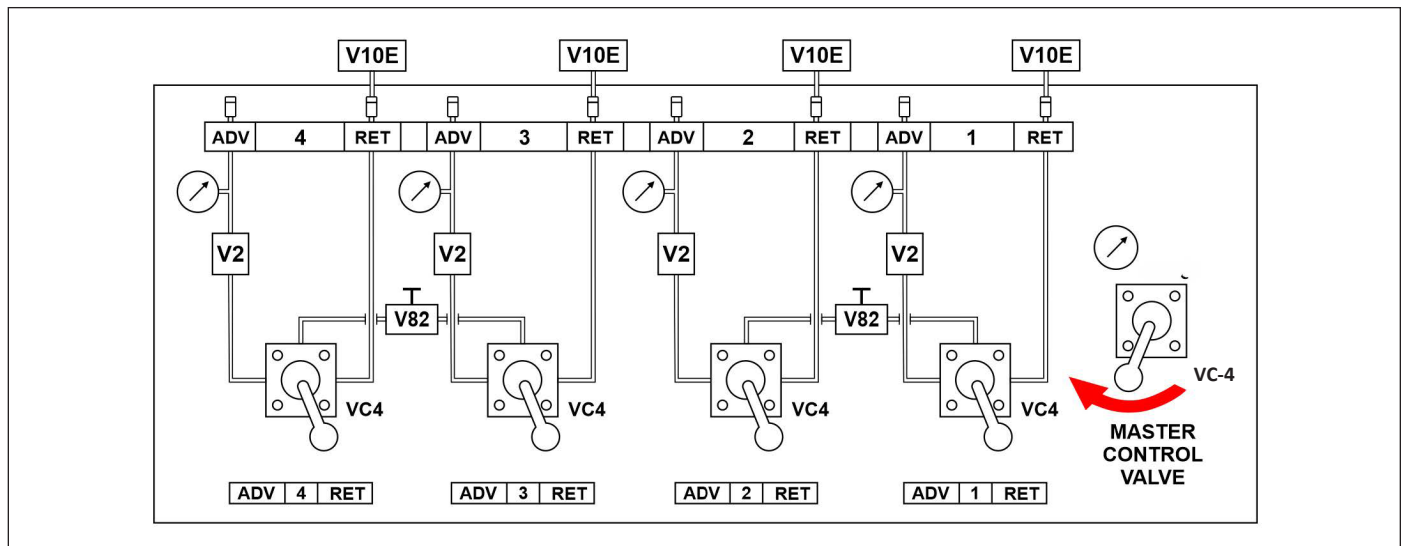


Figure 19: Shift **MASTER CONTROL VALVE** to **ON** to start synchronous lift

4. Cylinders will rise synchronously. At any time, the lift can be stopped by shifting the **MASTER CONTROL VALVE** back to center (**OFF**) position.

5.5.1.9. Lowering with Single-Acting Cylinders

1. All **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** must be in **NEUTRAL** (center) position.
2. Ensure **V10E VALVES** are fully closed..

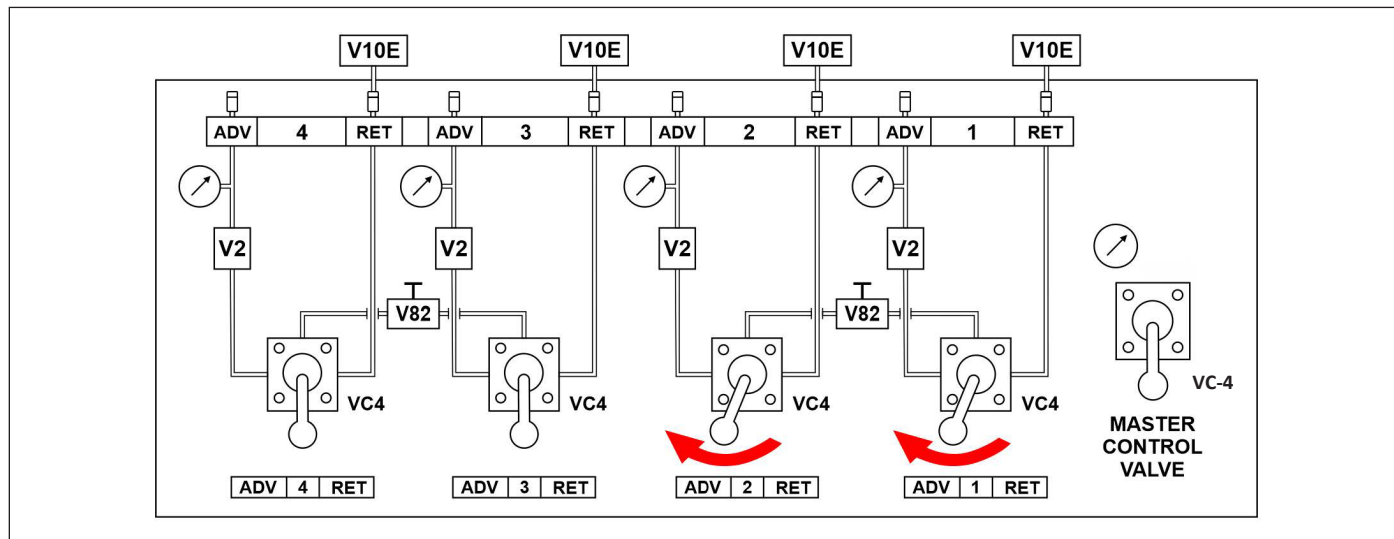


Figure 20: Initial Control Setup for Single-Acting Cylinders

3. Shift required **CIRCUIT CONTROL VALVES** to the left (**ADV**) position.
4. Leave **MASTER CONTROL VALVE** in the center (**OFF**) position.
5. Gradually open the **V10E** Flow Control valves about $\frac{1}{4}$ turn.
6. Jacks will lower but **not synchronously**. The lowering speeds may be adjusted by adjusting the **V10E** flow control valves.
7. It will be necessary to ensure your load remains stable when retracting with single-acting Cylinders and may require lowering end-to-end in steps using only two Cylinders at a time.
8. When the Cylinders are fully retracted, close the **V10E VALVES** and return **CIRCUIT CONTROL VALVES** to the **NEUTRAL** (center) position.

⚠ WARNING All couplers, when not connected to a hose, **MUST** have the steel dust caps installed securely, and **NO PERSONNEL** should be present on the back side of the unit during operation.

5.6.2 Jacking

5.5.2.1. Setup Mode

1. All **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** must be in **OFF** (center) position prior to start up.
2. **V82 VALVES** must be closed.
3. Connect push cylinders to the coupler manifold with appropriate 10,000 psi [700 bar] rated hydraulic hoses. Connect the bottom port of each jack to the control valve **ADVANCE PORT (ADV)** and the top port of the cylinder to the control valve **RETURN PORT (RET)**. Ensure that all couplers are fully engaged and hand-tight, otherwise the hose check valves will not open up and the cylinders will not function properly.
4. Start engine (See Section 5.2 & 5.3 – Power Unit Start up)

5.5.2.2. Synchronization Mode

1. Shift **MASTER CONTROL VALVE** to the left (**ON**) position.
This puts pressure to the **CIRCUIT CONTROL VALVES**.
 2. Shift each **CIRCUIT CONTROL VALVES** one at a time to the left (**ADV**) position.
- NOTICE** You can use any or all of the circuits as required.
3. Advance the corresponding cylinder until it just makes contact with the load.
 4. Shift the **CIRCUIT CONTROL VALVES** to the **NEUTRAL** (center) position.
 5. Repeat this process for each of the push cylinders.
 6. Ensure all hydraulic cylinders are fully set in the track slots and just contacting the load.
 7. Shift the **MASTER CONTROL VALVE** to center (**OFF**) position.
 8. The synchronous skidding operation is ready to begin.

5.5.2.3. Pushing Mode

1. Shift required **CIRCUIT CONTROL VALVES** to left (**ADV**) position.

NOTICE You can use any or all of the circuits as required.

2. When ready to push, shift the **MASTER CONTROL VALVE** fully to the left (**ON**) position.
Do Not feather this valve as it may cause the system to lose synchronization.
3. The system is in synchronous skidding mode and will push the load evenly throughout the cylinder stroke.
4. At any time, the skidding can be stopped by shifting the **MASTER CONTROL VALVE** back to center (**OFF**) position.
5. If a re-synchronization is required at any time refer to synchronization instructions above.

5.5.2.4. Retracting Mode

1. Shift **CIRCUIT CONTROL VALVES** to the right (**RET**) position.
2. When ready to retract the push cylinders, shift the **MASTER CONTROL VALVE** fully to the left (**ON**) position.
3. The system is now in synchronous retract mode.

5.5.2.5. Feathering/ Fine Adjustment Mode

If it becomes necessary at any time during raising or lowering to make small or fine adjustments, it is possible to feather the **CIRCUIT CONTROL VALVES** either individually or together, in either advance or retract mode.

6. Start with all **CIRCUIT CONTROL VALVES** and **MASTER CONTROL VALVE** in center (neutral) position
7. Shift **MASTER CONTROL VALVE** to the left (**ON**) position.
8. Shift individual **CIRCUIT CONTROL VALVE(S)** as required to make adjustment.
9. Return **MASTER CONTROL VALVE** to the center (**OFF**) position.

5.5.2.6. Combining Ports

The SFP-D synchronous power units allow for combining of ports to increase the flow rate to selected ports while maintaining full synchronization. The number of usable ports is however reduced.

Up to half of the circuits can be used with double the normal lifting or lowering speed by combining ports.

To **double** the skidding speed:

1. Open the **V82 VALVE** located between each pair of **CIRCUIT CONTROL VALVES** that you wish to use.
2. Connect the hydraulic hoses to one of the **CIRCUIT CONTROL VALVES** in each pair.
3. Shift the other **CIRCUIT CONTROL VALVE** in each pair to the right (**RET**) position. Do not attach any hoses to this valve.
4. Operate the **CIRCUIT CONTROL VALVE** (with the hoses attached) as in the skidding or retracting modes above.

NOTICE At all **other** times the **V82** must remain closed.

CAUTION All couplers, when not connected to a hose, **MUST** have the steel dust caps installed securely and no person should be present on the back side of the unit during operation.

CAUTION **MASTER CONTROL VALVE** should always be in center (**OFF**) position when the system is not in lifting or lowering operation.

6. Maintenance

6.1 Hydraulic System

A complete inspection of the unit should be performed prior to each use at a minimum. Visually inspect all system hoses, pipes, and pipe connections for signs of leaks. Have a qualified hydraulic technician repair or replace any worn, damaged, or broken parts. Contact Enerpac Authorized Service Center for replacement parts.

Inspect and clean the hydraulic oil cooling fan radiator periodically. The cooling fan is located at the front of the power unit above the hydraulic oil reservoir.

6.1.1 Hydraulic Oil

Regularly check the hydraulic oil level and fill as necessary. This unit comes filled with HF ISO32 fluid. It is recommended to use this same fluid for topping up or when doing a complete oil change.

The Enerpac HF-series Hydraulic Oil is specially formulated for powered hydraulic pumps. The HF-series oil contains anti-sludge, anti-rust, and anti-foam additives for overall superior performance. The HF-series hydraulic oil prevents cavitation and offers maximum volumetric efficiency and maximum heat transfer.

Do not mix oils. If mixing of oils is necessary, only do so if they have similar properties and are compatible. Residual oil in the system will not be harmful as long as the oils are compatible. If the hydraulic oil appears “cloudy”, there could be air or water in the system and the unit should be serviced and the oil replaced.

Check the Return Oil Filter Indicator located on top of the hydraulic oil reservoir. If the needle is in the red zone, the filter will need to be replaced. The type of filter used is the:

- MP Filtri return filter element

It is recommended to change the hydraulic oil when the return oil filter is replaced.

6.1.2 Hydraulic Oil Reservoir

At least once per year, the lid of the hydraulic oil reservoir should be removed and the inside of the tank inspected. Close the shut off valve located on the bottom of the tank inside the power unit. Drain the oil by removing the drain plug located on the front of the tank near the bottom. Wipe the reservoir clean with lint free rags, removing all debris. Clean the steel mesh suction strainer by rinsing or blowing out.

6.2 Diesel Engine

Regularly check the fluid levels in the engine and fill up as needed. Please refer to the Kubota Operator’s Manual for recommended service and maintenance requirements.

NOTICE After any maintenance is performed on the power unit, the system should be restarted and checked for proper operation before being put back into service.

6.3 Spare Parts

Available spare parts for SFP-D:

Description	Part Number
MP Filtri return filter element	MF1002A10HBP01
Disc Replacement	CH542950SR
Shear Seal Replacement	DA9560041SR
Enerpac VC4, 4-Way, 3-Position Circuit Control Valve	VC4
Enerpac V2 Counterbalance Valve	V2
Enerpac V152 Adjustable Pressure Relief Valve	V152K
Enerpac V82 Shut-off Valve	V82K
Enerpac 0 – 15,000 psi Pressure Gauge	G2536L

Operators can purchase SFP-D spare parts from the Enerpac’s website using the links provided.

7. Troubleshooting

Troubleshooting Guide		
Problem	Possible Cause	Action
Cylinders do not extend at the same rate	Attempting to feather Master Control Valve	Do not feather Master Control Valve
Cylinder(s) advance only partially	A coupler is not fully engaged	Check and tighten all couplers
	Oil level in pump is low	Add oil to reservoir
Cylinder(s) will not extend	A coupler is not fully engaged	Check and tighten all couplers
	Load exceeds capacity	Reduce load
	Skid shoe is jamming in track	Realign track
	Oil level in pump is low	Add oil to reservoir
	Cylinder seals leaking	Repair/replace cylinder
Cylinder(s) exhibit jerky, sporadic movement	Air in hydraulic system	Bleed hydraulic system
Cylinder(s) will not retract	Coupler is not fully engaged	Check and tighten all couplers
Push cylinder will not extend and oil is coming from pressure relief valve or top of cylinder	Coupler on return line is not fully engaged	Check and tighten all couplers
Pressure gauge(s) are reading pressure but there is no load on jacks	A coupler is not fully engaged and counterbalance valve is holding the pressure	Shift Control Valve to retract and then shift Master Control valve.
		Return Master Control Valve to neutral.
		Shift Control Valve to neutral
Pressure gauge(s) are reading pressure but there is nothing connected	System has been inadvertently pressurized and counterbalance valve is holding the pressure	Shift Control Valve to retract and then shift Master Control valve.
		Return Master Control Valve to neutral.
		Shift Control Valve to neutral
Cylinders extend although Master Control Valve is closed.	When a control valve is open but the Master Control Valve is closed, there is a small amount of pressure in the recirculating line that may cause an unloaded cylinder to extend seemingly on its own. This is a normal occurrence and will not build up significant pressure.	Close all control valves by shifting to the neutral position until ready to lift/move.

8. Transportation & Storage

1. When not in use, store the power unit with cover supplied in a, dry location, protected from damage. Take special care of all hydraulic components, hoses and fittings.
2. Wipe clean inside and outside of all hose couplers using a clean, non-fibrous cloth before connecting and always use protective caps when not in use.
3. When transporting the power unit:
 - Lift only using the provided lifting lugs or forklift pockets.
 - Ensure it is blocked under the main frame to take the weight off the wheels.
 - Ensure it is adequately secured to the transport vehicle using appropriate tie-downs attached only to the designated lifting points or forklift pockets.
 - Cover for protection from elements.

Appendix 1 – Cold Weather Starting

For cold weather starting (ambient temperature below 10°C (50°F)) of the diesel engine, please refer to the Kubota Operating Manual supplied with the Power Unit.

All SFP-D Diesel Power Units come with a block heater for cold weather starting.

If the Temperature drops below 0°C (32°F), it is recommended that the power unit be warmed up using the block heater.

If the ambient temperature is between 0°C (32°F) and -10°C (14°F) and the power unit is protected from wind, it is recommended to warm the engine up with the block heater for at least 30 minutes.

If the ambient temperature is between 0°C (32°F) and -10°C (14°F) and the power unit is exposed to wind, it is recommended to warm the engine up with the block heater for at least 60 minutes. If the ambient temperature falls below -10°C (14°F) and the power unit is exposed to wind, the engine will need to be warmed up using the block heater for longer than 1 hr., perhaps overnight. The colder and windier the weather gets, the longer the engine will need to warm up.

It is also recommended to warm up hydraulic oil in the reservoir during cold weather. Ensure dust caps are installed on the port quick connect couplers. Without any hoses connected to the power unit, turn on the power unit (see Section 3.2 – Power Unit Start up) and engage one of the manual control valves to either the ADVANCE (ADV) or RETURN (RET) port. Engage the Master Control Valve to pressurize the open circuit. This will allow hydraulic oil to flow over the adjustable pressure relief valve in the open circuit and cause the hydraulic oil to heat up. This also provides additional load to the engine causing it to warm up faster. Allow the hydraulic oil to flow this way for 5-10 minutes, no more than 15 minutes.

Warming up the hydraulic oil this way also helps to dissipate moisture that has become entrained in the oil due to cold temperatures.

Cold weather start-ups are also hard on the battery. If possible, disconnect the battery and store in a warm, dry place during cold weather. The battery should be kept fully charged for proper cold- and warm-weather starting. It is recommended that the battery be kept fully charged and tested regularly.

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Appendix 2 – Oil Temperature In Cold Weather

INSTRUCTIONS FOR MAINTAINING OIL TEMPERATURE ON SFP-D SYNCHRONOUS POWER UNIT SYSTEMS IN EXTREME COLD WEATHER

ATF D3M is the standard hydraulic fluid used in most SFP-D Synchronous Power Units. It has very good anti-friction and high volumetric efficiency characteristics and is stable in both high- and low-temperature operating conditions. The fluid's operating range is from -40°C/-40°F to 160°C/320°F.

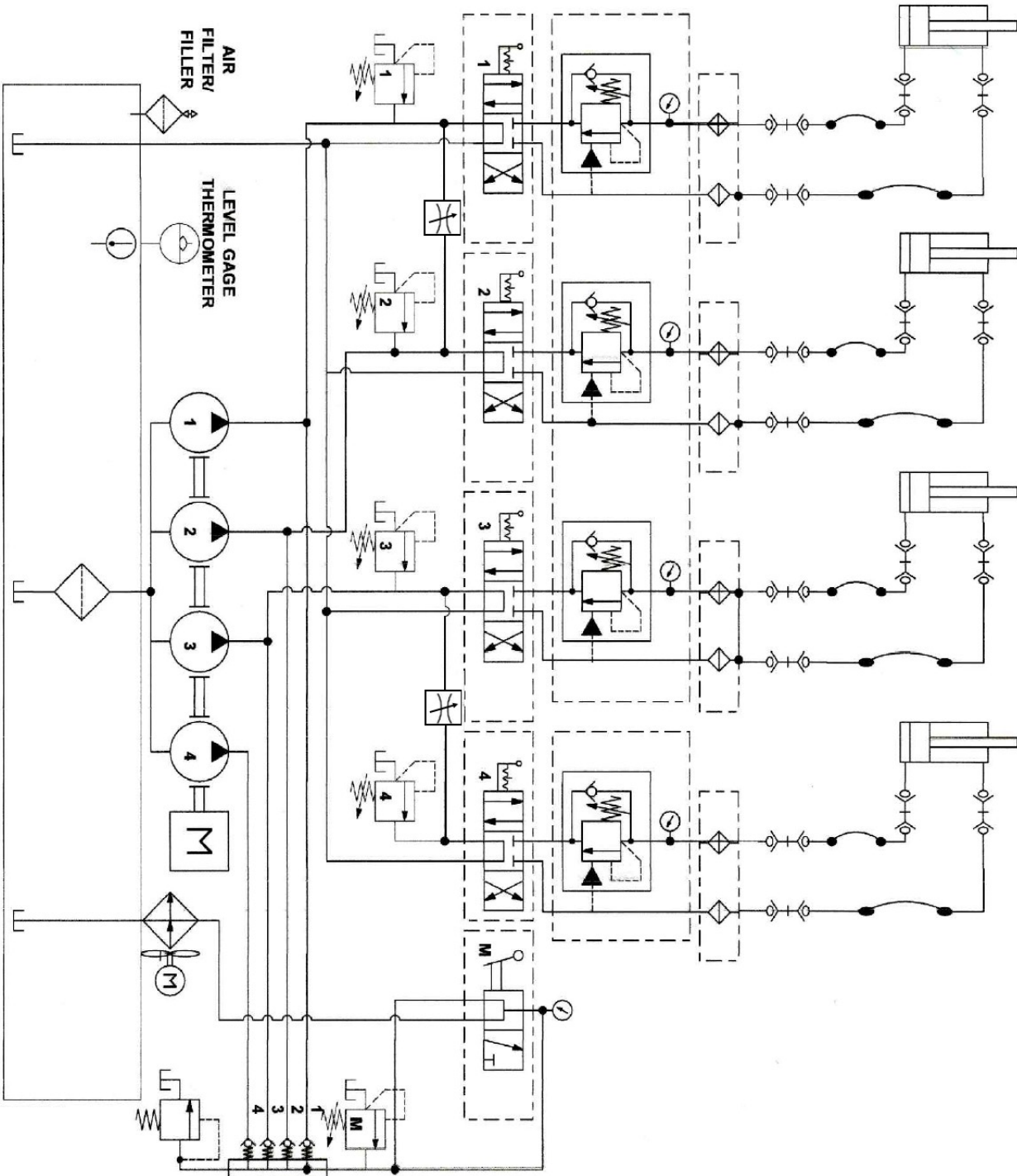
In very low temperature conditions, it is recommended to store the power unit inside (preferably heated) when not in use, and to warm up hydraulic oil in the reservoir prior to use.

To heat oil in reservoir using any circuit V152 relief valves:

1. Ensure steel dust caps are installed on all port quick connect couplers.
2. Without any hoses connected to the power unit, turn on the power unit (see Section 5.2 – Power Unit Start up) and engage one of the **CIRCUIT CONTROL VALVES** to either the **ADVANCE (ADV)** or **RETRACT (RET)** side.
3. Shift the **MASTER CONTROL VALVE** to the left (**ON**) to pressurize the open circuit. This will allow hydraulic oil to flow over the adjustable pressure relief valve in the open circuit and cause the hydraulic oil to heat up. This also provides additional load to the engine causing it to warm up faster.
4. Allow the hydraulic oil to flow this way for 5-10 minutes, no more than 15 minutes. Warming up the hydraulic oil this way also helps to dissipate moisture that may have accumulated in the oil due to cold temperatures.

If the power unit is to be used in very cold weather conditions (less than -40°C/-40°F) and the oil cannot be kept within its recommended operating range, the oil can be changed to a suitable low-temperature oil such as HYDREX MV Arctic 15 Oil, which has a temperature operating range -44°C/-47°F to 23°C /73°F.

Appendix 3 – Hydraulic Schematic



SPF419MD shown

NOTES

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