CONVERSION OF B.M.A. K850 CENTRIFUGALS FROM OIL LUBRICATION TO GREASED BEARINGS

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Abstract

The conversion of BMA continuous centrifugals from oil lubrication to grease lubrication is described.

History

Up to 1969 Tongaat's 'C' centrifugal battery consisted of manual/batch Broadbents and Pott Cassell and Williamson machines, which had worked well for many years and were due for replacement. It was expected of the new equipment that it would be able to cure lower purity boilings, handle the increased load of 'C' massecuite, need minimum operating staff, and require little maintenance. The decision was finally made to install ten BMA K850 continuous machines during the 1969 off-crop, and a further five were added the following year.

Troubles

The BMA's are efficient machines which deal with 'C' massecuites quite easily, and the operator on the station has little to do other than keep a watchful eye on the units. But, after a relatively short period, a messy, time-consuming problem arose in respect of the lubrication system.

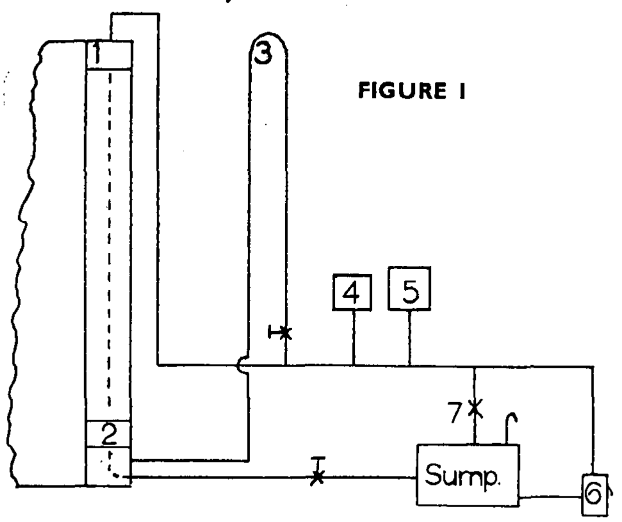

FIGURE I

1. SKF 22215 CJ.
2. SKF 3312 DM.
3. Loop to show oil level when filling housing for off-crop.
4. Low Pressure Relay.
5. High Pressure Relay.
6. Oil Pump and Motor.
7. Spring Loaded Relief Valve.

Each 'C' battery machine has its own self contained oil system (Figure 1) — unlike two other installations in the factory where a central sump/pump supplies five or six centrifugals — and the individual units each have high and low pressure switches or relays, flexible hoses, valves, unions and connectors, all of which have a natural tendency to leak.

When starting a BMA with this oil system one has to wait for the low pressure relay to record minimum pressure before starting the main motor and, if there is a blockage in any of the lines, the high pressure trip switches the power off whilst the relief valve in the system returns the excess from the gear pump to drain. Two or three of the low pressure relays that were opened up were found to have the contacts jammed-in and therefore were of no use in circuit.

Servicing and breakdowns

The normal time recorded for servicing the oil system once a month was 15 minutes electrical and 15 minutes mechanical, and it was seldom, if ever, that an electrician and fitter were available at the same time. The nett result was that machine downtime

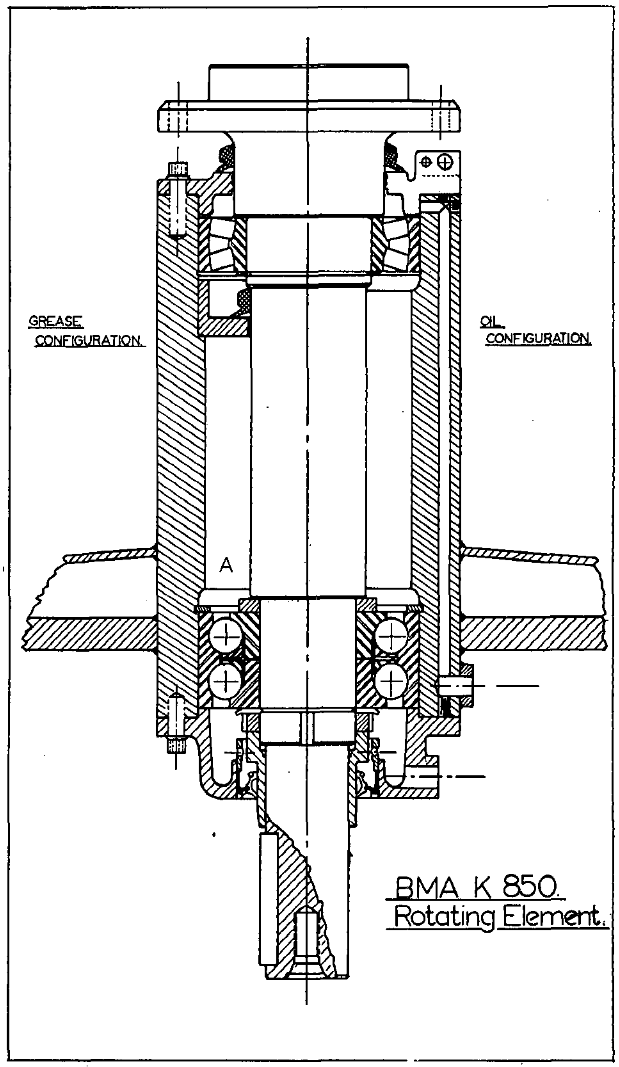

FIGURE 2

was considerably longer than $\frac{1}{4}$ hour for routine maintenance. Since the initial installation in May, 1969, four oil pump motors have had to be rewound and, to date, only four of the originals have not burnt out. Similarly, in the past 18 months, 30 hours of fitting time has been logged for clearing choked lines or filters and repairing minor leaks, outside of scheduled maintenance.

Major breakdowns, of which at least eight can be directly related to burnt bearings, have claimed 416 hours since May, 1969. With respect to the bearing failures, a spacer disc (marked 'A' in Figure 2) on the thrust race was found in three cases to have a taper of between 0,2 and 0,4 mm and could have caused trouble, but the remainder were caused by failure of the oil system, in particular the low pressure relay.

Grease

At this stage, because of oily messes and reports of bearing failure, consideration was given to grease-packed bearings. BMA were approached in this regard, but they felt that the temperature and vibration would cause grease to slump, resulting in the top race running dry, and they therefore advised against it. Despite this advice, having studied the operation of the 'A' and 'B' set machines which had greased bearings, a decision was made to try Darina 2.

This is a Bentonite or clay based grease with a high slump temperature at about 190°C. The speed of the machine at 2 200 rpm was reasonably within the grease limit and, to counteract any adverse effect of vibration, it was felt that the bearings should be over-packed with grease and allowed to pump the excess upward so that any slump occurring would be back into the cage. To ensure that this would be the case, the bearing housings had to be sealed at the bottom. The lower housing was already sealed for oil and posed no problem, but the upper race was open for oil flow. Sealing this top section was done by boring out the static housing to take a mild steel cup on which an SKF 70 mm Vee ring seal would seat, the main drive shaft being skimmed 0,5 mm where the seal sat and the upper retaining shoulder machined back 0,6 mm to afford a square face for the seal. These dimensions, along with the overall dimensions of the cup, result in a 0,3 mm nip on the Vee ring. The cup itself is a neat fit in the outer housing and has a 0,8 mm clearance on the shaft. The inlet and drain oilways only needed to be plugged.

At this stage a report arrived of greased bearings having been tried in a centrifugal at a European factory with disastrous results, but no information of the type of grease was available. Opinion in Tongaat was that a Lithium based grease had been used and had not stood the temperature, so preparations continued.

Time involvement

The first conversion on 2nd September, 1970, took 12 hours from bearing failure to start up, and, apart from a brief examination of the bearings six months later, it is still running without trouble. In an attempt to reduce machine downtime, a complete spare element is kept so that if a bearing collapses it takes a little under 6 hours to start again on grease.

The first machine on grease was so successful that to date nine of the fifteen machines have been converted to Darina grease, the conversion period being 100 hours.

There have been bearing failures on grease — one for no apparent reason, one where the top seal (Vee 90 mm) failed and allowed grease out, resulting in a dry bearing, and one due to a fitting error which caused the cup to nip the outer race of the top bearing and thus preload the bearing. The total downtime for these three failures was 27 hours, of which 11 hours was spent on the machine with a preloaded race.

The running period, considering all fifteen centrifugals, has totalled 404 months using the oil system and 81 months with the grease configuration. Downtime during these periods was 370 hours on oil and 27 hours on grease. Since there was a very good reason for one failure where the bearing was preloaded, due to a machining error on the second conversion, it would be realistic to deduct that period from the total downtime, making the total 16 hours on greased bearings.

If the mechanical efficiency of a centrifugal is considered in hours downtime per machine month, then the results for oil or greased bearings in this particular case would be:

1. For oil — 55 minutes per machine month.
2. For grease — 11,85 minutes per machine month.

This shows a reduction of 78,6% on maintenance downtime which, when converted to man hours, becomes an economic proposition.

Other advantages

After six month's running time, the bearings were checked on a few of the machines and it was decided that as the condition was so good there was no need to carry out scheduled greasing or maintenance on the bearings, and since there was no longer a pump and motor, no relays or electrical circuitry to clean out, and no system to be filled with oil through the duration of the off-crop, the scheduled 20 hours maintenance of the main rotor was struck off, thus saving the time budget some 300 hours. The bearings are now on a breakdown schedule and have not yet been touched, so the savings have been well worth the cost of conversion.