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05287



Distr.
LIMITED
ID/WG.163/29
20 February 1974
Original ENGLISH

United Nations Industrial Development Organization

Seminar on the Furniture Industry

Lahti, Finland, 6-25 August 1973

MACHINE MAINTENANCE 1/

by

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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

1. General points of view

The machinery of a company represents considerable investment. Therefore it is essential to realize the importance of machine maintenance. Proper maintenance lengthens the life of the machinery considerably and accordingly lowers capital costs.

Continuous wear and increasing age cause the value of the machine to decrease. The life of a wood-working machine is, depending on the use and the quality of the machine, 4...20 years.

The first consideration before deciding about the purchase of a new machine is whether there is enough work for the machine. This depends on the size of the company and the number of orders.

The capacity of the machine depends on the size and the quality of the machine, which must be in correct relation to each other. The more expensive the machine, the more work it should perform. Therefore, it is not wise for a company to buy a very efficient and expensive machine and only use it part of the time.

2. Arrival of a new wood-working machine

When the machine has arrived in the factory, it is important to check that it has not been damaged during transportation. The cutter shafts (spindles) and the rotors of electric motors must revolve freely and silently when rotated manually from the end of the shaft. This must be done before any wood-working machine is started.

The next thing to check is that the stampings on the plate of the machine are correct and in accordance with the order. An example of them is the temperature in which the machine will be used. It is also important to check the voltage of the electric motors and to see if it is a Y or D coupling.

When mounting and test-running, it is very important that the electric motor runs in the desired direction, since rotation in the wrong direction can break the machine immediately.

During complete service the motor is always disconnected. Before starting the machine it is necessary to check the rotation direction using a short start, i.e. giving a start impulse and, immediately after it, a stop impulse.

The company which manufactures the machine must always be asked to supply the purchaser with detailed installation, maintenance and safety instructions with diagrams in the language agreed upon. These must be carefully observed.

Generally the manufacturing companies lubricate the bearings of a machine before delivery. The exceptionally high temperature and relative humidity in the developing countries require considerably shorter intervals between services. Accordingly the bearings must be protected

by lubricating them more frequently than would be necessary in a dry and cool atmosphere.

In the lubrication of machine parts only high-quality lubrication materials must be used, preferably those recommended by the manufacturer. If another make of lubrication material is substituted for the one used before, the former material must be thoroughly cleaned away. Mixtures of lubrication materials often result in thickening and an almost complete loss of lubricating qualities and consequently damaged bearings.

The most suitable materials for cleaning ball- and roller-bearings are White Spirit, good Water White, petrol or benzine. The last two are inflammable and must therefore be handled with extreme care.

After cleaning the bearings must not stay dry for a longer period of time. Immediate oiling or greasing is necessary. When doing this the bearings are rotated a few revolutions so that the oil or grease enters all important point and prevents the bearings from rusting. This is particularly important when lubricating the bearings of machines which will stay unused for a long time before once again being used.

Intervals between lubrications of ball- and roller-bearings:

<u>rev/min</u>	<u>lubrication</u>
1,000	after 2,400 hours in operation
1,500	" 1,200 - " -
3,000	" 200 - " -
Over 24,000	daily

3. Maintenance of electric machine parts

To protect the electric motor from dust it must never be covered or encased. It is recommended that dust is daily brushed off or blown off with pneumatic spray. Encased electric motors are equipped with a fan on the outside which cools the motors. The fan opening must not be against the wall or otherwise prevent the air from flowing into the opening. If the electric motor is situated in a place where glue, paint, lacquer or grease might drop on it, daily cleaning is necessary. A thin layer of grease on the surface prevents the glue or paint from sticking to the surface.

4. Inspection of starting equipment

The starting equipment is inspected in connection with the annual service. If the model is simple and has a pressure switch with an on-off control or a 3-stage switch with a lever, the contacting surfaces are ground with grinding paper No. 400 or 600 wrapped around a wood or plastic strip. This work must always be done by an electrician.

An improved - and also more expensive - model has been equipped with a heat protection release. In case of overload, e.g. if the blade of a circular saw is stuck in the work piece, the "on" switch is automatically released and the machine will not start again until the bi-metal strip of the protective equipment has cooled off. The machine is serviced in the same way as the one described before, except that in addition the bi-metal strips of the heat protection equipment are inspected. They and their fasteners are standard parts and can be replaced.

There are also switches which can be locked with a key. Generally special machines are locked so that they will not be broken. Also the main currents can be locked thus preventing the start of all machines. It is very important to have a spare key.

The most common starting switches of electric motors are heat protection switches and contactor switches which are provided with automatic release mechanisms when overloaded. If the machine is overloaded or if the blade is stuck in the work piece, the heat protection release stops the motor. The motor will not start unless the heat protection is set again in the starting position. There are also constructions in which the start button automatically sets the heat protection.

A contactor is safe to use since possible disturbances in the distribution net of electric energy release the switch and the machine will not start again by itself even when the current is on again. This is called a memory switch.

5. Maintenance and service of a contactor switch

Contactors, heat protection and coil are standard parts and can be easily replaced. The contactor coil can be 220 V or 380 V, the latter being normal to industrial use.

When switching on strong currents, contactors filled with transformer oil are used. The contacting surfaces of the switch must be serviced annually and replaced if necessary. They are standard parts. The oil must be changed if it is not transparent or seems to have particles in it, which will result in its losing its insulation qualities.

The moving connection cables must be carefully inspected. The insulation of the cables may have worn or be otherwise broken or damaged. It can be dangerous in operation and may even cause a fire. Any faulty electric equipment must immediately be replaced.

6. Inspection and maintenance of ball- and roller-bearings of electric motors

Listening to ball- and roller-bearings while they are in operation can ensure that they are faultless. This listening can be done e.g. by putting one end of a stick against the ear and the other end against the bearing chamber. If the bearing is in good condition a silent humming sound is heard. If the sound becomes louder or one of the bearings is louder than the other, there is something wrong with the bearing. If the bearing ring is faulty, a clinking sound is heard. Frequently a faulty bearing ring causes over-heating of the bearing chamber soon after start-up. As soon as a faulty bearing has been found it must be replaced. It is very important to have spare bearings in stock.

7. Changing the bearing

The fuses of the feed conductor of the electric motor are removed and a sign "Men at work" is put up in the distribution centre. Only the person who put up this sign may remove it.

Only a skilled mechanic may change the bearings in an electric motor. Most motor makes have their own tool sets. There are operation instructions in the service manual which must be carefully observed.

If a bearing is broken during operation, particles of it and grease are thrown into the coil of the motor. Only detergents which do not damage the lacquer and the coils can be used.

8. Intervals between lubrications of the bearings of an electric motor:

	<u>rev/min</u>	<u>lubrication</u>
under	1,000	after 2,400 hours in operation
	1,500	" 1,200 - " -
	3,000	" 200 - " -
	24,000	daily

If the motor is situated in a place where excessive moisture, dust, corrosive agents, etc. can enter the bearing chamber, it has to be protected by lubricating it more frequently than would be necessary in a clean place. Only high-quality ball-bearing grease must be used, preferably those recommended by the manufacturer.

E.g.

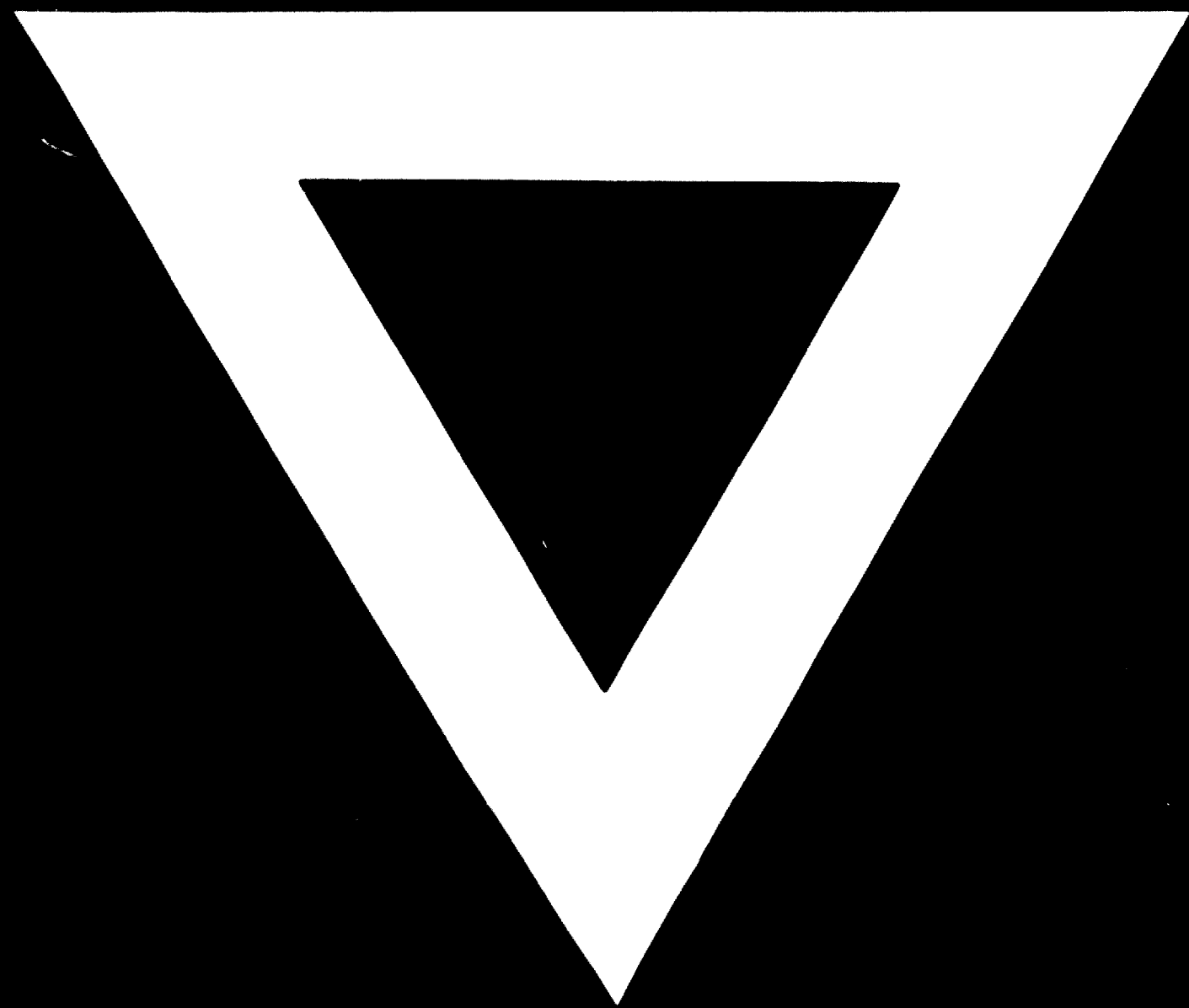
Mobil Oil	Mobilux Grease No. 2
Shell	Alvania Grease 2
Esso	Beacon 2
Gulf	Precision Grease No. 3

When changing from one grease to another it is very important to wash carefully away the remnants of the grease used before. (Mixtures of lubrication materials thicken and almost completely lose their lubrication qualities).

If an electric motor is disconnected from its conduits, they must be marked with tape to ensure correct revolution direction.

In case of flood or if the motor has otherwise become wet, no attempts must be made to start the motor. It must be disconnected from its conduits and taken apart. The coil must be dried carefully. Trying to start a moist or wet motor will damage the coil.





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