Customer Unmet Need

A lift truck manufacturer recognized the need to streamline and update their hydraulic systems. Eliminating traditional hydraulic components from the operators cab was critical. In addition, there was a need to simplify the methods for troubleshooting system issues.

One main objective was to combine as many functions as possible into one package, to reduce/simplify the system plumbing.

Solution

A single integrated hydraulic valve assembly was developed to house all of the priority steering, braking and other typical lift truck functions. The center manifold was designed to adapt to both the open-center V20 and VG35 sections that control the “Lift”, “Tilt”, and “Accessory” functions on the machine. A special “bottom ported” VG35 section was developed to assist with the machine plumbing issues.

IQAN electronics was used to control all of the major machine functions, as well as provide improved diagnostic capabilities. The use of the IQAN electronics eliminated the hydraulics from the operators cab.

Success Factors

- Developed a custom integrated valve package to control the “Lift” truck functions.
- Utilized the IQAN (MD3 & XA2) product to drive the hydraulic functions.
- Introduced a special “bottom ported” VG35 work section to address the close quarter plumbing issues.
- Combined our typical stack style V20 and VG35 sections via a custom center inlet manifold.

Customer Values

- Elimination of the pneumatic system and compressor saves ~$300/machine.
- Wireless diagnostic capabilities for the hydraulic, engine, and transmission systems reduces on-site trouble-shooting. Estimated savings were $20K/yr.
- Simplified the machine plumbing saves ~$100/machine.
- Fewer suppliers for their Fluid Power needs.
- Opportunity to utilize one supplier to obtain the products in assembly kit saves ~$8K/year.

Benefit: Improved Serviceability & Fewer Components

Market: Lift Truck Market

Product: HVD Systems

Contact: Chip Knothe, Application Engr. 864-706-0412
Customer Unmet Need

Forestry feller-bunchers and harvesters typically need to operate the implement and tool functions at lower pressures than the track functions. However, to maintain cycle time and reduce heat it is very important that the reduced pressure is NOT achieved by using port relief-valves which would vent high flows to tank and result in lost speed and increased heat.

Additionally, this equipment needs to be very productive; therefore, cycle times are critical. This often results in pump over-demand conditions which can adversely affect productivity in traditional pre-compensated valves, because the function with the highest pressure can involuntarily shutdown.

Solution

Parker models L90 and K220 are pressure compensated, load-sense type valves that have the capability of selectively limiting the work port pressures via the feed reducers located in the work section. These feed reducers pass a minimal amount of flow to tank (0.25 GPM) when the target pressure is reached.

Additionally, Parker can add hardware to each work section that will enable it to have flow-sharing capability. This means that in a pump over-demand condition, the speed of the selected functions will slow down, but they will maintain the speed relationship selected by the operator.

Success Factors

- The ability to integrate flow-sharing technology into a control valve with pressure-limiting (feed reducers) capability.
- Priority to a function can be achieved by not adding the flow-sharing hardware to that work section. This is useful for the clamp function and steering circuits in other types of machines.
- Uptime and productivity are critical in the forestry market and the L90 and K220 valve models are proven performers.

Customer Values

- Flow-sharing can save up to $1,000/machine without having to go to a larger pump.
- Work sections with pressure limiting (feed reducers) can be configured so that they also limit the pressures to any downstream sections. This saves the cost of those feed reducers and the time spent by the manufacturer to adjust them.
- Due to the savings of feed reducers, the customer could downsize the cooler by 20%.

Benefit: Improved Productivity
Market: Forestry and other mobile equipment
Product: HVD Systems
Contact: Jonas Knutsson & Tim Paisley - Product Mgrs (847-955-5018) and (847-955-5292)
Customer Unmet Need

An electric lift truck manufacturer had a requirement to receive an electrical signal from a switch when a spool would move from neutral. This signal would be used to communicate with a controller, which would command a variable speed electric motor connected to a fixed pump, to rotate at a specific RPM equal to the maximum flow rating for each spool function.

Although the maximum flow for that function would be obtained when the spool was at full stroke, flow and energy consumption was wasted whenever the spool was used for precise metering.

Solution

An infinitely variable spool stroke sensor was developed for the V10 directional control valve. This sensor produces a signal proportional to the spool stroke, so now the customer can drive their electric motor/pump for the exact flow required at a specific spool stroke, therefore, wasting no excess flow and extending battery life.

Furthermore, the spool metering area can be increased to lower the pressure drop since the pump output is used to control the function speed. The pump output flow can also be customized for a non-linear profile when improved sensitivity is desired at the start of flow.

Success Factors

- A non-contact, solid-state, programmable “hall effect” sensing element was used for long life with no mechanical adjustments.
- A durable plastic housing was used for its low cost, corrosion resistance and its non-magnetic characteristics required for this type of sensor.
- The sensor housing also serves as the end cap for the centering spring assembly.
- The sensor plunger is spring loaded against the centering spring assembly for ease of installation and field service.

Customer Values

- Reduced warranty cost of field-adjustment and repair of switches expected to save customer $10K/year.
- Hydraulic efficiency increased by 20% for typical operation of truck.
- Improved safety of operation by using non-contacting sensing device instead of mechanical switches.
- Improved customer reputation for producing reliable product.

Benefit: Spool Position Feedback
Market: Mobile Equipment
Product: V10 Directional Control Valve
Contact: Jim Janecke (262-549-1705)
V20 Propel Circuit
Innovative Mobile Solutions from Hydraulic Valve Division

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Improved Performance and Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Construction</td>
</tr>
<tr>
<td>Product</td>
<td>V20 Open-Center Directional Control Valve</td>
</tr>
</tbody>
</table>

Customer Unmet Need:
Operators were having difficulty loading and unloading a small directional drill unit off trailers. The propel was surging when flow was first introduced to the propel motors in either travel direction. Operator safety and potential equipment damage was a major concern. High operating temperatures due to system pressure losses was another concern. A major hydraulic circuit redesign was not an acceptable solution due to costs and time constraints.

Solution:
A customized propel spool was developed for this open-center application. Review of the flow requirements resulted in increasing the valve size and development of a spool to improve the metering characteristics of the propel circuit. Development turnaround time was reduced since all testing was done on the customer’s machine. Other improvements to additional Parker components were incorporated during the testing phase.

Success Factors:
- Strong long term relationship with the customer.
- Minimum development time.
- Improved operating characteristics. The propel drive motors can inch the machine forward or in reverse. No bucking as before.
- Minimum increase to final vehicle cost.
- New valve reduced heat generation and allowed for smaller oil cooler.

Customer Unmet Need:
- Improved safety and performance. Users can now inch the unit off trailers. As the customer advertises “easy to mobile”.
- More consistent operation. Each unit operates the same as the next.
- Minimum turnaround time to introduce performance improvements to the market.
- Less heat generation allowed for a smaller oil cooler (cost savings $125 per unit).

Success Factors:

<table>
<thead>
<tr>
<th>Workport Flow (Gpm)</th>
<th>Spool Stroke (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>-0.300</td>
</tr>
<tr>
<td>30</td>
<td>-0.200</td>
</tr>
<tr>
<td>20</td>
<td>-0.100</td>
</tr>
<tr>
<td>10</td>
<td>0.000</td>
</tr>
<tr>
<td>0</td>
<td>0.100</td>
</tr>
<tr>
<td>-0.100</td>
<td>0.200</td>
</tr>
<tr>
<td>-0.200</td>
<td>0.300</td>
</tr>
<tr>
<td>-0.300</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Customer Values:
- Improved safety and performance. Users can now inch the unit off trailers. As the customer advertises “easy to mobile”.
- More consistent operation. Each unit operates the same as the next.
- Minimum turnaround time to introduce performance improvements to the market.
- Less heat generation allowed for a smaller oil cooler (cost savings $125 per unit).
Customer

Unmet Need

A refuse truck manufacturer was using an open-center model VA35 operated directional control valve that was operated pneumatically, and wanted to convert to electrohydraulic operation.

These were the three main goals of the customer:
1) To have the valve generate and regulate the pilot pressure to select the spools.
2) Maintain pilot pressure to the solenoids, during a pump over-demand condition.
3) To ensure that the operator must actuate a switch to allow operation of the main control valve.

Solution

A section was developed that could be integrated into a model VA35 directional-control valve that accomplished these three goals.

Upon selecting a spool, pilot pressure is generated so the valve has sufficient pressure to move the spool. Once the load pressure is inside the valve, the integrated pressure-reducing valve regulates the pilot pressure to the solenoids to a level within their pressure rating.

Also, during pump over-demand conditions, the pressure to the solenoids is kept stable. This improves productivity vs. designs that have the pressure-reducing valve in the outlet.

Success Factors

- Minimal impact on open-center pressure drops, when the spools are in neutral.
- No impact on loop pressure drops (P-A/B & A/B-T).
- Pilot pressure “triggered” to on, only when a spool is selected.
- Dedicated drain of pilot signal ensures stability of the main spool.

Customer Values

- An in-line solution for generating and regulating the pilot signal would have had a premium of $125/machine.
- Fuel savings associated with only having pilot pressure on-demand are estimated at $15,000 over the life of the machine. This is based upon 10,000 hours of use.

Benefit: Improved controllability with electrohydraulics

Market: Refuse and all mobile

Product: Model VA35 Directional Control Valve

Contact: Rob Shimko, Product Mgr.  419-518-1209
    John Schurman, Product Mgr.  763-531-3555

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035 USA
Tel: 440-366-5200
Fax: 440-366-5253
www.parker.com/hydraulicvalve
**Customer**

**Unmet Need**

Refuse Front Loader operation can be grouped into high and low usage functions. The high usage functions are the “arms, forks and packer” -- while the low usage functions are “tailgate, tailgate lock and top door”.

It is desirable to have all of the functions consolidated into one valve assembly. However, it is undesirable to have parallel path pressure from the high-usage functions find its way into the work-ports of the low-usage functions, because this can cause function drift or pressure intensification.

**Solution**

By placing the high usage, parallel sections first in the assembly and making the first low-usage section with tandem circuitry, parallel path pressure cannot be conveyed to downstream work-sections. Therefore, the low usage sections do not see high pressure in the power core when the high usage sections are operating. This prevents unwanted drift for the low usage functions.

This same type of arrangement could be applicable in many other pieces of mobile equipment.

---

**Success Factors**

- Application specialist assigned to the refuse market.
- Tandem circuitry was a part of the product breadth for the VA35 valve model line.
- Incumbent on machine.
- Responsive to customer’s needs.

**Customer Values**

- Eliminating the need for in-line pilot-operated checks saves approximately $200/machine. This is based upon three low-usage functions per valve assembly.
- For other pieces of mobile equipment, the savings should approximate $65-$70 / function.
Customer Unmet Need

A lift-truck manufacturer wished to improve the rigidity of their mast. Specifically, during the transport mode, the two tilt cylinders tended to transfer oil to each other. This was possible because the cylinders were connected to the directional control valve port via two lines and a T-fitting. This resulted in spongy operation and exerted additional stress on the mast.

Solution

Parker designed a work-section with two “B” ports that could be stacked into our model VG35 directional control valve. This enabled each tilt cylinder to be connected directly to a port on the control valve.

The dual-ported work-section isolates each cylinders “raise” line when the spool is in neutral. This means the two “B” ports are not in parallel when the spool is in neutral. Therefore, if one of the hoses should fail, the load will be supported by the other cylinder.

Success Factors

- Close working relationship with the customer.
- Integrating the solution into the existing main control valve.
- Isolating each line that is plumbed to the two tilt cylinders.
- Being able to isolate the two “B” ports within the work-section when the spool is in neutral.

Customer Values

- An in-line solution that would include counter-balance valves and extra plumbing would have cost $125/machine.
- Vendor consolidation and fewer purchase orders can save $300-500/year.

Benefit: Cost Savings
Market: Lift Trucks
Product: HVD Systems
Contact: Rob Shimko, Product Manager
   419-518-1209; rshimko@parker.com

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035 USA
Tel: 440-366-5200
Fax: 440-366-5253
www.parker.com/hydraulicvalve
Customer
Unmet Need

A wheel loader manufacturer had a problem with machine cavitation during the boom-down and bucket dump segments of the cycle. This resulted in spongy operation and pre-mature component wear.

For the customer, it was critical that the cycle times not be compromised and that pump displacement not be increased.

Solution

A new outlet was developed for our VP170 pressure-compensated, load-sense valve with flow sharing. This outlet maintains a fixed backpressure in the tank core and forces oil across any anti-cavitation checks when the machine is cavitating. In addition, if there is still a void in the control valve’s tank core when the spools are returned to neutral, the valve will keep the piston pump on stroke until that fixed pressure is reached. This eliminates unnecessary machine manipulation to correct the hydraulic void and ensures that a clean and crisp load-sense signal between the control valve and pump is maintained.

Success Factors

- Very close working relationship with the machine engineers.
- Excellent application knowledge of wheel loaders.
- The solution was able to maintain a fixed pressure level in the control valve tank core, regardless of the cylinder exhaust flow.
- The solution addressed the possibility of having a void in the hydraulic loop when the spools were brought back to neutral.

Customer Values

- Compared to an in-line solution, the annual savings was $200K. In addition, an in-line approach would not have been as effective.
- Machine performance was made more consistent, because the load-sense signal to the pump did not degrade.
- Cylinder seal life was increased 5-10%.

Benefit: Longer component wear and productivity
Market: Mobile machines with fast cycle times.
Product: HVD Systems
Contact: Sonny Duttaroy – Technical Sales 419-518-1356
Customer Unmet Need

An Aerial-Work Platform manufacturer needed a way to limit the extension of the upper and lower boom cylinders, in order to prevent the machine from getting outside its safety zone (anti-tip).

The customer wanted the solution to be integrated into the existing directional control valve, and it needed to limit the extension of the boom cylinders, but allow full retraction of the boom cylinders.

Solution

Integrate logic into the VPL directional control valve that enables a work port to become selectively disabled and thereby, preventing the operator from putting the machine in a possible “tip-over” condition.

This was accomplished by adding a small pilot-operated check in the work-section. This check is in parallel with the spring chamber of the compensator. When the backside of the check is vented to tank thru an in-line valve, the work-section compensator is closed.

Load-Sense Disabling

Success Factors

- The disabling of the load-sense signal can be configured for work-section port A, B or A & B.
- Integration of pilot-operated check into the VPL Directional Control Valve.
- Integration of the 2-position 3-way solenoid valve into the directional control valve. An in-line solution is optional.
- One in-line solenoid used to vent the load-sense signal of several work sections.

Customer Values

- Saved the customer ~$80/machine vs. an in-line solution. This pertains to load-sense disabling for two work sections.
- Vendor consolidation and fewer purchase orders can save $300-500/year.
- Improved safety thru an optimized match between the unloading valve, the solenoid valve and the main directional control valve.

Benefit: Integrated Anti-Tip Control

Market: Aerial-Work Platforms, Cranes and Firetrucks

Product: HVD Systems

Contact: Tim Paisley and Jonas Knutsson (847-955-5292 and 847-955-5018)
Customer
Unmet Need

Truck-mounted cranes oftentimes employ a two pump hydraulic system for separate control of the main winch and the other boom functions. However, there is also the need to selectively combine both pump flows to achieve a “burst of speed” for the winch. This is required for high speed winch control, during set-up with an empty hook - and for two speed control of light loads. Typically, in-line solenoids and manifolds were used to provide the logic for the winch speed control.

Solution

Design an integrated solenoid and dump cartridge that could be installed into an outlet that has low and high-pressure ports. When the solenoid is de-energized, all of the pump flow goes to tank via the low-pressure port. When the solenoid is energized, open-center flow is now directed out of the power-beyond port and combined with second pump for the winch “burst of speed.”

Success Factors

Parker’s application knowledge is extensive for truck-mounted crane circuits and end-user preferences. This knowledge facilitated the development of a well-defined design brief that reflected the voice of the customer.

Consequently, Parker was able to provide the customer with a differentiated solution and a cleaner package.

Customer Values

- Reduced circuit complexity and reduction of hoses and fittings saves approximately $150/machine.
- Vendor consolidation and fewer purchase orders can save $300-500/year.
- On-site application support, during start-up. Value up to $2000.
Heavy duty wreckers used to be a two-man operation. One person needed to be close to the target vehicle, while the other person was positioned at the wrecker control valve. The integration of electronics enabled the addition of radio-remote control and the change to a one-man operation.

A key customer’s unmet need was the need to increase the flexibility of the wrecker, by enabling it to be manually operated from either side of the truck without complex linkage.

Parker has developed a unique spool control allowing for on-off electrohydraulic (radio remote) control and manual operation from both sides of the valve without pivot linkages and supporting brackets.

In addition, on-demand pilot pressure for electrohydraulic operation can significantly reduce energy losses due to heat buildup while the wrecker is idling.

Success Factors

- A close working relationship with the customer facilitated an open dialogue of their needs.
- Pressure generation for the solenoids is only activated when the main spools are selected. This means that open-center pressure drops are kept to a minimum, even if the PTO is engaged.
- Open-center and loop pressure drops of the V20 directional control valve. Machine operation calls for two pumps to dump flow into the control valve, at the same time. Keeping pressure drops low, saves fuel and reduces heat.

Customer Values

- Reduced linkage hardware and the related installation time save an estimated $125/machine.
- On-demand pilot pressure and lower pressure drops save an estimated $500-1000 per year in fuel.

Benefit: Radio remote and dual-side manual operation
Market: Truck – Heavy Duty Wreckers
Product: V20 Directional Control Valve
Contact: John Schurman, Open-Center Product Manager 763-531-3555
Customer Unmet Need

Truck-mounted cranes needed a cost-effective method of deploying an anti-tip system for the boom and tele functions and an anti-two block system for the winch. The driver for this was safety.

Historically, this was achieved with in-line components. Namely, pilot-operated check valves connected to the boom, tele and winch functions. In addition, a 2-position solenoid was plumbed in series with the pilot-operated checks.

Solution

Designed an unloading valve that could be installed into the port relief valve cavity of a directional control valve. The backside of the unloading valve is internally connected to a 2-position solenoid within the control valve. When the solenoid receives a signal from the pressure transducers for the boom and tele or the limit switch for the winch, the solenoid valve will open and vent the backside of the unloading valves. Function flow is then dumped to tank within the control valve.

Success Factors

- Parker’s application knowledge of circuits for truck-mounted cranes and the preferences of end-users were a key factor. This knowledge facilitated the development of a well-defined design brief that reflected the voice of the customer. Consequently, Parker was able to provide the customer with a differentiated solution and a cleaner package.
- The unloading valves and the unloading solenoid were integrated into the main control valve. And the inclusion of back-flow checks in the unloading valves, to prevent involuntary function movement.

Customer Values

- Reduced circuit complexity by integrating unloading valves and solenoid into the main control valve. Estimated savings of $165/machine.
- Fewer leak points.
- Vendor consolidation and fewer purchase orders can save $300-500 per year.
- Improved safety thru an optimized match between the unloading valve, the solenoid valve and the main directional control valve.

Benefit: Integrated anti-tip and anti-two block
Market: Truck-Mounted Cranes
Product: V20 Directional Control Valve
Contact: John Schurman, Product Mgr. 763-531-3555

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035 USA
Tel: 440-366-5200
Fax: 440-366-5253
www.parker.com/hydraulicvalve
Customer Unmet Need

On occasion, there is a need to selectively interrupt the pump flow to the control valve. For example, some aerial work platforms must conform to ANSI Specification A92.2-2001, which indicates that the hydraulic circuit must have the capability of selectively disabling the pump. Also, if they are working close to high power lines, the booms must be insulated and the control valve must be operated via hydraulic-remote.

Solution

Parker developed a special “BLOCKING” inlet for their Series VPL control valve. The inlet houses a special 2-position valve to isolate pump flow from work sections. It also has a pressure-reducing valve which regulates a pilot signal to a hydraulic-remote controller. With the controller in neutral, the 2-position valve is closed and causes the piston pump to be de-stroked. Movement of the controller lever by the operator sends a signal to open the 2-position valve and allow flow to go downstream to the work sections.

Success Factors

- Application expertise with aerial-work platforms.
- Hydraulic valve application knowledge.
- Close working relationship with the customer.
- Responsive to customers’ needs.

Customer Values

- Circuit integration into existing control valves saves expense of approximately $200/machine vs. an in-line solution.
- Fewer part numbers in system and vendor consolidation can save up to $300.
- Fewer leak points.
- Can be used on machines that are operated by hydraulic remote or electric remote.

Benefit: Faster, less complicated system
Market: Aerial Work Platforms and other mobile markets
Product: Series VPL Control Valve
Contact: Tim Paisley, Product Manager  847-955-5292
**Customer Unmet Need**

Historically, hydraulic-remote control systems have the potential for safety related problems. This is due to the fact that the pilot circuit between the remote controller and the control valve is a closed-center circuit. This means that there is no positive flow of oil between these components. Also, during the cold weather, viscosity levels reach intolerable levels. This condition adversely affects the responsiveness of the pilot circuit and can result in the operator not being able to stop the movement of a function.

**Solution**

Parker developed a “purge system” to achieve a backflow for the pilot circuit. This ensures warm oil start-up and purges any air in the pilot circuit. Consequently, satisfactory responsiveness between the controller and the control valve is achieved.

This was accomplished by taking advantage of the fact that pilot circuits are actually open-center circuits, when the flow is circulating from the valve to the controller.

This solution consists of two purge checks installed in the pilot cavity of each work-section.

**Success Factors**

Parker’s application knowledge of Aerial Lift circuits resulted in a clear definition of the problem.

Also, Parker’s design and manufacturing experience of the components in this sub-system facilitated the design of an optimum solution.

**Customer Values**

- Improves safety by ensuring that the response time of the circuit is predictable. Potential savings from litigation could be worth hundreds of thousands of dollars.
- Since the solution is integrated into the VPL vs. an in-line arrangement, the plumbing savings are $175 per machine.

**Benefit:** Warm-oil start-up of pilot circuits

**Market:** Control valves operated via hydraulic-remote

**Product:** HVD Systems

**Contact:** Tim Paisley, Product Mgr. 847-955-5292

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035 USA
Tel: 440-366-5200
Fax: 440-366-5253
www.parker.com/hydraulicvalve