SERVICE REPAIR

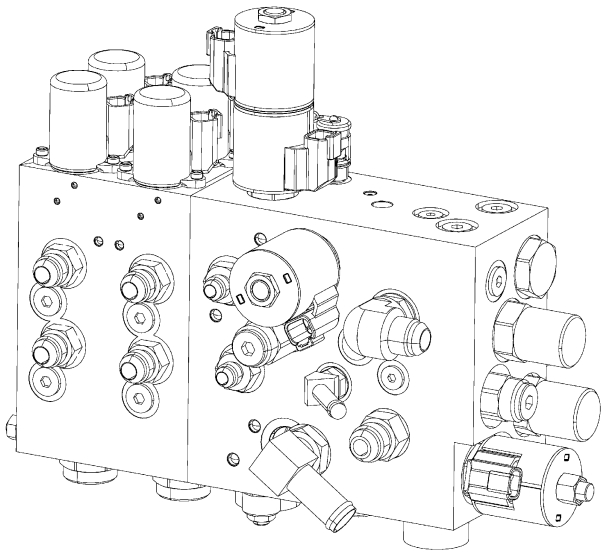
MANUAL

Hyster E210 (V30ZMD) Forklift

HYSTER

ELECTRO-HYDRAULIC CONTROL VALVE

J2.00-3.20XM (J40-65Z) [B416]; E1.50-2.00XM (E25-35Z, E40ZS) [F114]; E2.00-3.20XM (E45-65Z) [G108]; V30ZMD [E210]; E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) [E098]



HYSTER

PART NO. 1616865

2000 SRM 1224

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the WARNING symbol and word are on orange background. The CAUTION symbol and word are on yellow background.

TABLE OF CONTENTS

This section is for the following models:

J2.00-3.20XM (J40-65Z) [B416];
E1.50-2.00XM (E25-35Z, E40ZS) [F114];
E2.00-3.20XM (E45-65Z) [G108];
V30ZMD [E210];
E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) [E098]

"THE
QUALITY
KEEPERS"

HYSTER
APPROVED
PARTS

General

This section has a description and the repair procedures for the Electro-Hydraulic control valve.

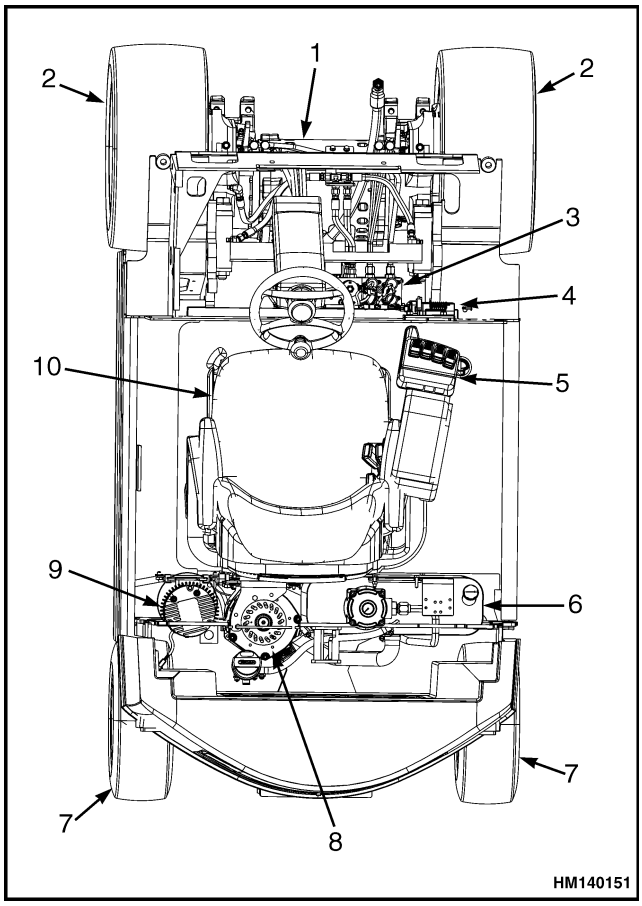
Description

ELECTRO-HYDRAULIC CONTROL SYSTEM

The electro-hydraulic control system controls all hydraulic functions, to include, lift/lower, tilt, and auxiliary functions. The system consists of the following components:

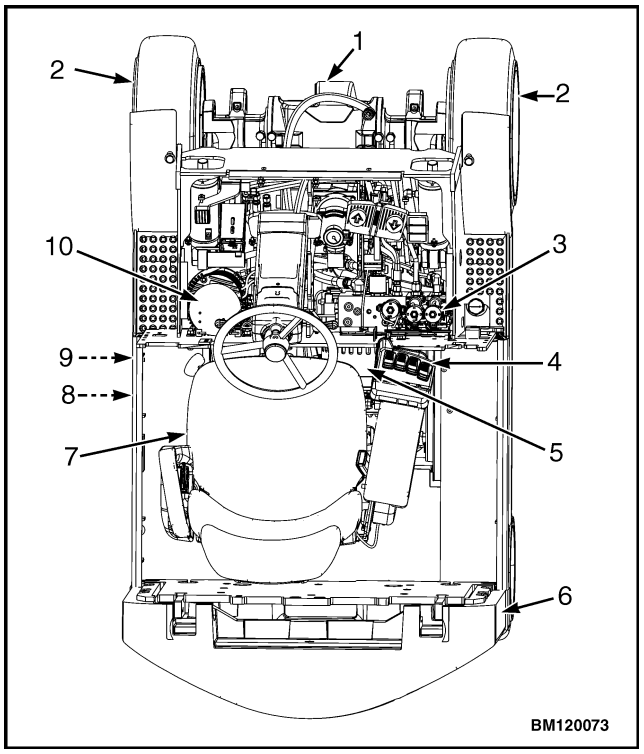
- Electro-Hydraulic Control Valve
- Electro-Hydraulic Valve Driver Module
- Mini-Levers or Joystick controls
- Vehicle Master Controller
- Hydraulic Pump Motor Controller
- Dash Display
- Pump Motor and Fixed Displacement Gear Pump
- Operator's Seat and Armrest
- PC Based Service Software (ETACC)

See Figure 1, Figure 2, or Figure 3 for component location. The vehicle master controller, electro-hydraulic valve driver module, mini-levers or joystick controls, and hydraulic pump motor controller communicate with each other via the CANbus communication system. The master controller controls the hydraulic pump motor and the electro-hydraulic control valve based upon the inputs received from the mini levers or joystick controls. The master controller converts the operator's input into controlled oil flow by simultaneously commanding the hydraulic pump motor controller to deliver a specific motor speed, and by commanding the electro-hydraulic valve drive module to deliver specific valve metering. Pump speed is variable up to the maximum speed preset in the master controller for the required hydraulic function. See Figure 4.



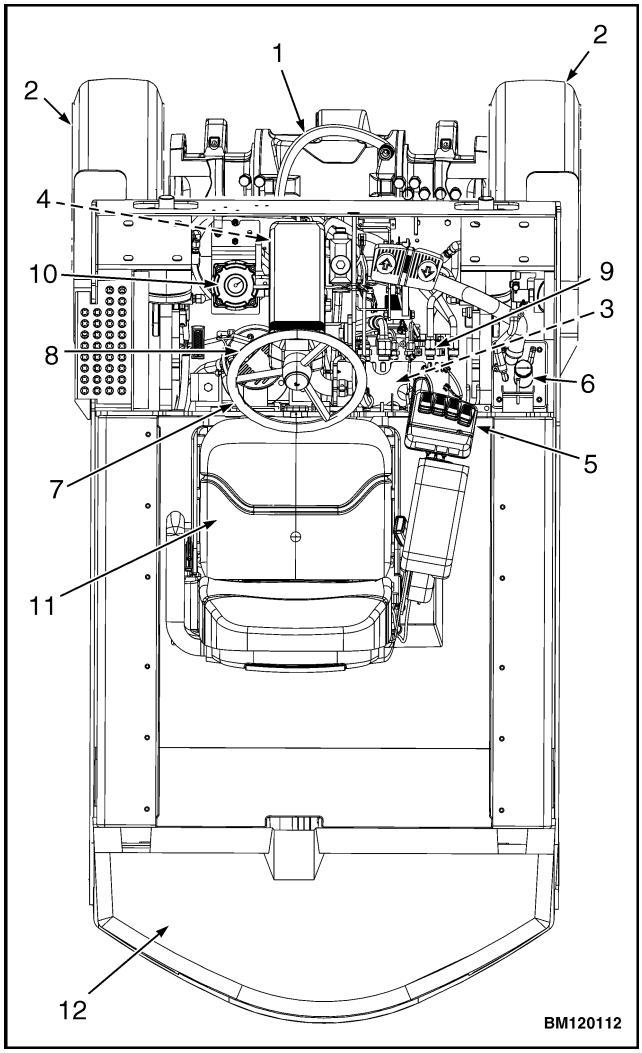
1. TRACTION MOTOR
2. DRIVE WHEEL
3. ELECTRO-HYDRAULICS CONTROL VALVE
4. ELECTRO-HYDRAULICS VALVE DRIVER MODULE
5. MINI-LEVER HYDRAULIC CONTROL CONSOLE
6. HYDRAULIC OIL TANK
7. STEER WHEEL
8. HYDRAULIC PUMP MOTOR
9. STEERING PUMP MOTOR
10. OPERATOR SEAT

Figure 1. Component Location J2.00-3.20XM (J40-65Z) (B416)



1. DRIVE AXLE
2. DRIVE WHEEL
3. ELECTRO-HYDRAULICS CONTROL VALVE
4. MINI-LEVER HYDRAULIC CONTROL CONSOLE
5. TRACTION MOTOR
6. COUNTERWEIGHT
7. OPERATOR SEAT
8. MASTER CONTROLLER
9. ELECTRO-HYDRAULICS VALVE DRIVER MODULE
10. STEERING PUMP MOTOR

Figure 2. Component Location E2.00-3.20XM (E45-65Z) (G108); V30ZMD (E210)



1. DRIVE AXLE
2. DRIVE WHEEL
3. ELECTRO-HYDRAULIC CONTROL VALVE
4. ELECTRO-HYDRAULIC VALVE DRIVER
5. MINI-LEVER HYDRAULIC CONTROL CONSOLE
6. HYDRAULIC TANK FILL
7. STEERING WHEEL
8. STEERING PUMP MOTOR
9. TRACTION MOTOR
10. HYDRAULIC OIL FILTER
11. OPERATOR SEAT
12. COUNTERWEIGHT

Figure 3. Component Location for Lift Truck Model E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

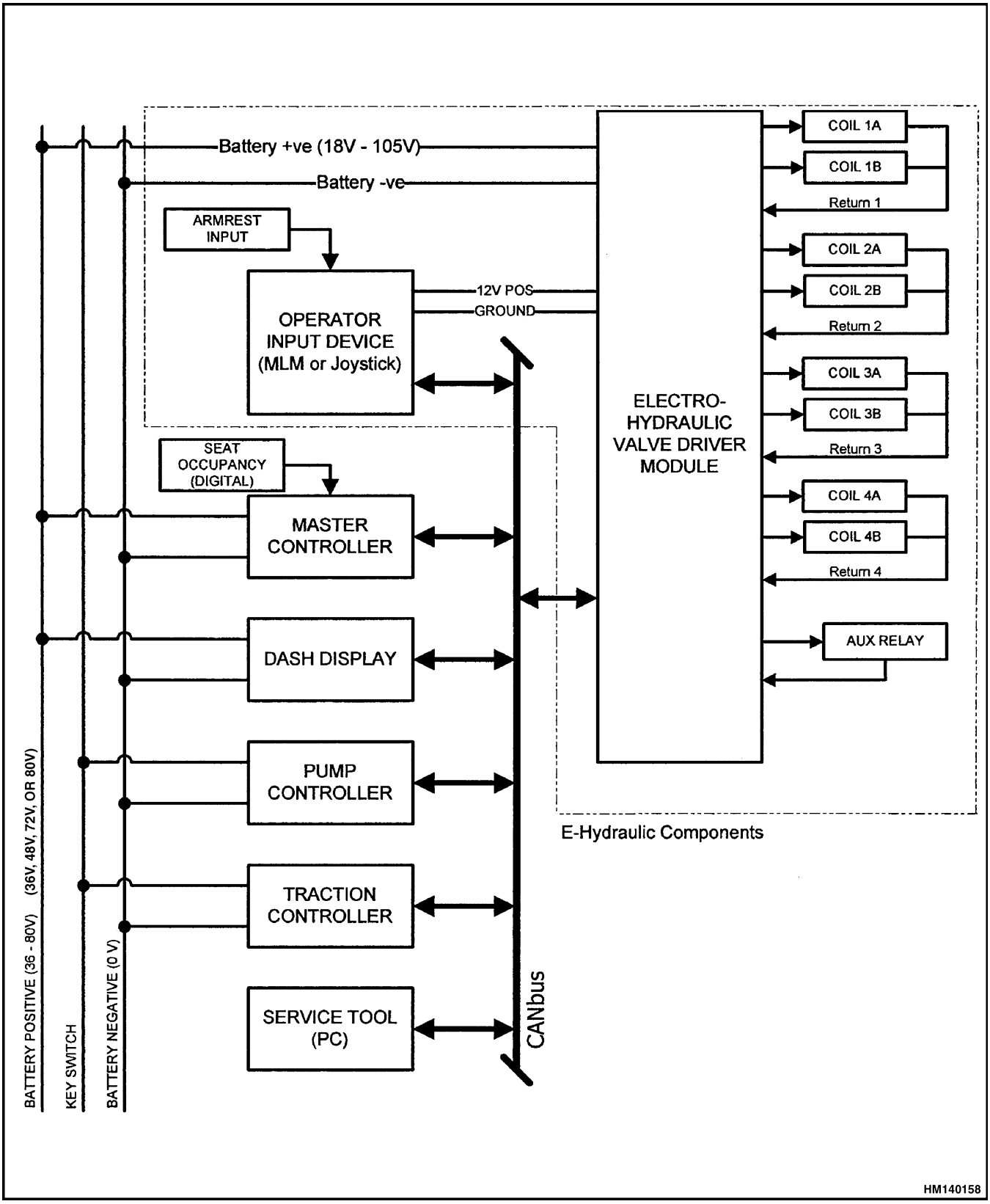


Figure 4. Logic Diagram - Electro-Hydraulic Controls

ELECTRO-HYDRAULIC CONTROL VALVE

The electro-hydraulic control valve is modular in design. Two valve blocks are stacked together to assemble a three- or four-function valve assembly. See Figure 5 and Figure 6. The main block consists of lift and tilt sections. The additional block consists of either a single or double auxiliary hydraulic functions.

The following electro-hydraulic control valve options are available:

- 3 function (single auxiliary) standard flow 23 liter/min (6 gal/min)
- 4 function (dual auxiliary) standard flow 23 liter/min (6 gal/min)
- 4 function (dual auxiliary) high flow 40 liter/min (10.5 gal/min)
- 3 function (single auxiliary) high flow for lift truck models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098) only 57 liter/min (15 gal/min)
- 4 function (dual auxiliary) high flow for lift truck models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098) only 38 liter/min (10 gal/min)

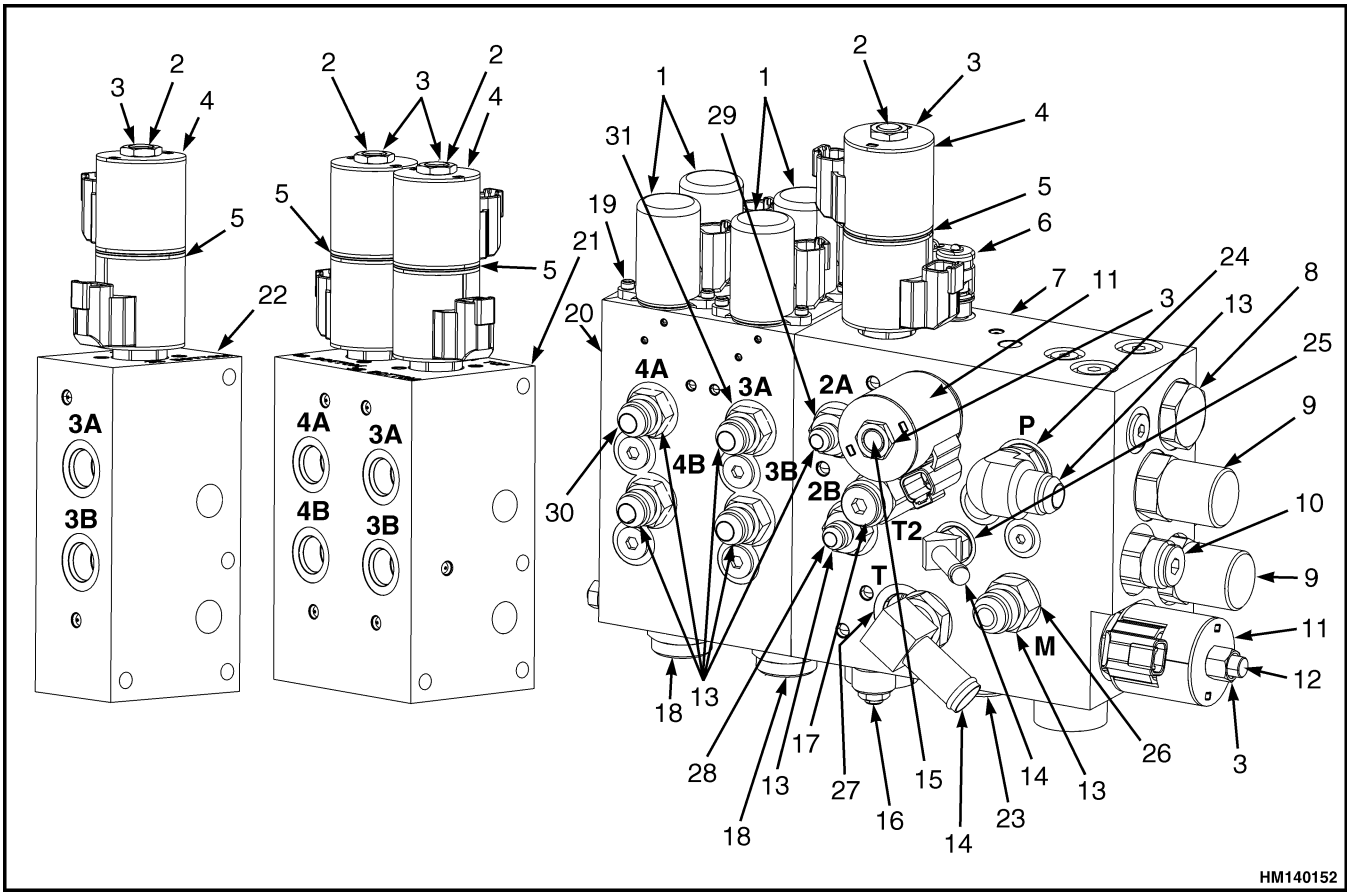
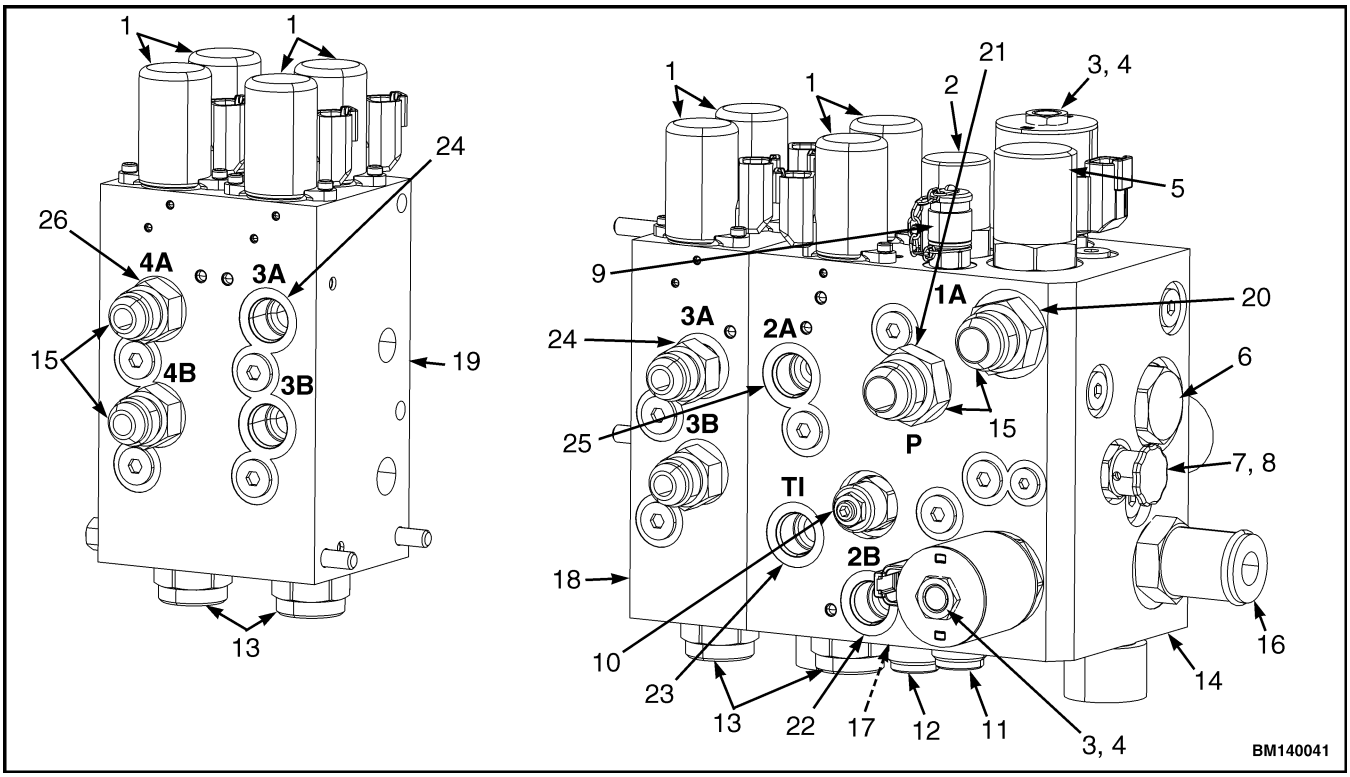


Figure 5. Electro-Hydraulic Control Valve Assembly for Lift Truck Models J2.00-3.20XM (J40-65Z) (B416), E2.00-3.20XM (E45-65Z) (G108), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), and V30ZMD (E210)

Legend for Figure 5

1. ELECTRO-HYDRAULIC PRESSURE REDUCING VALVE (EHPR)
2. CARTRIDGE (TILT, STANDARD FLOW AUXILIARY)
3. COIL RETAINING NUT
4. TWO-PIECE SOLENOID VALVE
5. SPACER
6. PUMP PRESSURE PORT
7. MAIN VALVE SECTION
8. LIFT CIRCUIT CHECK VALVE
9. COMPENSATOR VALVE
10. PRIMARY RELIEF VALVE (SEE TABLE 1)
11. SINGLE SECTION SOLENOID VALVE
12. LOWERING CARTRIDGE AND MANUAL LOWERING VALVE
13. FITTING
14. HOSE NIPPLE
15. LIFT CARTRIDGE
16. TILT COUNTERBALANCE VALVE
17. SECONDARY RELIEF VALVE (SEE TABLE 1)
18. PROPORTIONAL PILOT-OPERATED VALVE
19. CAPSCREW
20. AUXILIARY VALVE SECTION FUNCTIONS 3 AND 4 (HIGH FLOW)
21. AUXILIARY VALVE SECTION FUNCTIONS 3 AND 4 (STANDARD FLOW)
22. AUXILIARY VALVE SECTION FUNCTION 3 (STANDARD FLOW)
23. FLOW REGULATOR VALVE
24. PRESSURE PORT (P)
25. STEERING RETURN PORT (T2)
26. MAST PORT (M)
27. TANK PORT (T)
28. TILT ROD PORT (2B)
29. TILT ROD PORT (2A)
30. AUXILIARY WORK PORT (4A)
31. AUXILIARY WORK PORT (3A)



1. PILOT OPERATED SOLENOID VALVE (EHPR)
2. PRIORITY COMPENSATOR VALVE (EC1)
3. PROPORTIONAL SOLENOID VALVE (SP1 AND SP2)
4. COIL (CL1)
5. LOWERING COMPENSATOR VALVE (EC2)
6. CHECK VALVE LIFT CIRCUIT (CV1)
7. KNOB (KN1)
8. MANUAL LOWERING VALVE (NV1)
9. DIAGNOSTIC COUPLING (TP1)
10. COUNTERBALANCED CARTRIDGE
11. FLOW REGULATOR VALVE (FR1)
12. PRIMARY RELIEF VALVE (SEE TABLE 1) (RV1)
13. PROPORTIONAL PILOT OPERATED VALVE (PE1)
14. MAIN VALVE SECTION
15. FITTING
16. HOSE NIPPLE
17. SECONDARY RELIEF VALVE (SEE TABLE 1) (RV2)
18. SINGLE AUXILIARY VALVE SECTION (HIGH FLOW)
19. DOUBLE AUXILIARY VALVE SECTION (HIGH FLOW)
20. MAST PORT (1A)
21. PRESSURE PORT (P)
22. TILT ROD PORT
23. STEERING RETURN PORT (T1)
24. AUXILIARY WORK PORT (3A)
25. TILT ROD PORT (2A)
26. AUXILIARY WORK PORT (4A)

Figure 6. Electro-Hydraulic Control Valve Assembly for Lift Truck Model E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

Table 1. Primary and Secondary Relief Valve Values

Hydraulic Control Valve	Lift Truck Model	Primary Relief Pressure	Secondary Relief Pressure
Valve Assembly 3 Function Standard Flow	E1.50-2.00XM (E25-35Z,E40ZS) (F114)	17.9 MPa (2600 psi)	15.5 MPa (2250 psi)
Valve Assembly 3 Function Standard Flow	J2.00-3.20XM (J40-65Z) (B416), E2.00-3.20 (E45-65Z) (G108), V30ZMD (E210)	22.7 MPa (3300 psi)	15.5 MPa (2250 psi)
Valve Assembly 4 Function Standard Flow	E1.50-2.00XM (E25-35Z,E40ZS) (F114)	17.9 MPa (2600 psi)	15.5 MPa (2250 psi)
Valve Assembly 4 Function Standard Flow	J2.00-3.20XM (J40-65Z) (B416), E2.00-3.20 (E45-65Z) (G108), V30ZMD (E210)	22.7 MPa (3300 psi)	15.5 MPa (2250 psi)
Valve Assembly 4 Function High Flow	E1.50-2.00XM (E25-35Z,E40ZS) (F114)	17.9 MPa (2600 psi)	15.5 MPa (2250 psi)
Valve Assembly 4 Function High Flow	J2.00-3.20XM (J40-65Z) (B416), E2.00-3.20 (E45-65Z) (G108), V30ZMD (E210)	22.7 MPa (3300 psi)	15.5 MPa (2250 psi)
Valve Assembly 3 and 4 Function (High Flow)	E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)	22.06 ±0.7 MPa (3200 ±100 psi)	15.5 ±0.7 MPa (2250 ±100 psi)

The electro-hydraulic control valve is a fully-proportional, closed centered valve. The circuit was designed for an on-demand variable pumping system. A priority flow compensator divides the circuit into a primary and secondary circuit. The primary circuit is protected at the inlet port by a direct acting, differential area relief valve. The secondary circuit pressure is limited by a secondary relief valve.

Control of velocity for the hoist function primarily comes from the fixed displacement pump running at variable speed proportional to the operator's input or demand. The lift flow has priority over the auxiliary functions because of the priority flow compensator on the inlet port. If a second function is operated simultaneously with the lift function, the proportional valve in the lift circuit will control the lift velocity and the pump rotational speed is increased so the input flow exceeds the demand for hoist flow. The inlet compensator provides priority to the hoist function regardless of the load pressure in either the primary circuit or the secondary circuit.

The opening of the lowering solenoid valve controls lowering velocity. The valve is compensated by the lowering compensator. This results in a consistent lowering speed for a given input regardless of load pressure.

The opening of the tilt solenoid valve combined with the pump speed controls the velocity of the tilt function.

Overrunning load and load holding of the tilt function is controlled by the counterbalance valve CB1. The valve has a 3:1 pilot ratio which reduces the amount of pressure required to open the valve when tilting forward. The counterbalance valve has an internal bypass check valve which allows the tilt back with minimal resistance. The inherent low leakage of the counterbalance valve holds the tilt function in place when under load.

The standard flow auxiliary valves are also proportional valves similar to the tilt valve.

The high flow auxiliary valves are pilot operated proportional directional control valves. The opening of the valves is proportional to the pilot pressure applied to the ends of the spool. The EHPR proportional pressure reducing/relieving valves provide the pilot pressure. There are two EHPR valves per auxiliary function. The directional valves are internally pressure compensated. See Figure 7, Figure 8, Figure 9, and Figure 10.

Legend for Figure 7

1. AUXILIARY 2 VALVE (SP5)
2. AUXILIARY 1 VALVE (SP4)
3. TILT CYLINDERS
4. LIFT CYLINDER
5. SECONDARY LOWERING CONTROL INTEGRAL WITH LIFT CYLINDERS
6. PRIMARY LOWERING CONTROL (MOUNTED ON MAST)
7. STEERING CYLINDER
8. STEERING WHEEL
9. STEERING CHECK PORT
10. STEERING CONTROL UNIT
11. HAND PUMP
12. STEERING VALVE
13. MAIN CONTROL VALVE
14. STEERING PUMP
15. STEERING RELIEF VALVE
16. HYDRAULIC TANK
17. HYDRAULIC FILTER
18. HYDRAULIC PUMP
19. PRIMARY RELIEF VALVE (RV1)
20. SECONDARY RELIEF VALVE (RV2)
21. TILT SOLENOID VALVE (SP3)
22. LIFT SOLENOID VALVE (SP1)
23. PRIORITY COMPENSATOR VALVE (EC1)
24. LOWERING COMPENSATOR VALVE (EC2)
25. TILT COUNTERBALANCE VALVE (CB1)
26. CHECK VALVE LIFT CIRCUIT (CV1)
27. FLOW REGULATOR VALVE (FR1)
28. LOWER SOLENOID VALVE WITH MANUAL OVERRIDE (SP2)
29. GAUGE PORT
30. AUXILIARY VALVE SECTION

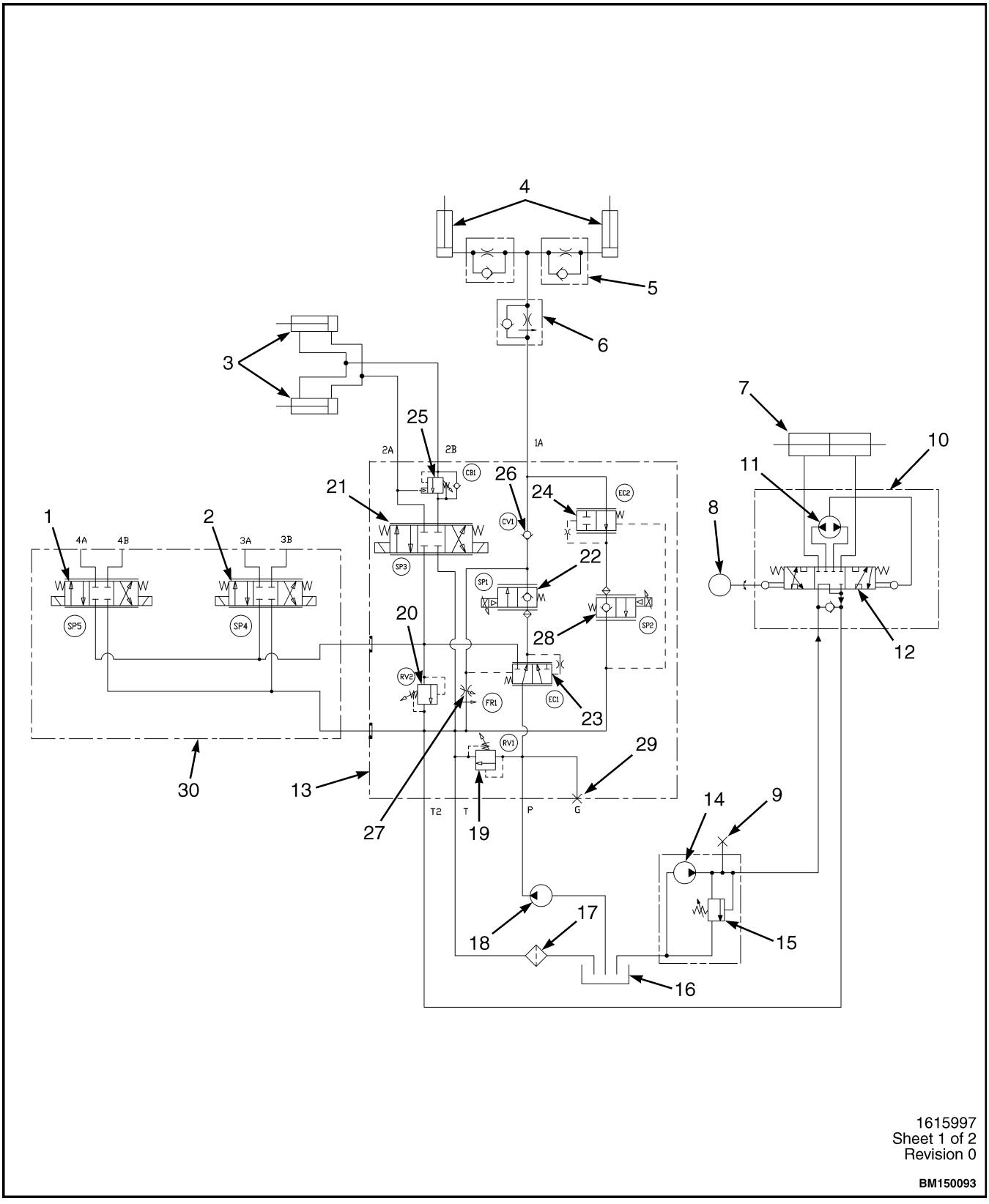


Figure 7. Electro-Hydraulic Control Valve Schematic (Standard Flow), all Trucks Except V30ZMD (E210) and E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

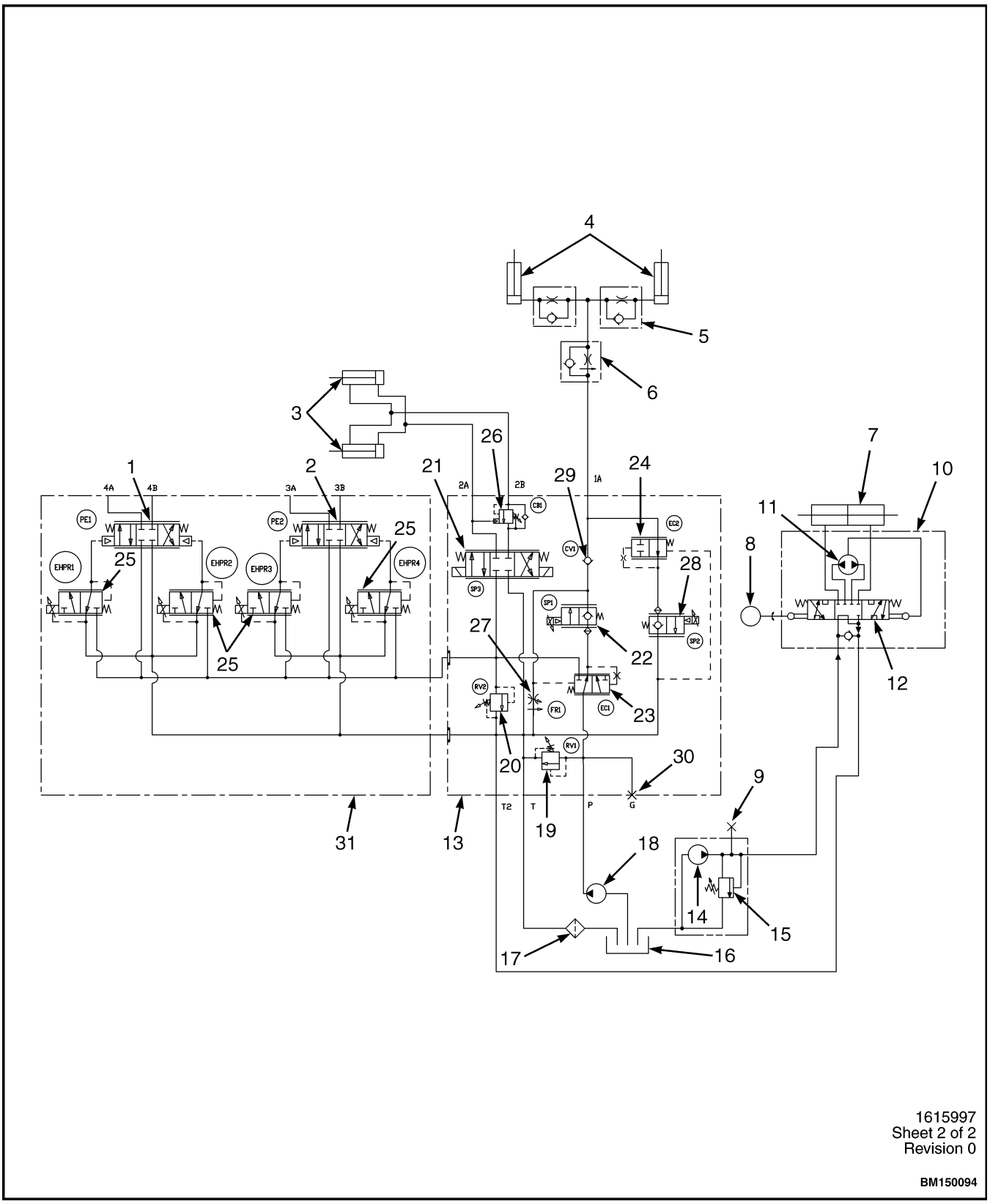


Figure 8. Electro-Hydraulic Control Valve Schematic (High Flow) for Lift Truck Models J2.00-3.20XM (J40-65Z) (B416), E2.00-3.20XM (E45-65Z) (G108), and E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114)

Legend for Figure 8

1. PILOT-OPERATED SPOOL VALVE (PE1)
2. PILOT-OPERATED SPOOL VALVE (PE2)
3. TILT CYLINDERS
4. LIFT CYLINDER
5. SECONDARY LOWERING CONTROL INTEGRAL WITH LIFT CYLINDERS
6. PRIMARY LOWERING CONTROL (MOUNTED ON MAST)
7. STEERING CYLINDER
8. STEERING WHEEL
9. STEERING CHECK PORT
10. STEERING CONTROL UNIT
11. HAND PUMP
12. STEERING VALVE
13. MAIN CONTROL VALVE
14. STEERING PUMP
15. STEERING RELIEF VALVE
16. HYDRAULIC TANK
17. HYDRAULIC FILTER
18. HYDRAULIC PUMP
19. PRIMARY RELIEF VALVE (RV1)
20. SECONDARY RELIEF VALVE (RV2)
21. TILT SOLENOID VALVE (SP3)
22. LIFT SOLENOID VALVE (SP1)
23. PRIORITY COMPENSATOR VALVE (EC1)
24. LOWERING COMPENSATOR VALVE (EC2)
25. PILOT-OPERATED SOLENOID VALVE (EHPR1 THROUGH 4)
26. TILT COUNTERBALANCE VALVE (CB1)
27. FLOW REGULATOR VALVE (FR1)
28. LOWER SOLENOID VALVE WITH MANUAL OVERRIDE (SP2)
29. CHECK VALVE LIFT CIRCUIT (CV1)
30. GAUGE PORT
31. AUXILIARY VALVE SECTION

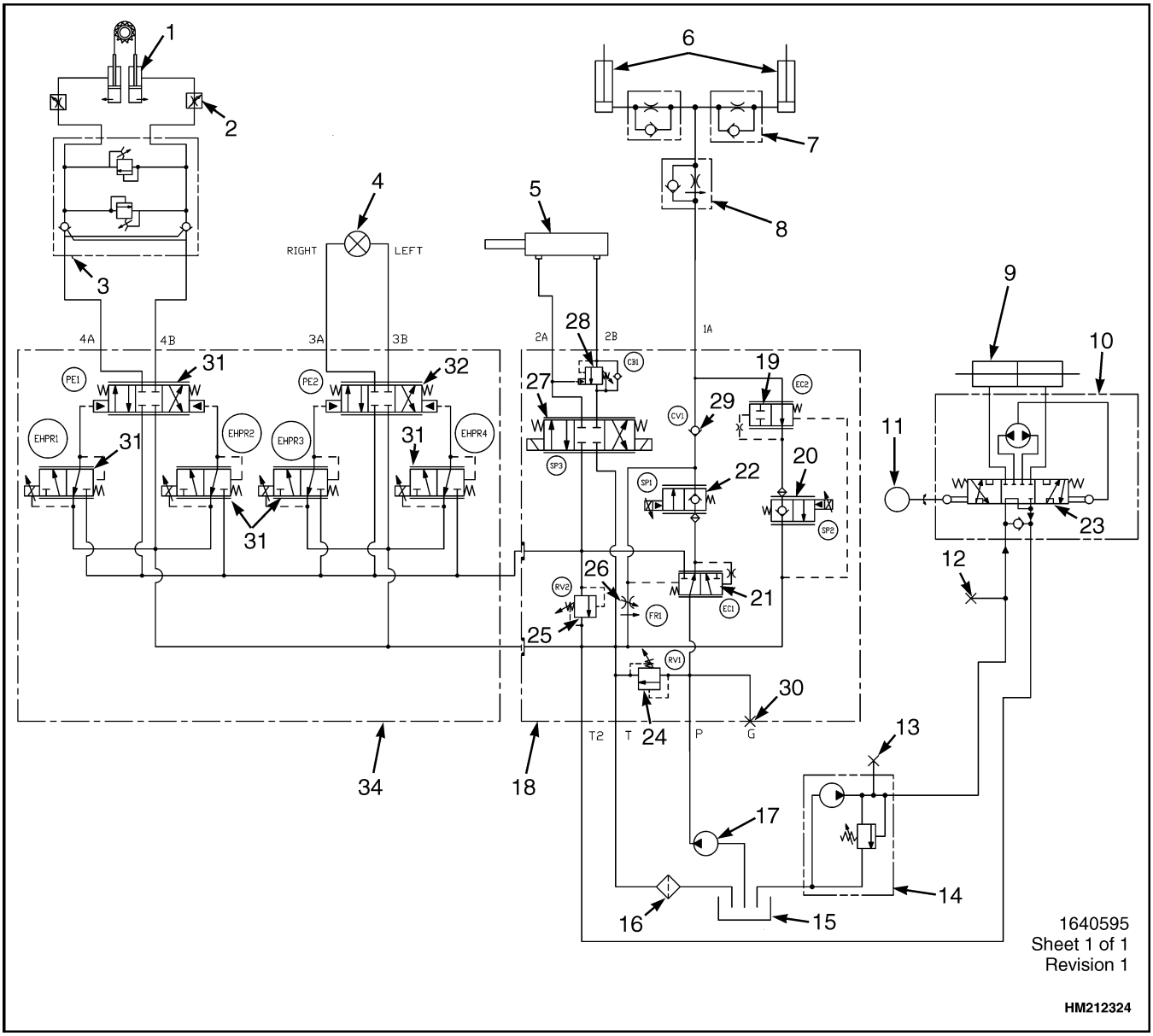
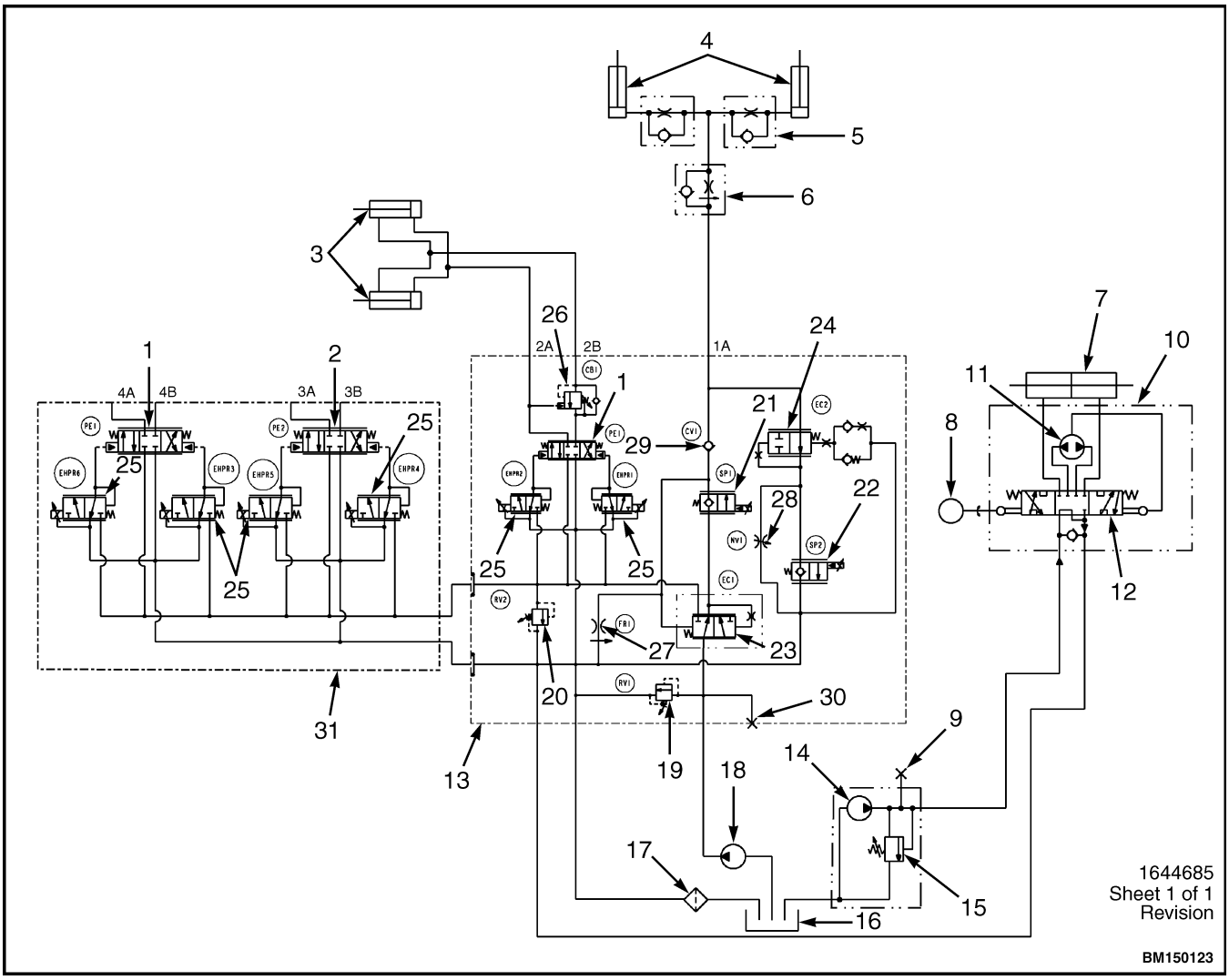


Figure 9. Hydraulic Schematic With Electro-Hydraulics for Lift Truck Model V30ZMD (E210)

Legend for Figure 9

1. SINGLE ACTING PIVOT CYLINDER
2. ADJUSTABLE FLOW RESTRICTOR
3. LOCK/CROSS OVER RELIEF VALVE
4. TRAVERSE HYDRAULIC MOTOR
5. SIDESHIFT CYLINDER
6. LIFT CYLINDERS
7. SECONDARY LOWERING CONTROL
8. PRIMARY LOWERING CONTROL
9. STEERING CYLINDER
10. HAND PUMP
11. STEERING WHEEL
12. LINE PRESSURE TAP
13. CHECK PORT
14. STEERING PUMP
15. HYDRAULIC TANK
16. HYDRAULIC FILTER
17. HYDRAULIC PUMP
18. MAIN CONTROL VALVE
19. LOWERING COMPENSATOR VALVE (EC2)
20. LOWERING SOLENOID VALVE WITH MANUAL OVERRIDE (SP2)
21. PRIORITY COMPENSATOR VALVE (EC1)
22. LIFT SOLENOID VALVE (SP1)
23. STEERING VALVE
24. PRIMARY RELIEF VALVE (RV1)
25. SECONDARY RELIEF VALVE (RV2)
26. FLOW REGULATOR VALVE (FR1)
27. TILT CYLINDER VALVE (SP3)
28. TILT COUNTERBALANCE VALVE (CB1)
29. CHECK VALVE LIFT CIRCUIT (CV1)
30. GAUGE PORT
31. PILOT OPERATED SOLENOID VALVE (EHPR 1 THROUGH 4)
32. PILOT OPERATED SPOOL VALVE (PE1)
33. PILOT OPERATED SPOOL VALVE (PE2)
34. AUXILIARY VALVE SECTION

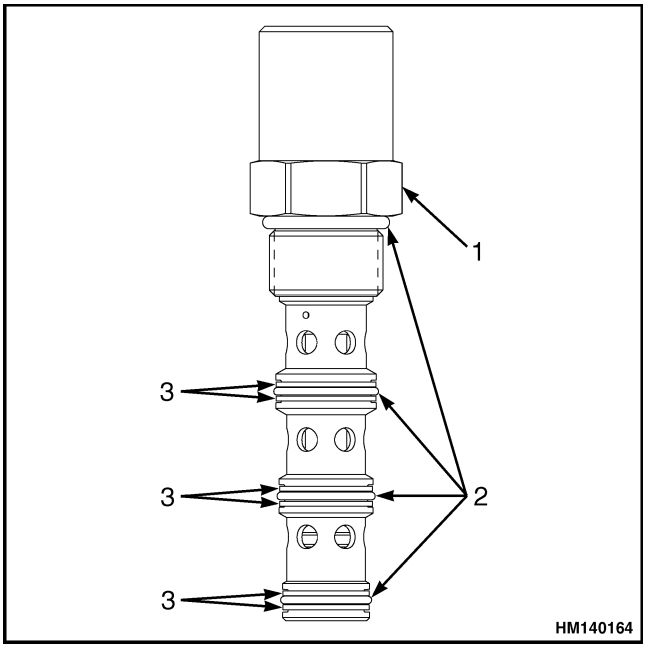


1. PILOT-OPERATED SPOOL VALVE (PE1) (AUXILIARY 4)
2. PILOT-OPERATED SPOOL VALVE (PE2) (AUXILIARY 3)
3. TILT CYLINDERS
4. LIFT CYLINDERS
5. SECONDARY LOWERING CONTROL (INTEGRAL W/LIFT CYLINDERS)
6. PRIMARY LOWERING CONTROL (MOUNTED ON MAST)
7. STEERING CYLINDER
8. STEERING WHEEL
9. STEERING CHECK PORT
10. STEERING CONTROL UNIT
11. HAND PUMP
12. STEERING VALVE
13. MAIN CONTROL VALVE
14. STEERING PUMP
15. STEERING RELIEF VALVE
16. HYDRAULIC TANK
17. HYDRAULIC FILTER
18. HYDRAULIC PUMP
19. PRIMARY RELIEF VALVE (RV1)
20. SECONDARY RELIEF VALVE (RV2)
21. PROPORTIONAL SOLENOID VALVE (LIFT) (SP1)
22. PROPORTIONAL SOLENOID VALVE (LOWERING) (SP2)
23. PRIORITY COMPENSATOR VALVE (EC1)
24. LOWERING COMPENSATOR VALVE (EC2)
25. PILOT-OPERATED SOLENOID VALVE (EHPR 1 THROUGH 6)
26. TILT COUNTER BALANCED VALVE (CBI)
27. FLOW REGULATOR VALVE (FRV)
28. MANUAL LOWERING VALVE (NV1)
29. CHECK VALVE LIFT CIRCUIT (CV1)
30. GAUGE PORT
31. AUXILIARY VALVE SECTION (DUAL AUXILIARY VALVE SHOWN)

Figure 10. Hydraulic Schematic With Electro-Hyraulics for Lift Truck Models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

The main control valve block contains the following components:

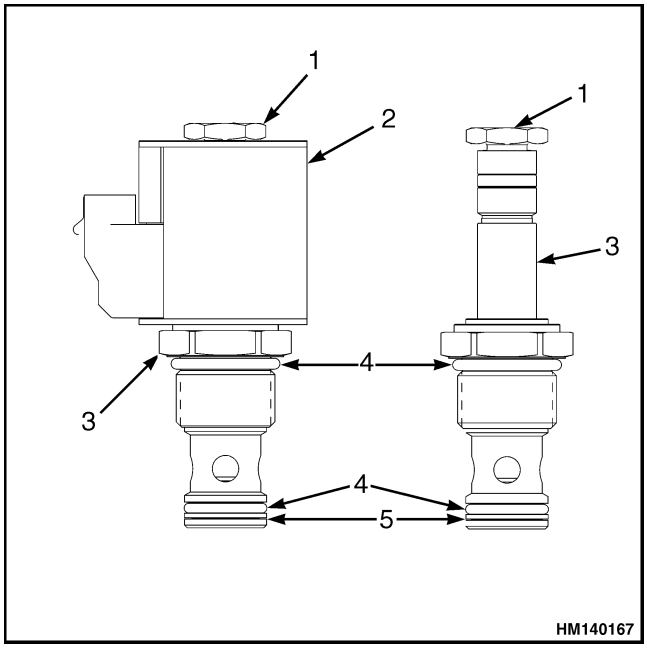
- Priority Compensator Valve (EC1): The priority compensator is a load sensing priority on-demand compensator. It provides priority flow to the lift circuit. It also compensates the lift function by maintaining a constant pressure drop across the lift solenoid valve. Excess flow not demanded by the priority circuit (lift circuit) is bypassed to the secondary circuit. With no demand for flow on primary circuit, all of the flow is available to the auxiliary circuit. See Figure 11.



1. PRIORITY COMPENSATOR
2. O-RING
3. BACKUP RING

Figure 11. Priority Compensator Valve

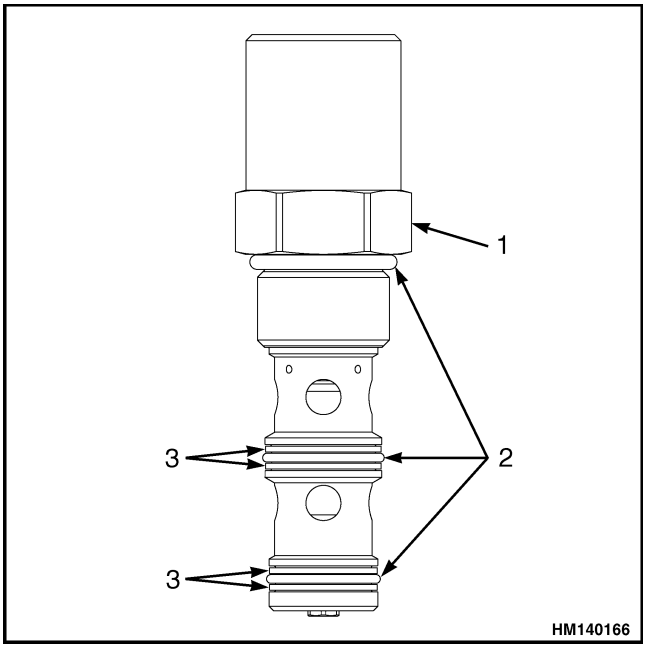
- Lift Solenoid Valve (SP1): The Lift Solenoid Valve is a normally closed-proportional poppet valve. Increasing current in the coil opens the valve by causing the main poppet to lift. When closed, the valve has a leakage rate of a few drops per minute. See Figure 12.



1. NUT
2. SOLENOID
3. CARTRIDGE
4. O-RING
5. BACKUP RING

Figure 12. Lift Solenoid Valve

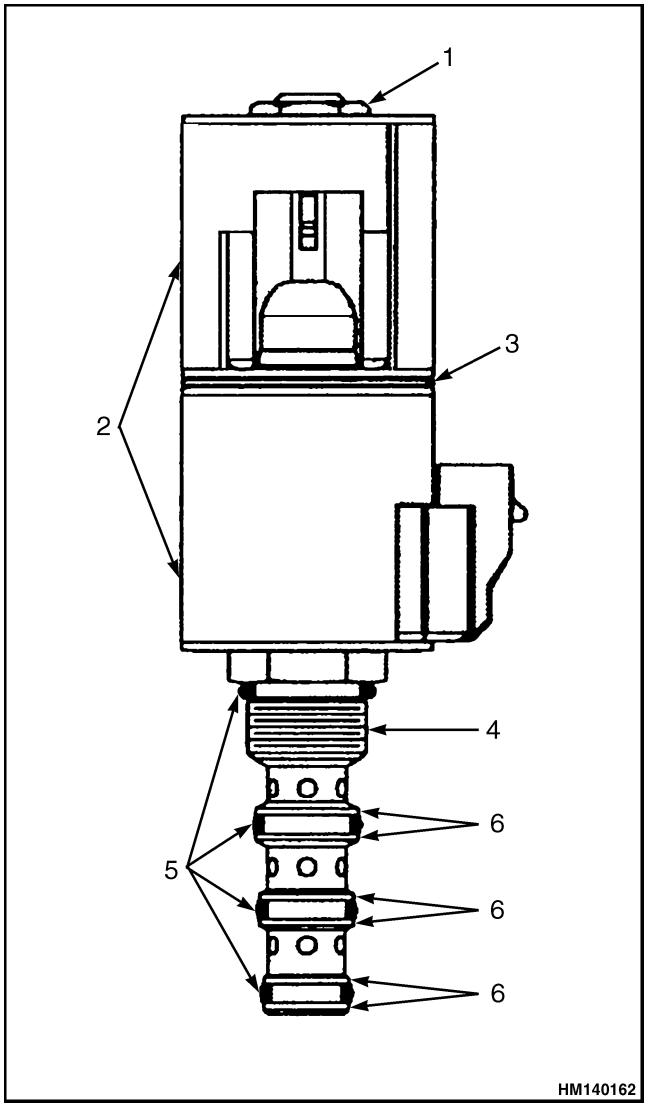
- Lowering Compensator Valve (EC2): This is a compensator designed specifically for gravity lowering circuits. It includes damping features for stability and low leakage design for load holding applications. See Figure 13.



1. LOWERING COMPENSATOR VALVE
2. O-RING
3. BACKUP RING

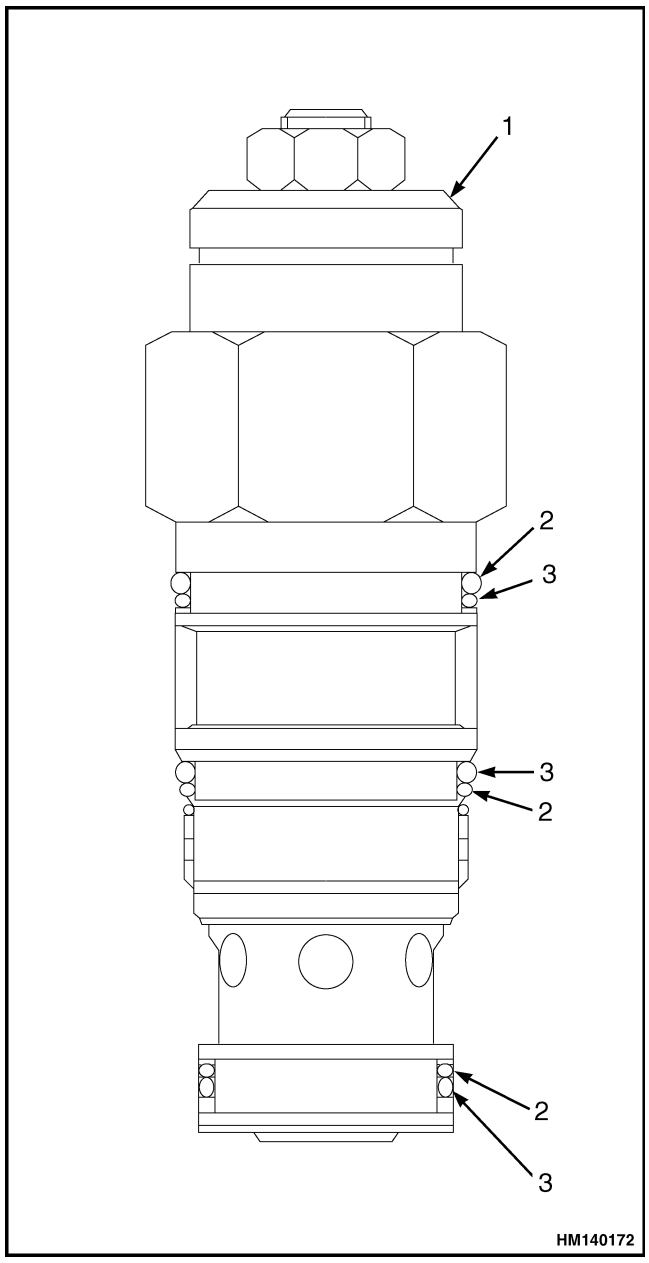
Figure 13. Lowering Compensator Valve

- Tilt Solenoid Valve (SP3): For lift truck models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210), this is a direct-acting valve that increases opening with increasing current in the coils. When in the non-energized or neutral position, the pressure port and work ports are blocked. This is a four-way, three-position valve utilizing 2 coils. This provides control of both directions with one valve. See Figure 14.
- Tilt Counterbalance Valve (CB1): For lift truck models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210), the tilt counterbalance valve is a semi-restrictive counterbalance valve with a 3:1 pilot ratio. The valve is designed to control overrunning loads, as well as, hold loads in position at low leakage. See Figure 15.



1. NUT
2. SOLENOID
3. SPACER
4. CARTRIDGE
5. O-RING
6. BACKUP RING

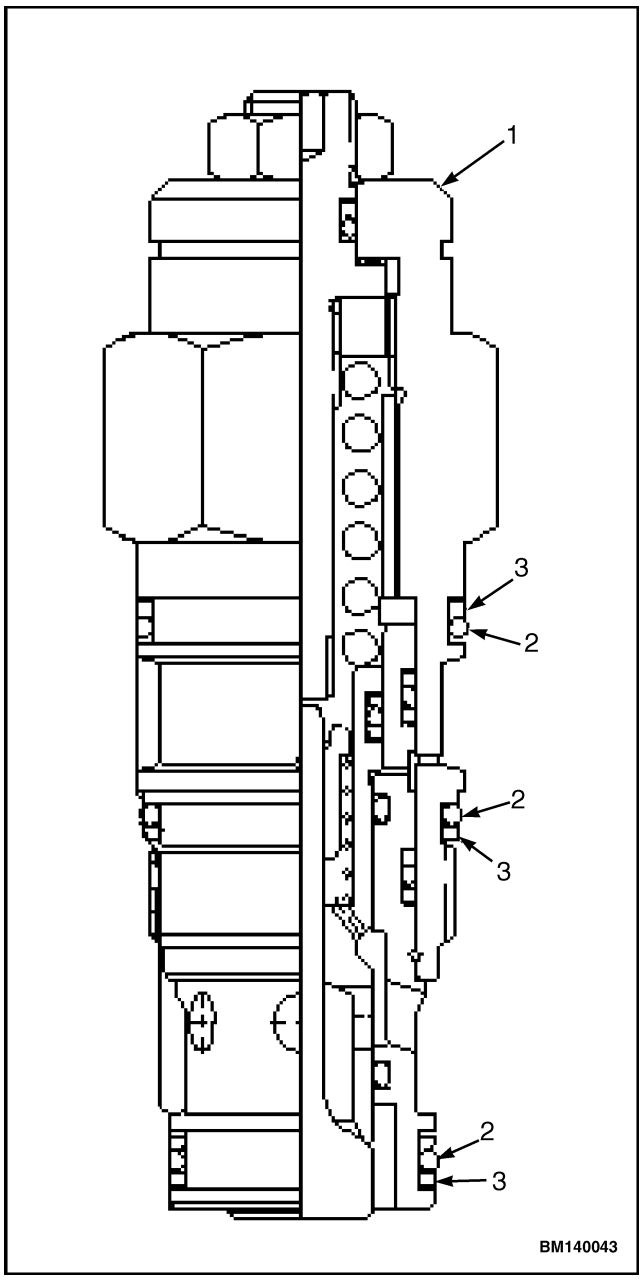
Figure 14. Tilt Solenoid Valve for Lift Truck Models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210)



1. TILT COUNTERBALANCE VALVE
2. O-RING
3. BACKUP RING

Figure 15. Tilt Counterbalance Valve For lift truck models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210)

- Tilt Counterbalance Valve (CB1): For lift truck models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098), the tilt counterbalance valve is a semi-restrictive counterbalance valve with a 3:1 pilot ratio. The valve is designed to control overrunning loads, as well as, hold loads in position at low leakage. See Figure 16.

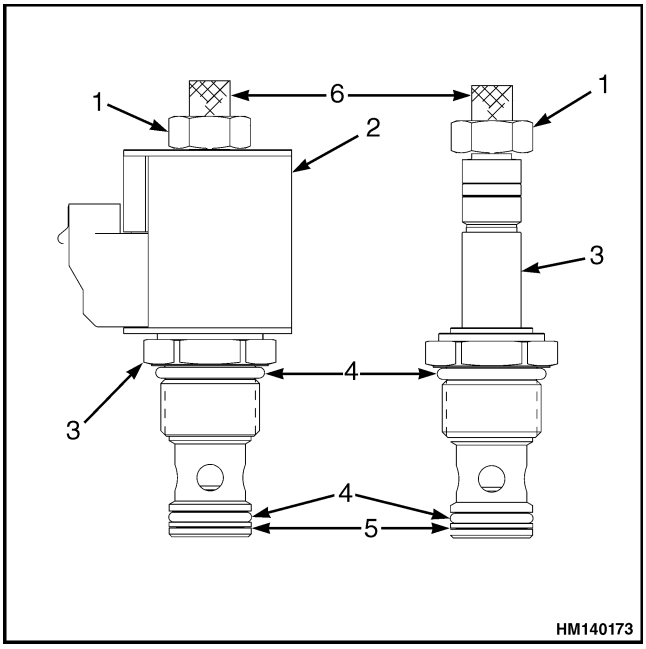


1. TILT COUNTERBALANCE VALVE
2. O-RING
3. BACKUP RING

Figure 16. Tilt Counterbalance Valve for Lift Truck Models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

- Lowering Solenoid Valve and Manual Lowering Valve (SP2): For lift truck models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210), the Lowering Solenoid Valve is a normally closed-proportional poppet valve. Increasing current in the coil opens the valve by causing the main poppet to lift. When closed, the valve has a leakage rate of a few drops per minute.

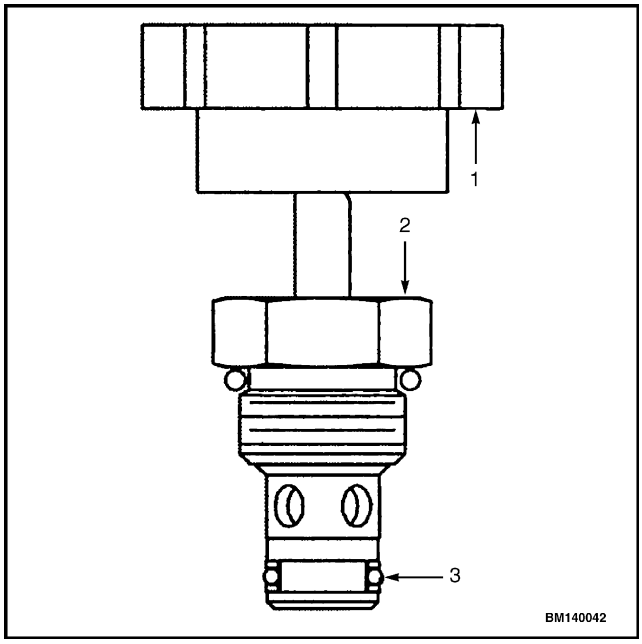
  The manual lowering valve is used to lower the load in the event of an electrical power failure. The manual lowering valve has a knurled portion on the end of the lowering solenoid valve shaft. The manual lowering valve is activated by pushing in and turning the knurled shaft to the left (counterclockwise), it will then pop out to safely lower the load. When the load is lowered the knurled shaft is pushed back in and turned to the right (clockwise) to close the manual lowering valve. See Figure 17.



1. KNOB
2. VALVE
3. CARTRIDGE
4. O-RING
5. BACKUP RING
6. KNURLED SHAFT

Figure 17. Lower Solenoid Valve With Manual Override For Lift Truck Models J2.00-3.20XM (J40-65Z) (B416), E1.50-2.00XM, E2.00XMS (E25-35Z, E40ZS) (F114), E2.00-3.20XM (E45-65Z) (G108), and V30ZMD (E210)

- Manual Lowering Valve (NV1): For lift truck models E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098), the manual lowering valve is used to lower the load in the event of an electrical power failure. The manual lowering valve has a knob on the end of the lowering solenoid valve shaft. The manual lowering valve is activated by turning the knob to the left (counterclockwise) to safely lower the load. When the load is lowered the knob is turned to the right (clockwise) to close the manual lowering valve. See Figure 18.



1. KNOB
2. VALVE
3. O-RING

Figure 18. Manual Lowering Valve for Lift Truck Model E3.50-5.50XL, E4.50XLS (E70-120Z, E100ZS) (E098)

- Pump Pressure Gauge Port: Pressure reading point for the valve inlet pressure as supplied by the hydraulic pump. The pump pressure port is labeled Port G on the control valve.
- Steering Return Port: Hydraulic oil from the steering system is routed through the main block and combined with the valve return flow to the return filter and then to the hydraulic oil tank. The steering return port is labeled T2 on the control valve.
- Check Valve (CV1): The check valve is part of the lift circuit. Its purpose is to block the escape of oil from the mast through the lift circuit. See Figure 19.