Systems Guide
A Guide to Mobile Hydraulics – Open Centre, Constant Pressure and Load Sensing Systems
Introduction – Definitions

The contents of this brochure highlight important differences between open centre, constant pressure and load sensing systems.

1. Work ports A and B
   Connection for hoses to cylinders or motors.

2. Parallel line

3. Open Centre line
   Gallery for the pump oil in an open centre valve where surplus oil flows. Progressively builds up pump pressure the more the spools are moved out of neutral position.

4. Load check valve
   Prevents oil from going in the wrong direction through the work ports.

5. Work port relief valve
   Relief valve protecting the work ports, with or without anti-cavitation function.

6. Anti-cavitation
   A check valve for refilling.

7. Notch
   Notch pump to tank (P–T), in open centre line, building up system pressure.

8. Notch
   Notch pump to work port (P–W).

9. Notch
   Notch work port to tank (W–T).

10. Spool functionality
    Unit delivering oil to the system.

11. Pump
    Unit delivering oil to the system.

12. Pump connection
    Unit delivering oil to the system.

13. Tank connection
    Unit for containing, cooling and de-airing oil.

14. Tank
    Unit for containing, cooling and de-airing oil.

15. Filter
    Unit for cleaning oil.

16. Cylinder
    Unit converting oil flow to linear movement.

17. Motor
    Unit converting oil flow to rotating movement.

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**Single function operation**
The operator moves one lever/spool at the time.

**Simultaneous operation**
The operator moves two or more levers/spools at the same time.

**Flow interference**
Flow from one section is affected when another section is activated.

**Controllability**
Used for both single function operation and simultaneous operation; indicates how well the valve modulates flow and pressure at each work port.
Mobile valves – spool actuators

<table>
<thead>
<tr>
<th>Manually operated</th>
<th>Pilot operated</th>
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<tr>
<td><strong>Manual</strong></td>
<td><strong>Pneumatic</strong></td>
</tr>
<tr>
<td>1 axis proportional lever</td>
<td>1 and 2 axis proportional levers</td>
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<tr>
<td>No mechanical hysteresis</td>
<td>30 % mechanical hysteresis</td>
</tr>
<tr>
<td>Some force hysteresis</td>
<td>10 % mechanical hysteresis</td>
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<tr>
<td><strong>Hydraulic</strong></td>
<td><strong>Electro-hydraulic</strong></td>
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<tr>
<td>1 and 2 axis proportional levers</td>
<td>1, 2 and 3 axis proportional levers</td>
</tr>
<tr>
<td>10 % mechanical hysteresis</td>
<td>3 % mechanical hysteresis</td>
</tr>
</tbody>
</table>

Mobile motors

Parameters for discussion:

- Displacement
- Axial torque
- Pressure
- Speed
- Sensitivity to dirt
- Sensitivity to temperature shocks

Cylinders and accumulators

Parameters for discussion:

**Cylinders:**
- Stroke
- Diameter
- Pressure
- Service life

**Accumulators:**
- Pressure ratio
- Pre-charge level
- Amplitude
- Frequency
- Volume
# Heat Generation

## – Pump Choice

### Required engine power (kW):

| Highest pressure (bar) x pump flow (l/min) | 600 |

### Fixed pump

![Diagram of fixed pump with heat loss, cylinder 1, and cylinder 2]

- **Heat loss**
- **Cylinder 1**
- **Cylinder 2**

### Bypass:

A spool in L90LS inlet. Enables the use of a fixed displacement pump. When using a bypass, system designation is LS or CFC.

### Gear Pump

- **Light/Medium Duty**

### Vane Pump

- **Medium/Heavy Duty**

### Axial Piston Pump

- **Medium/Heavy Duty**

### System Designations:

- **Open Centre Valve**
- **Closed Centre Valve Bypass**
- **Open Centre System OC**
- **Load Sensing System LS (CFC)**
Heat Generation
– Pump Choice

Heat generation:
Red areas in the diagrams represent heat loss

Improved Systems:
Multi-pump system
One pump for high pressures, one for low

Variable pump

Cylinder 1

Cylinder 2

Heat loss

Flow

Available

Actual

Pressure

Axial Piston Pump
Medium/Heavy Duty

Regulator
Pressure Compensated

Regulator
Load Sensing

Closed Centre Valve

Constant Pressure System – CP

Constant Pressure High-Low System – CPhl
(Unloaded System – CPU)

Load Sensing System
LS

Regulator:
A pump unit controlling the pressure difference between LS and pump pressure.

CPhl – CPU:
High (h) pressure when spools are activated, low (l) pressure when spools are in neutral position.
Manually operated
Parker’s unique Intermediate Pressure Technology reduces flow interference for improved precision and efficiency compared to generic systems.

**Added values of Parker OC technology:**
- Less dead band => Longer active lever stroke => Better controllability and precision
- Well defined intermediate pressure level => Less interference in multiple function operations
- Easier to distribute all available pump oil => Can improve productivity by up to 50 %

Pilot operated
Parker’s Pressure Compensation Technology further enhances system performance compared to generic systems.

**Added values of Parker OC technology:**
- Less dead band => Longer active lever stroke => Better controllability and precision
- Load independence => A specific stroke always equals the same flow => Easier operation
- Well defined intermediate pressure level => Less interference in multiple function operations
- Easier to distribute all available pump oil => Can improve productivity by up to 50 %

20 % increase in productivity = € 15000 per year for a timber crane!
Before: Loading and unloading, 1 hour; transport 3 hours. After: Loading and unloading, 40 minutes; transport 3 hours.
Value for the operator: 50 extra loads per year = € 15000.
Environmental value: 1000 litres less fuel spent loading and unloading = € 1000.
Logistics value: Frees up unloading space at the saw mill.

Guide to diagrams
The following diagrams show relative flow, pressure and lever strokes for different systems while lowering and lifting a load.

- Yellow lines indicate flow
- Dotted blue lines indicate pressure
System Performance
– Open Centre Valves

**Generic system**

**Parker OC Technology**
System Performance
– Constant Pressure Valves

Manually operated – single function
• Section flow is affected by load pressure
• All loads start moving at the same lever stroke

Manually operated – multiple function
• No interference

Pilot operated – single function
• Pressure Compensation Technology – section flow is less affected by load pressure
• All loads start moving at the same lever stroke

Pilot operated – multiple function
• No interference

Why
• Low cost for directional valve
• Stable system

Where
• Mining machines
• Refuse machines
• Forestry machines
• Telehandlers

How
• Individual flow rate per work port
• No interference between the work ports’ flow

Flow, %
Manual operation, lifting

Flow, %
Pilot operation, lifting

Flow, %
Manual operation, lowering

Flow, %
Pilot operation, lowering

Why
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Flow, %
Manual operation, lifting

Flow, %
Pilot operation, lifting

Flow, %
Manual operation, lowering

Flow, %
Pilot operation, lowering
System Performance
– Load Sensing Valves

**Why**
- Usually the most efficient type of mobile system

**Where**
- Forestry machines
- Large and medium size wheel loaders
- Cranes
- Excavators
- Refuse machines

**How**
- With variable or fixed displacement pump
- Individual flow rate per work port
- Individual pressure per work port
- No interference between work ports’ flow

**Parker performance values**
- Force feedback enables soft acceleration
- Adapted flow forces enable soft retardation
- Feed Reducer gives more efficient use of pump oil
- 10–20 % higher productivity

**Manually operated – single function**
- Section flow independent of load pressure (compensator)
- All loads start moving at the same lever stroke
- Pressure control per work port (compensator)
- No interference

**Manually operated – multiple function**
- Section flow independent of load pressure (compensator)
- All loads start moving at the same lever stroke
- Pressure control per work port (compensator)
- No interference

**Pilot operated – single function**
- Section flow independent of load pressure (compensator)
- All loads start moving at the same lever stroke
- Pressure control per work port (compensator)

**Pilot operated – multiple function**
- No interference

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10 % increase in productivity = € 36000 per year for a harvester!

Before: 60 trees per hour. After: 66 trees per hour. Value for the operator: An additional 3 cubic metres per hour = € 12 per hour = € 36000 per year!
**Cleanliness**

**Purpose of filtration**
- Long service life for the hydraulic circuit
- Maximizing system availability

**In-line filtration**
- Designed to handle full system flow
- Fixed displacement pump: Continuous filtration
- Variable displacement pump: Filtration at work port flow only
- Pressure filter: System protection against component wear
- Return filter: System protection against ingestion and component wear
- Breather filter: System protection against ingestion

**Off-line filtration**
- Filtration works whether the system is running or not
- Usually low flow through the filter, which enables very small particles to be filtered out
- Easier to over-dimension for increased capacity
Value Added Services

Purpose of Value Added Services:
- Minimizing transactions and logistics
- Minimizing acquisition and product cost
- Reducing development and production time
- Ensuring 100% functionality

Breadman
Packed and delivered just-in-time

Kitting
Complete sets saving time

Assembly
Ready for final assembly

Sub-assembly
Partial pre-assemblies

Tech Services
Cost reduction and Dry Technology concepts through engineering solutions

Training
Fully adapted to the clients needs

EDI
Paperless transactions

Strategic Account manager
One client – one contact
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