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## 1. SCOPE

- 1.1. This specification covers SAPO's requirements for gearing, shafts, bearings, brakes, lubrication, vee-belts, keys and key ways.

## 2. GENERAL

- 2.1. All spur gearing shall be straight or helical spur of standard tooth form having a 20° pressure angle of standard module, machine cut to class "B" of B.S.435, and having ample width of face for strength and wear. Other standards will be considered, but must be specified.

The pinions are to be cut from solid blanks of heat treated nickel-chrome steel of suitable composition, and the gear wheels are to be of normalised high carbon cast steel, carbon 0,4 % minimum to 0,45 % of tensile strength not less than 590 Mpa.

- 2.2. B.S. No. 436/Latest Edition, shall be worked to generally in regard to design and tolerances, in conjunction with Clause 32 of B.S. No. 2452/Latest Edition. For strength all gears shall be designed for 1,8 x full load, and for wear 0,6 x full load, with the combined speed factors Xb and Xc of charts 10 and 11 respectively, of B.S. 436, for a running time of 6 hours.
- 2.3. All gearing shall be suitably heat treated. It is desired to have the wear factor of the gearing as high as practicable in order to reduce maintenance.
- 2.4. As far as practicable, all gearing shall be totally enclosed and operated in oil baths. Sight glasses or dipsticks to indicate the oil level must be fitted. All gearing not totally enclosed shall be guarded where necessary. Where practicable, all gears must be supported between bearings, none being overhung. A full detailed specification of all gearing must be given when tendering, together with details of diametral pitch and width of all gearing. Particular care must be taken to ensure that the seals provided for the gearboxes effectively exclude grit and prevent leakage of the oil where the shafts protrude through the casing. It should be noted that helical or straight spur gearing is preferred.

- 2.5. Where it is not possible to "age" the castings for cast iron gearboxes by weathering them for an adequate period before machining, they must be stress-relieved by heat-treatment at 450/590°C. It is preferred that the boxes be rough machined before stress-relieving. Suppliers will be required to guarantee that the gearboxes supplied will not warp in service.

Dowels or fitted bolts must be used to ensure the alignment of the top and bottom halves of gearboxes.

- 2.6. All worm gearing shall have worm wheels having phosphor bronze rims and the worms are to be of 3,5 % nickel or nickel chrome case hardened steel and shall conform generally with B.S. 721/Latest Edition, in regard to design and tolerance.
- 2.7. Provision must be made to eliminate noise, as far as practicable from the motors and gearing.
- 2.8. Flexible couplings shall be provided between each motor and its extension shaft, and the tenderers must give particulars of the type they propose to supply.

### **3. SHAFTS AND BEARINGS**

- 3.1. All shafts shall be of suitable mild steel, the quality of which is to be specified by the tenderer, in accordance with the British Standard series of steels.
  - 3.1.1. All shafts shall be carried on precision ball and/or roller bearings, which shall be of the self-aligning type where necessary.
- 3.2. All bearings shall be of the anti-friction ball or roller type, mounted in dust proof housings, and shall be lubricated by oil bath or grease gun.
  - 3.2.1. Bearings must have a lifetime, which is compatible with the lifetime of the mechanism.

### **4. BRAKES**

- 4.1. An efficient and ample braking system for all motions, consistent with the requirements of maximum safety must be provided, full particulars of which must be furnished by tenderers. Tenderers are to note that it is desirable that the mechanical parts should not be adversely affected by the sudden application of brakes.
- 4.2. Tenderers are to note that all braking systems are to be so designed that brakes may be readily inspected, adjusted and/or removed for overhaul, without resorting to stripping of major components such as motors, etc.

## 5. LUBRICATION

5.1. All bearings on shafts, axles, etc., and other bearings wherever practicable, must be arranged for lubrication by a positive grease lubrication system using an efficient button type nipple which will allow the grease gun being attached by the operator to the nipple and left hanging on the nipple, so that if necessary he can use both hands in shifting his position to get better command when screwing down the grease gun in difficult positions.

Parts difficult to access should be provided with spring feed lubricators of an approved type.

5.2. Particular attention should be given to provide straight or angle nipples, as the case may be, making it as easy and safe as possible for the operator to grease the bearings efficiently. Full particulars shall be furnished by tenderers of what they propose to supply in this connection.

5.3. All lubricating nipples shall be of the hexagon type in accordance with either types Nos. 11A or 11E under Table 1 of B.S. No. 1486 Part 1/Latest Edition, and shall be spaced for the "hook-on" type of lubricating connector as reflected under Table 10 of the above mentioned specification.

5.4. The arrangement of the lubrication system shall be such that all greasing points are brought out to common batteries which are easily accessible.

5.5. Where grouped lubrication is used the diameter of the piping used must be ample and in no case shall they be less than 8 mm outside diameter.

5.6. Only stainless steel or copper piping and brass fittings shall be used. Copper piping must be protected from physical damage.

5.7. Tenderers shall supply the following information regarding all lubricants to be used on the appliance:-

Application: (E.g. crank-case hydraulic system, gearbox etc.)	Lubricant normally recommended by tenderer (Not more than 2 brands per application to be given)	
	Local available (grade –equivalent)	OEM Specified grade
1.		
2.		
3.		
4.		
5.		
6.		

6. **VEE BELTS**

6.1. Vee belts and pulleys shall be to an established standard and such standard stated. The sizes, code numbers, name and address of manufacturer and the source of supply ex stock in the Republic of South Africa of all vee belts offered shall be stated.

7. **KEYS AND KEYWAYS**

7.1. All keys and keyways shall be in accordance with B.S. 4235 : Part 1/Latest. No shimming of taper keyways will be allowed.

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***END OF SPECIFICATION HE 9/2/4 [Version 4]***

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