

**DIRECTORATE GENERAL BORDER ROADS**

**GENERAL MAINTENANCE INSTRUCTION NO. 16**

**TECHNICAL INSTRUCTION FOR MAINTENANCE OF 365 CFM KG KHOSLA AIR COMPRESSOR**

**AIM**

Aim of this instruction is to enhance the life of the 365 of KG Khosla Compressor.

**GENERAL**

This instruction lays down various maintenance task to carried out to presser the life of the equipment. Equipment are generally used in the environment where it is subjected to severe stress and strain due to high altitude, low temperature and better performance of the equipment.

Detail instruction of maintenance of this compressor is given in appendix 'A' of this instruction, Particular exphasis to be given about the correct lubricant to be used as given in page 12 of the appendix 'A' and also maintenance of air filter as given in pate 5 of appendix 'A'.

**APPX 'A' TO GMI NO. 17**

**TECHNICAL INSTRUCTION FOR KG 365 CFM AIR COMPRESSOR**

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## DAILY STARTING AND STOPPING

### DAILY STARTING

- (a) Place the unit in level.
- (b) Check that the lubricating oil level in the compressor crank case and engine sump is at top notch on the respective dipstick. If necessary, fill up to the top notch, not higher.
- (c) Fill the fuel in the fuel tank.
- (d) Fill engine radiator with clean water to its capacity.
- (f) Open all the delivery cocks on the air storage tank.
- (g) (i) Pull/turn the switch knob/lever in to position I, and keep it there for about 15 seconds to allow the glow indicator (on gauge panel) to reach bright red glow.  
  
(ii) Pull/turn the switch knob lever to position 2, actuating the engine by means of electric starter. As soon as the engine starts running, put the switch knob lever back to the 'off' position. If the engine does not start within a few seconds, put the starter switch in 'off' position and wait for a few seconds before attempting to start the engine again.
- (h) Let the engine run at idle speed for a few minutes.
- (j) Accelerate the diesel engine gradually and bring it to about 1300 Rpm thus allowing both the engine and the compressor to warm up. Allow the machine to run on this speed without load till the cooling water temperature of the diesel or engine rises to about 70°C. If necessary, radiator be blanked off for sometime by covering it with a thick cloth of paper so as to allow the engine attain its working temperature soon.

#### NOTE:-

NEVER BRING THE DIESEL ENGINE TO FULL SPEED SUDDENLY AS THIS IS LIKELY TO CAUSE DAMAGE BOTH TO THE ENGINE AND THE COMPRESSOR.

- (j) (i) Accelerate the engine further to full speed of 1650 Rpm. Close the drain cock and the air delivery wheel valves and let the pressure in the air storage tank rise to 6.05 Kg/cm<sup>2</sup>, and check that the engine pressure regulator actuates the throttle lever to reduce the speed of the engine to about 1300 Rpm. Release some air from the storage tank, and as the pressure in the air storage tank falls below 5.5Kg/Cm. the engine should pick up full speed.  
  
(ii) Close the valves again and let the air storage tank pressure rise to 7kg/cm<sup>2</sup> so that compression is recommended and allow the air storage tank pressure fall still further to 5.5 kg/cm<sup>2</sup> so that the engine re-assumes full speed operation.

THE AIR COMPRESSOR IS NOW READY TO BE PUT IN NORMAL OPERATION AND WILL BE AUTOMATICALLY GOVERNED BY THE UNLOADING AND SPEED CONTROL MECHANISM INCORPORATED IN THIS MACHINE.

- (k) When the unit has been in normal operation, keep a watch on the readings being registered by various gauges on the instrument panel. The readings should be approximately as follows :-

Compressor oil pressure	:	2 to 5 kg/cm <sup>2</sup>
Air pressure 1st stage	:	1.7-2.0 kg/cm <sup>2</sup>

Air pressure 2 <sup>nd</sup> stage	:	7.0 kg/cm <sup>2</sup>
Water temperature engine	:	80-90 <sup>o</sup> C.

### **TO STOP WORKING**

1. Open to atmosphere the air delivery wheel valves on the air storage tank.
2. Open drain cock at the bottom of the air storage tank.
3. Let the compressor run idle for 2/3 minutes to drain out all condensates and oil from the air storage tank.
4. Deaccelerate engine by pulling accelerating lever handle to lading speed.
5. Run the engine at idle speed for a few minutes and then pull stop lever control and hold until the engine stops.
6. Drain after sometime the engine radiator in case any possibility of freezing exists. Alternatively, use anti freeze solution in suitable quantity as per manufacturer's recommendations.

### **WORKING OF UNLOADING AND SPEED CONTROL MACHINES**

The attached schematic sketch shown the layout of the arrangement for regulation of capacity, firstly by reduction in engine speed and secondly by unloading of compressor cylinders. Described below is the manner in which this system operates :-

(i) Pressure regulators (A) and (B) are connected to the air storage tank (R) through moisture trap (M).

(ii) The pressure regulator (A) communicated to the speed reducer (S) of the diesel engine. The speed reducer comprises of a simple arrangement wherein a plunger moves in a barrel against a spring and while it so moves (on the air under pressure being allowed to enter the barrel) it actuate the governor lever to effect reduction in engine speed.

(iii) The pressure regulator (B) is connected to the unloading system of the air compressor. (For detailed description refer to the operation manual).

(iv) The pressure regulator (A) is set to cut off and cut in the following pressures :-

(a) Cut off pressure	:	6.5 kg/cm <sup>2</sup>
(b) Cut in pressure	:	5.5 kg/cm <sup>2</sup>

(v) The pressure regulator (B) is set to out off and cut in at the following pressure :-

(a) Cut off pressure	:	7 kg/cm <sup>2</sup>
(b) Cut in pressure	:	6 kg/cm <sup>2</sup>

(vi) With the pressure regulators set to operate as above, this system comes into play at various stages of operation of the air compressor as indicated below :-

(a) In case the requirement of the compressed air is such whatever free air is being delivered by the air compressor is being consumed by the pneumatic equipment being worked, the machine will continue to work at the rated speed of 1650 rpm.

(b) Should, however, the air consumption decrease at a particular stage of operation, the pressure in the air storage tank will start rising and as it reaches 6.5 kg/cm<sup>2</sup> the pressure regulator (A) will operate and allow the compressed air to pass into the speed reducer of the diesel engine

and shall thereby operate the governor lever and the engine speed shall drop to about 1300 rpm. With the reduction in speed thus effected, the free air delivered by the air compressor is proportionately decreased and if this reducer free air delivery can meet with the requirement prevailing at the particular time, the air compressor shall continue to run on this reduced speed of 1300 rpm. Alternatively, if the demand of compressed air increases again, the air storage tank pressure starts falling and as it reaches  $5.5 \text{ kg/cm}^2$ , the pressure regulator (A) cuts in and allows the air entrapped between this pressure regulator and speed reducer to be released and the speed reducer plunger is moved back into the original position raising the engine speed to the rated rpm.

(c) In case it so happens that the compressed air requirement falls short of the free air delivery of the air compressor at 1300 Rpm the air storage tank pressure still continues to rise and as it reaches  $7 \text{ kg/cm}^2$ , the pressure regulator (B) cuts off, thus allowing the air to operate the decompressor provided on each of the 3 cylinder heads and the blow off valve. While the compressor is working in unloaded condition no more compressed air is being fed into the air storage tank and the pressure therefore continues to decrease and as it reaches  $6 \text{ kg/cm}^2$ , the pressure regulator, (B) cuts in and compression in the compressor cylinder is recommenced. The machine continues to run at 1300 Rpm till such time that the demand of compressed air increases to such an extent that the air pressure in the air storage tank starts falling because of more off-take than the free air delivery at this speed and as the pressure reaches  $5.5 \text{ kg/cm}^2$ , the pressure regulator (A) is operated and the engine speed is increased to the rated Rpm.

(d) The air compressor continues working in the above cycle, depending on the compressed air requirement during the course of the day.

## **MAINTENANCE OF OIL WETTED DRY AIR FILTERS**

Your attention is drawn to the description of the dry type air filter appearing under the heading 'Suction Filter' in the relevant operators manuals for our air compressors. Instructions with regard to the clearing of the elements of these filters have been amended to read as under:-

### **Clearing**

- (a) Unscrew the central screw and remove the upper cap.
- (b) Take out the filter element from the perforated shell of the air filter.
- (c) Wash element in kerosene oil, dry, re-oil with the lubricating oil, drain excess oil and replace,
- (d) Replace the perforated shell and cap and tighten the central screw.

### **Note**

- (1) Low viscosity lubricant, preferably SA 10, should be used for re-oiling of the element.
- (2) It is important that all surplus oil is completely drained before the filter is refitted, as otherwise particles of oil may be carried with the filtered air and cause contamination.

### **Replacement**

Replacement filter element with a new one after every 500 Hrs.

## **MAINTENANCE OF CONCENTRIC VALVES**

The air valves are the heart of the compressor and a little attention will give them a long life and ensure a trouble free service.

It is advisable to examine them thoroughly and clean them at regular intervals, say after 400/500 working hours. The most stressed parts, such as valve plates and

spring plates should be changed after certain intervals or running. We recommend replacing these after 2500 hrs.

If there is much dust in the air, valves will require more frequent cleaning than if the intake air is clean and free from dust.

Whenever a valve is found defective, the faults

Whenever a valve is found defective, the fault should be remedied immediately so that it will not be aggravated. If running is continued with a broken valve plate, pieces of the ..... may drop in the cylinder and cause serious damage.

## **REMOVAL**

BEFORE OPENING PIPE CONNECTIONS (TO REMOVE CYLINDER HEAD) THE AIR STORAGE TANK SHOULD BE EMPTIED TO AVOID AN ACCIDENT DUE TO PRESSURE REMAINING IN THE CYLINDER HEAD.

For removal of the valve, proceed as follows:-

- (1) Unscrew the screws connecting the pipe flanges with the cylinder heads.
- (2) Remove the pressure air pipe connections of de compressor on the low and high pressure cylinders.
- (3) Unscrew the nuts and remove the cylinder heads. Care much be taken to prevent damaging the gaskets while removing cylinder heads.
- (4) Remove the de compressor tables and take out the springs.
- (5) Take out complete valves.

## **DISASSEMBLY OF CONCENTRIC VALVE**

- (1) Remove the split pin and unscrew the crown nut.
- (2) Separate the upper part.
- (3) Remove and separate spring plate and valve plate on the delivery side, and valve plate and spring plate on the suction side and free rings or hubs.

## **CLEANING**

Put the valve parts in paraffin or kerosene oil, followed by a brushing with a brass wire brush, or light scraping with sharp edge of a knife (but not with the point of knife) to remove any carbon formation. Take them out and **DRY THEM THOROUGHLY** with a clean cloth before assembly. Great care should be taken to avoid damage to the seating of the valve plates.

If any valve plate is worn out, replace it before it breaks. Irrespective whether these parts show sign of wear or not, we recommend to renew them after 2500 hours.

- (d) Tighten the nut over the cylinder head and tighten them diagonally little by little with even pressure to 65 Lbs ft torque.
- (e) Re-fit pressure air pipe connections to the de compressors.
- (f) Tighten the screws on the flanges connecting the pressure pipes between the cylinder heads and inter coolers.

## **DE COMPRESSOR TABLES**

De compressor table is an intermediate piece between the valve and de compressor piston (For details refer to sub-chapter "Unloading system" in the operator's Manual) and is resting on a reset spring, its legs floating free in the ribbed air passage

of the valve and clear off the valve plates during normal running of the air compressor. While the compressor unloads, the de compressor table is pressed down by the de compressor piston, against the reset spring, the movement of the table being guided by the valve central screw. The valve plate is thus kept off its seat and disallows any compression to take place till such time the air received pressure allows the de compressor piston to retract and allow the de compressor table moved by the spring to its original position.

It will be seen from the attached copy of the valve drawing, showing also a de compressor table in place, that the table is placed to work quite free and without its legs touching or being obstructed in movement by the valve fins.

The legs of the de compressor table are likely to sustain a bend, in handling, and the fitment of such a de compressor table is likely to cause a situation in which the affected legs are obstructed in their movement by the valve fin during each of the downward movement of the de compressor table on unloading of the compressor. Such obstruction tends to dislocate the table leg/legs and in due course results in failure of the same.

It is, therefore, important that the following precautions in respect of de compressor tables are observed during re-assembly of to the compressor valves and cylinder heads, etc. after the needed maintenance has been carried out :-

- (i) Ensure that the de compressor table legs are free from any obvious bend.
- (ii) Place the reset spring in its position and let the de compressor table rest on the spring. Ensure that all the legs are quite free in the various sections of the particular channel in which the legs are accommodated.
- (iii) Press the de compressor table by hand against the tension of the reset spring and further on to press the valve plate off its seat to the fullest extent and ensure that the table legs are completely free of any obstruction and that when released the table comes back to its position freely.
- (iv) In case any particular leg/legs tend to be obstructed in movement, remove the bend by light hammering and try it again in the valve till such time that the free movement of the leg is ensured as above.
- (v) In case such a breakage does occur and if it is found necessary to repair the de compressor table, it is most important to ensure that all the four legs are of equal and original length and that the table legs sit squarely on a flat surface. Any small increase in the length of the repaired leg is likely to cause slight tilting of the de compressor table while it is pressed by the de compressor piston resulting in unequal pressure being transmitted to the valve plate which is likely to break under unbalanced and excessive load caused by a longer de compressor leg.

### **PRECAUTIONS TO BE TAKEN WHEN NOT USING THE UNIT LONG PERIOD**

1. Before stopping the air compressor, OPEN ALL DELIVERY WHEEL VALVES and DRAIN COCK on the air storage tank. Remove the suction air filter and pour sufficient quantity of lubricating oil into the suction air pipe so as to 'OIL WET' all the valve plates and the cylinders. Then stop the unit and shut all delivery wheel valves.
2. Blank off the air intake.
3. Drain out cooling water from the engine radiator, engine cylinder block, and leave the drain cock open.
4. Pour sufficient amount of lubricating oil through the engine suction manifold and turn the engine 10-15 revolutions so that the oil is sucked in each cylinder to wet the liners, rings and valves.

5. Pour sufficient amount of lubricating oil through the compressor suction manifold and rotate the crankshaft by turning the fan blades.
6. If it can be arranged both the engine and the compressor should be turned over 2 or 3 revolutions by hand weekly. This will prevent the formation of corrosion ring, particularly in the engine cylinder if any condensate remains inside.
7. Grease all the parts wherever grease nipples are provided, so as to safeguard against "Weathering".
8. Drain fuel tank.

**RECOMMENDED LUBRICANTS FOR KG/MAW-INDIA COMPRESSOR**

We are reproducing below the chart of recommended lubricants for KG/MAW India Air compressors :-

		SUMMER Temperature above 90 <sup>o</sup> F or 32 <sup>o</sup> C	WINTER Temperature above 60 <sup>o</sup> F or 15 <sup>o</sup> C	EXTREME WINTER Temperature below 60 <sup>o</sup> F or 15 <sup>o</sup> C
1	ESSO	Motor Oil-40 (SKE 40)	Motor Oil-30 (SAE 30)	Motor Oil-20 (SAE 20)
2.	BURMAH-SHELL	Shell Rotella Oil 40	Shell Rotella Oil 30	Shell Rotella Oil 20
3	CALTEX	Rpm Delo Special SAE 40	RPM Delo Special SAE 30	RPM Delo Sepcial Sae 20
4	INDIA OIL	Delvac – 940	Delcav-930	Delvac-920

Viscosities of the various lubricating oils undergo a considerable change with the change in temperature. In the low temperature condition the viscosity of a lubricating oil increases and palpability of the same is reduced considerably. At the time of starting, therefore, lubrication of important components is likely to suffer and there is a possibility of metal to metal contact occurring. Use of higher viscosity oil than that recommended for the low temperature conditions, a above, can thus cause successive damage to the bearing and positions/cylinders at the time of starting.

In order to ensure proper bearing/cylinder lubrication in the machines working at higher altitudes where low temperature conditions exist, it is strongly recommended that lubricating oil for higher graded than SAE-20 should not be used.