



Hyden Engineering Pty Limited 1/10/2004
1/48 Racecourse Road
RUTHERFORD NSW 2320
Telephone: (02) 49320111
Facsimile: (02) 49320222
E-mail: hyden@hunterlink.net.au

ABN: 69 000 813 650

Hydraulics, Lubrication and Maintenance Management



FOR
UNDERGROUND
MINING
EQUIPMENT





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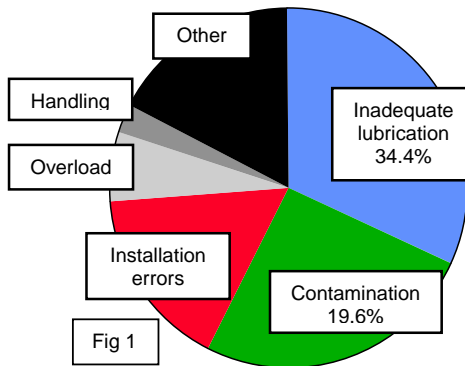
Hydraulics, Lubrication and Maintenance Management

EASILUBE

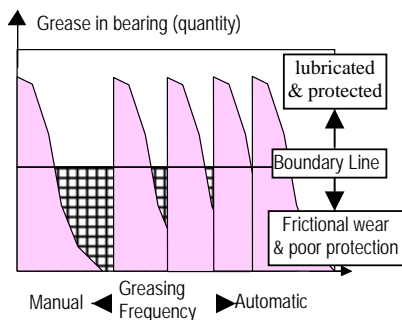
Overview:

54% of all bearing failures are due to inadequate lubrication as shown on a chart presented by SKF to the TAPPI 1995 engineering conference.

This percentage would be much higher if the study had been restricted to bearings on mobile machines. Easilube® addresses this high percentage of bearing failures. It does so by providing frequent small shots of #2 grease to the bearings for lubrication while setting-up and maintaining a film of grease to inhibit the ingress of contamination (Fig 2.). The benefits from frequent greasing are shown at Fig.3.



Generally, Easilube systems operate in parallel with hydraulic actuators giving a lubrication frequency to automatically match the demand and to grease the bearings while they are under load. This avoids the use of electrical timers, solenoid valves and similar components to enhance



reliability under adverse conditions (water cannons and the like) while simplifying the initial installation. In other applications where an appropriate pressure source is not available or where a more precise greasing rate is required, Easilube may use a simple adjustable timer to set greasing rate.

Importantly, Easilube provides grease while the machine is operating and the problem of 'tight' bearings with manual lubrication methods is thus solved.

Fig 3

Easilube Pump:

Being a single shot pump as opposed to a reciprocating pump, Easilube is almost bullet proof with moving components limited to a piston assembly with four seals. A drain provided between the grease seal and hydraulic seal eliminates any potential for grease contamination of the hydraulic oil.

The pump end-cap is available with various control valves to operate in systems where the hydraulic supply pressure may be very high or where it does not cycle at an appropriate frequency.



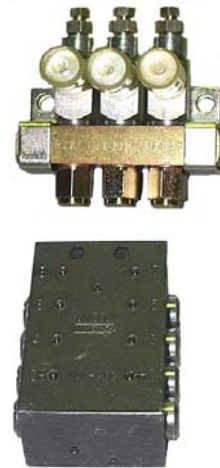
Reservoirs:

- A single or twin cartridge pump is available. Cartridges are preferred because they reduce the risk of contamination by avoiding the need to bulk-fill from a separate facility. Also, the change out period for cartridges (a shift, day or week) is generally below the critical period for the most critical bearing and costly alarm systems may be avoided.
- Where cartridges cannot sensibly be used, bulk-fill systems are offered. A 5-Kg to 20-Kg see-through canister facilitates quick assessment of the need to re-fill and steel reservoirs are available to 90-K.
- Options include fill-filtration, overflow prevention and various mechanisms for local and remote level indication.



Grease Distribution:

- Injectors are preferred because they offer maximum tolerance to contamination and independent adjustment to each bearing.
- With a compromise in contamination tolerance and/or flexibility, a lower cost is realized by grouping the bearings into zones according to lubrication demands. Separate injectors may be used for highly critical bearings whereas other bearings may be grouped and serviced by distributor valves fed from injectors to provide independent adjustment to each zone. Alternatively, Easilube may operate with systems having only distributor valves and such systems often provide the lowest cost option particularly where a large number of bearings are involved.
- Cartridge style pumps are strongly favored for systems with distributor valves because of the improved contamination control.



Alarms:

Easilube is available with various low level and mal-function alarms. Alarms are rarely required for cartridge style pumps because the replenishment period (1-shift, 1-day or 1-week) is usually well within the 'risk' period for the most critical bearing. The need for alarms for 5-Kg to 20-Kg bulk-fill systems is reduced because of the see-through feature of the reservoir. Alarm systems include:

- A simple switch actuated when the container is close to empty. This may be electrical to actuate an audible and/or visual alarm or a pneumatic switch to provide warning through a pressure gauge.
- A malfunction warning if system pressure fails to rise within a 'set' period. This involves the use of a pressure switch positioned either in the line to the most critical bearing or immediately downstream from a distributor valve where failure is most likely.

Hoses and fittings:

The lowest cost option utilizes grease filled high-pressure 'plastic' tube usually 8-mm for the supply line and 4-mm or 6-mm for the feed lines to the bearings. 'Plastic' has a lower impact resistance than hydraulic hose but it is readily repaired in the field without the need for a 'hose doctor'. Where hydraulic hoses are preferred, 1/4" or 3/8" is used for the supply line and 1/4" is used for the feed lines and double braid is selected.

Typical applications:

(Note: Prices relate to 2004 and exclude GST, travel and accommodation costs)

1. LHD (Eimco, FBL, Juggernaut, Wagner):

Generally, LHD's have high bearing loads at the articulation and bolster. Systems comprise either a single or twin cartridge Easilube pump with a number of injectors varying from 3 to 18 injectors with the pump placed in parallel with the steering cylinders. A twin cartridge pump last about 1-week between cartridge changes.

The price for the pump and injectors is \$1940 plus \$105 per point for the basic twin cartridge system.

Options include a low-level alarm system with warning by a gauge in the cabin or actuation of the air horn. A provision for manual lube is also available as an option.



2. Graders (Boart, Caterpillar, Anderson):

Graders have bearings under arduous conditions particularly at the steering links. Grease is applied to these critical bearings while loaded and a grease film is maintained to exclude contamination. Systems generally comprise a twin cartridge pump with between 24 and 30 injectors.

The price for the pump and injectors is about \$2000 plus \$105 per point for the basic twin cartridge system. Options include a low-level alarm system with warning by a gauge in the cabin or actuation of the air horn. A provision for manual lube is also available as an option.



3. Crusher Feeders:

Crushers do not have an operator and a bearing failure can have ramifications far beyond the cost of bearing replacement.

Kits for early machines comprise a twin cartridge Easilube pump with sequence valve and 8 large injectors. Later machines have 7 large injectors and a pressure-reducing valve at the pump. In most cases, the pump is powered from the conveyor circuit so that grease is applied to all eight bearings each time the conveyor is loaded. In cases where the load is near constant, a hydraulic timer is used.

The price for the pump is \$2210 for earlier machines and \$2450 for later machines. Injectors have a price of \$161 per point.



4. Road Headers:

Easilube systems are applied to road headers because of concern for the 'head' bearings. Kits comprise a twin cartridge Easilube pump with pressure reducing valve and 47 small injectors. The pump is placed in parallel with the cutter drum extension cylinder.

The price for the pump is \$2000 and the price for injectors is \$105 per point



5. Bolters (Fletcher and Hydramatic):

Most bearings in a bolter, work under arduous conditions because of the nature of the operation. It is not practical to provide automatic lubrication to all points because of the vulnerability of the hoses.

Generally the number of points has been limited to 32 for the Fletcher and 20 for the Hydramatic. Kits comprise a twin cartridge Easilube pump with sequence valve and small injectors. The pump is powered from the pressure line to the bolter motor for the Fletcher and from the TRS for the Hydramatic.

The price for the pump is \$2210 and the price for injectors is \$105 per point.

6. Continuous Miners (Jeffrey and Joy):

For standard miners, the number of points is normally limited to 8 being 2*cutter head hinge, 2*conveyor hinge, 2*stab jacks and 2*gathering head. Other miners may have bolting rigs to increase the number of points to about 26

Standard kits comprise a twin cartridge Easilube pump and 8 large injectors. The pump is placed in parallel with the swing cylinders upstream from the counter-balance valves.

The price for the pump is \$1700 and the price for injectors is \$161 per point.

6. Shuttle Cars:

The critical points on shuttle cars are the king pins and steering but generally 36 points are protected including the two points at the take-up cylinders. For applications where the conveyor is raised during the normal production cycle, the pump is actuated from the conveyor raise circuit. For other applications, the pump powered from one side of the steering system.

Standard kits comprise a twin cartridge pump for a conveyor actuated system or a pump with sequence valve for a steering actuated system and 36 small injectors.

The pump price is \$1700 for a 'conveyor' system or \$2210 for a 'steering' system. The price for injectors is \$105 per point.

7. MPV:

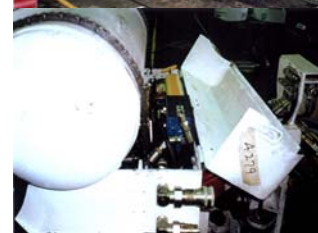
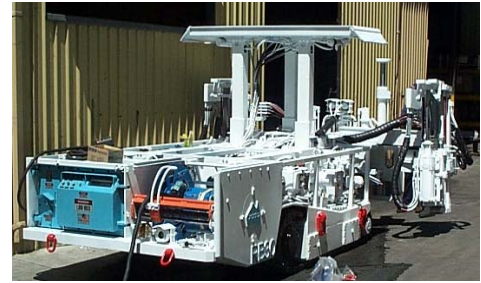
The critical points on MPV's are considered to be at the articulation. Generally 13-points are protected by Easilube. Standard kits comprise a twin cartridge Easilube pump and 13 small injectors.

The pump is placed in parallel with the steering cylinders.

The price for the pump is \$1700 and the price for injectors is \$105 per point.

8. OTHER (PJB, Shearers, Domino Dozers, etc):

Prices for less common applications are available upon request.



9. END USERS:

Underground Coal Mines: Appin, Berrima, Central, Clarence, Cooranbong, Crinum, Cumnock, Dendrobium, Glennies Creek, Grasstree, Munmorah, Myuna, Newstan, North Goonyella, Oaky Creek, Southern, Southland, Ulan, Westcliff and contractors such as Roche.

O/C Mines: Bengalla, Bulga, Callied, German Creek, Griffin Coal and Hunter Valley. Several other mines with hire machines from Emeco etc and machines by contractors such as Boral, Henry Walker Eltin, etc..

Earth Moving/Farming: ASMS, Emeco, Dal-Brois, Gregoire, Daracon, Dival, Dukes, Kennedy, Rosebrooke, Toll Logistics, Violi and Wilde.