Technical Presentation

“VARIABLE SPEED DIRECT HYDRAULIC DRIVE (DHD) APPLICATIONS AND ITS RECENT TECHNICAL DEVELOPMENTS FOR LOW SPEED HIGH TORQUE DRIVE APPLICATIONS IN VARIOUS BULK MATERIAL HANDLING INDUSTRY”

Presented By
Hagglunds Drives (India) Private Ltd
18/4 & 19/4, Hadapsar Industrial Estate
Pune – 411 013, India
www.Hagglunds.com
HIGHLIGHTS

- Alternatives of LSHT Drives
- The Concept of DHD (Direct Hydraulic Drive)
- Principle of Operation for DHD
- Comparison of Various Drives
- Distinct Features and benefits of DHD
- Conclusion
Alternatives of Drives

Electro-Mechanical Drives

Electro-Hydraulic Drives
Direct Hydraulic Drive
Direct Hydraulic Drive - Function

- Electric motor starts in an unloaded condition and runs at constant speed driving the hydraulic pump.

- The displacement of the pump dictates the rate of flow from the pump and hence the speed of the hydraulic motor.

- A simple electrical signal is used to signal the pump displacement hence the speed of the drive.

- Stopping/starting/reversing/and full speed control is catered for by the pump signal, E motor status is not effected.

- By interfacing other signals automation of speed control is possible.
A hydraulic direct drive has less than 1 % of the moment of inertia on an equivalent Electro-mechanical drive

Low Moment of Inertia for the Drive

Features of Direct Hydraulic Drive
Features of Direct Hydraulic Drive

Accurate torque response

- The Hydraulic Drive can operate at nearly constant torque throughout the speed range.
- The Hydraulic Drive can accurately limit the maximum torque of the system.
Features of Direct Hydraulic Drive

Four Quadrant drive

- Driving reverse
- Driving forward
- Braking reverse
- Braking forward

Maximum torque available
Maximum speed available
Installed power
Features of Direct Hydraulic Drive

Load sharing

- The hydraulic motors are supplied from a common hydraulic system
- Load is balanced by fluid pressure
- Multiple pumps or motors provides flexible combination.
Features of Direct Hydraulic Drive

Weight reduction

- The Hydraulic motor has much less weight than an equivalent Electro-mechanical drive solution
- The power pack can be installed remotely from the motor
- Less weight of the drive means reduced stress on the machine structure
Features of Direct Hydraulic Drive

Unlimited starts & stops without any problems.

Space saving & Simple to install
## Comparison Direct Hydraulic with Conventional Drives

<table>
<thead>
<tr>
<th>Function</th>
<th>Hydraulic</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation</td>
<td>No</td>
<td>Often needed</td>
</tr>
<tr>
<td>Gearbox</td>
<td>No</td>
<td>Needed</td>
</tr>
<tr>
<td>Starts &amp; Stops</td>
<td>No limits</td>
<td>Limited</td>
</tr>
<tr>
<td>Moment of Inertia</td>
<td>1</td>
<td>100-300 x higher</td>
</tr>
<tr>
<td>Shock Load Capacity</td>
<td>No limits</td>
<td>Very limited</td>
</tr>
<tr>
<td>Starting torque</td>
<td>200-300%</td>
<td>150-200%</td>
</tr>
<tr>
<td>Torque at low speed</td>
<td>No limitation</td>
<td>Limited</td>
</tr>
<tr>
<td>Standstill under load</td>
<td>No limitation</td>
<td>Limited/Not possible</td>
</tr>
<tr>
<td>4-Quadrant drive</td>
<td>Yes</td>
<td>Special drive</td>
</tr>
<tr>
<td>High voltage</td>
<td>HV Electrical motor</td>
<td>HV Motor/Inverter</td>
</tr>
<tr>
<td>Harsh environment</td>
<td>Not sensitive</td>
<td>Sensitive (Inverter)</td>
</tr>
<tr>
<td>Harmonic Distortion of Power network</td>
<td>No</td>
<td>Yes, extra equipment needed</td>
</tr>
</tbody>
</table>
Overall Efficiency

Hydraulic motor + planetary gearbox versus Hydraulic Direct Drive

High speed motor + planetary gear
\[ \eta_{\text{total motor}} = 93\% \]
\[ \eta_{\text{total gear}} = 91\% \text{ (3-stage at rated data)} \]
\[ \eta_{\text{total}} = 85\% \text{ (at rated data for gearbox)} \]

Medium speed motor + planetary gear
\[ \eta_{\text{total motor}} = 93\% \]
\[ \eta_{\text{total gear}} = 97\% \text{ (1-stage at rated data)} \]
\[ \eta_{\text{total}} = 90\% \text{ (at rated data for gearbox)} \]

Hydraulic Direct Drive
\[ \eta_{\text{total motor}} = 95-96\% \]
Bucket Wheel Drive

Slewing Drive
Bucket Wheel Drive

Before
(Electro-Mech. Drive)

After
(Direct Hydraulic Drive)
Wagon Tippler Drive Systems
CASE STUDY - APRON FEEDER DRIVE LAY-OUT

Apron Feeder

75 KW
1500 RPM

Fluid Coupling

15 teeth Pinion

83 teeth Bull Gear

Gearbox Ratio = 112 : 1
Hollow O/P Shaft fitted with SD

Feeder Pulley shaft
RPM = 2.3
(Considering F/Cplg slip)

DHD CAN BE CONSIDERED ON FEEDER PULLEY SHAFT IN PLACE OF BULL GEAR.
Mill Drive

CONVENTIONAL ELECTRO-MECHANICAL DRIVE

ELECTRO-HYDRAULIC DRIVE
POTENTIAL APPLICATION FOR DIRECT HYDRAULIC DRIVES

- Bucket Wheel & Slewing drives for Stacker cum Reclaimers
- Conveyor & Apron Feeder Drives
- Wagon Tipplers & Side Arm Charger
- Paddle Feeder Drives
- Roller Mills & Pulverizers
- Scrapper chain conveyor & Clinker Grinder Drives.
- Cooling Tower Fan
- Various type of Feeders.
- Stoker feeder drive / Bucket Elevator.
Conclusion

- Asia’s fast growing & demanding material handling industry can be benefited from this Direct Hydraulic Drive for following:

1. Apply the long term experience from Europe, America, China, Australia etc.
2. Improve reliability & productivity
3. Reduce down time, maintenance & life cycle cost.
4. Provide more flexibility for future expansion
THANK YOU

Questions ?

We are available throughout this conference