Technical Manual

Snap hoist, swing and drag brake switches to off position. This energizes brake magnet valves and allows air to enter brake cylinder releasing brake.

A. SWINGING

Swinging machine to right or left is controlled by the two foot pedals located in the front center section of operator's cab.

1. To swing to the left - depress left pedal.
2. To swing to the right - depress right pedal.

The rate of swing can be controlled by varying the amount the pedal is depressed. To bring machine to a stop depress the opposite pedal. The braking effect can also be varied by the amount the pedal is depressed. This is called "plugging" and may be done as rapidly and as frequently as is required for safe operation.

The swing brake should not be used for stopping machine when in motion except in an emergency. The brake should only be used when machine is at rest.

B. DRAG

The drag motion is controlled by the tall upright lever to the left of the operator.

1. Place the "Propel-Dig" switch in the Dig position. (This allows air to enter Drag Clutch).
2. To pay out - push lever forward.
3. To drag in - pull lever back.

The rate of dragging in and paying out can be controlled by varying the distance the lever is pushed forward or pulled back from the neutral position. To stop or change direction all that is required is to change direction of the lever or "plug" and bring bucket to a stop.

The drag brake should not be used during operation of dragline except during an energency, when machine is idle or to hold bucket in the air.

C. HOIST

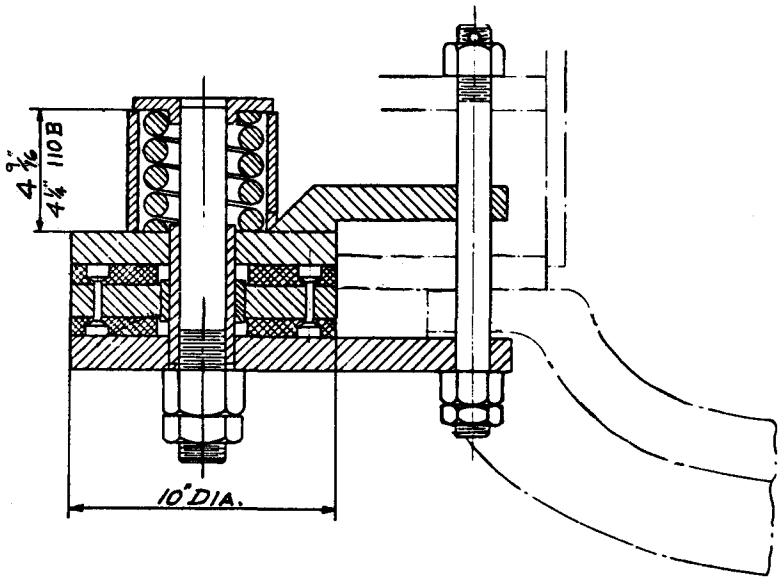
The hoist motion is controlled by the tall upright lever to the right of operator.

1. To hoist - push lever forward.
2. To lower - pull lever back.

The rate of hoisting and lowering can be controlled by varying the distance the lever is pushed forward or pulled back from the neutral position. To stop or change direction move lever in opposite direction or "plug".

The hoist brake should not be used during operation of dragline except in an emergency or when machine is idle.

The horn is operated by a latch mounted on the hoist lever.

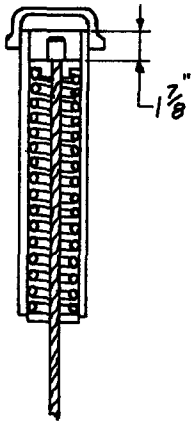


NOTE:

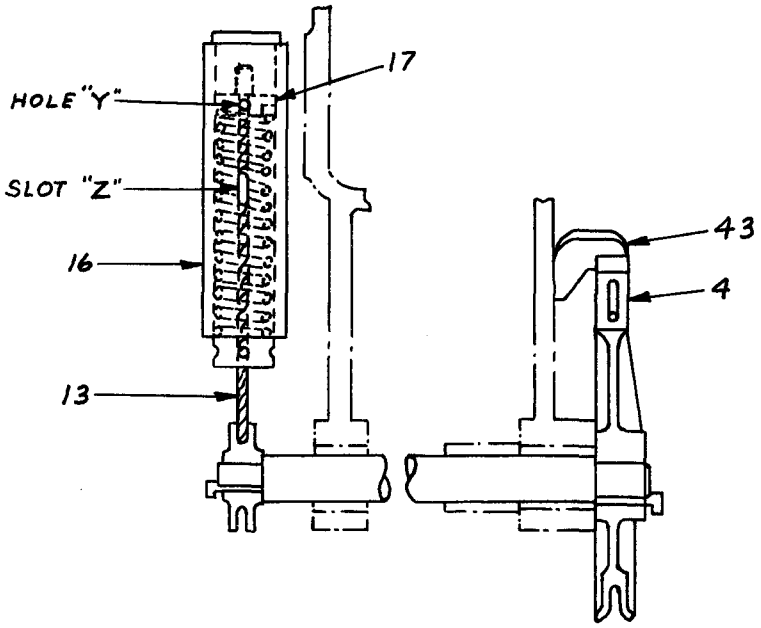
After shovel has been in operation the snubber friction disc will wear, to compensate for this the snubber spring should be readjusted to 4-9/16" by tightening the rod bolt.

DIPPER SNUBBER

Revised, May 1965
REF. DRAWING 232375



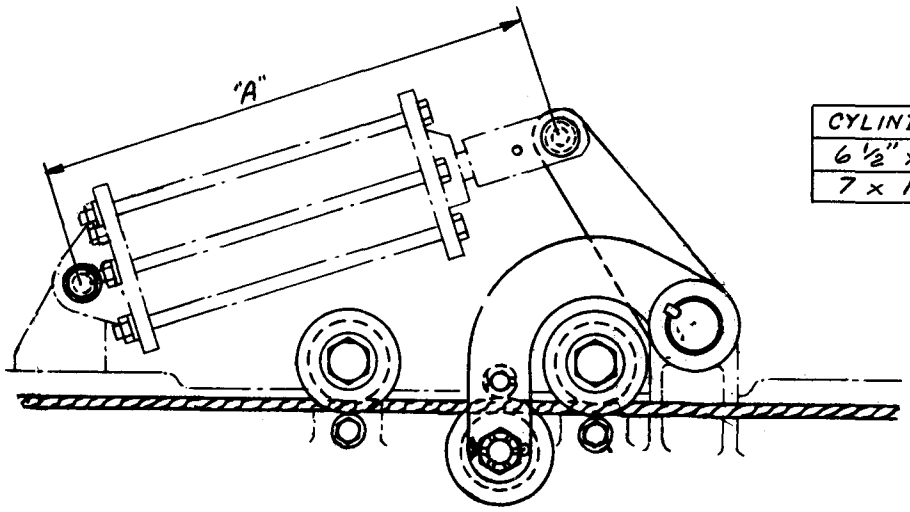
Removable cap
type spring cylinder
(See Note 1)



Non-removable cap
type spring cylinder
(See Note 2)

NOTE 1. With latch bar engaged remove the cap from the cylinder and adjust the spring length, by taking up on the trip rope adjusting screw at the rear end of the handle, so that the distance from the top of the cylinder to the spring follower is $1\frac{7}{8}$".

NOTE 2. With segment lever 4 in contact with stop 43, adjust return spring rope 13, by taking up on the trip rope adjusting screw at the rear end of the handle, so that spring follower 17 covers hole "Y" in cylinder 16. When dipper is operated spring follower 17 should be visible in slot Z in cylinder 16.



CYLINDER SIZE	"A"
6 1/2" x 9 1/2"	31 5/8
7 x 13	35 7/8

NOTE 3. To insure correct rope travel of the latch rope the distance from dead end of cylinder to end of reach rod should be "A".

Collector rings of wound-rotor and synchronous motors must be kept clean and polished. Ordinarily the rings will require only occasional wiping with a piece of canvas or non-linting cloth. If the rings become worn or pitted so that excessivc sparking occurs, grind or turn them to restore a smooth and true surface. Be sure all dust and dirt is blown out of the spaces between the collector rings.

Collector ring brushes must move freely in the holders and make firm contact with the rings. Check the brushes frequently to see that they are not stuck in the holders. New brushes should be ground to perfect fit with fine sandpaper. Maintain the brush spring tension at a pressure of from 2 to 3 pounds per square inch for carbon or graphite brushes. When replacing worn brushes, use the correct grade as furnished by Bucyrus-Erie Company.

Induction motors of small and medium size are usually furnished with ball or roller bearings. Induction or synchronous motors of the larger sizes may have oil-lubricated sleeve bearings.

Actual lubrication requirements of any particular motor or generator vary to a great extent on the details of construction, therefore it is impossible to give detailed lubrication instructions which will apply to all motors and generators. Manufacturers bulletins covering the electrical equipment are included with the instructions furnished for the machine. Read the bulletin applying to the particular piece of equipment for detailed maintenance instructions.

Couplings

The couplings used for connecting separate units of the motor generator set may be either of two general types, depending upon the construction of the motor generator set. Flexible couplings are usually used where both units to be connected have shafts supported at both ends. Solid (or rigid) couplings are used where one or both shafts are supported at one end only.

Solid couplings are of the flanged type and consist of two steel members rigidly bolted together. One half has a projecting ring on the face of the flange and the other half has a corresponding recess in the face of the flange. The fitted bolts holding the coupling halves together permit no flexibility, therefore the coupling halves must be very accurately aligned when assembling the coupling. The coupling was correctly installed at the factory but because of possible distortion in the supporting base, resulting from handling or from settling of the machine framework, it is well to check the alignment after the machine first goes into service and at increasingly greater intervals thereafter until it is definitely established that the alignment has not changed.

The first step in checking alignment of a motor-generator set consisting of two or more units all coupled with solid, flanged couplings, is to loosen all bolts and remove all but two diametrically opposite bolts in each coupling. Next, use jacking bolts to force the coupling halves far enough apart to permit inserting feelers between the coupling faces. Always open up the couplings next to the two-bearing unit (usually the driving motor) first, and do not open up the couplings too far, because the total end play must be divided between the couplings. After opening all couplings, remove the jacking bolts from all couplings and check alignment starting with one of the couplings next to the two-bearing unit.

Check the coupling halves for parallel faces by measuring the gap between halves with feeler gauges. Measure the gap at four points spaced 90 degrees apart around the coupling, then turn both shafts ¼ revolution and again take the four gauge measurements. Repeat this procedure two more times, turning the shafts ¼ revolution each time, taking care to turn both shafts the same amount, so that the relative position of the coupling halves is not disturbed.

The measurements on the sides of the coupling should check within 0.002 in. for all positions but the top and bottom readings may show a constant difference due to the tendency for the shafts to drop slightly at the open coupling.

Correction of vertical misalignment is obtained by adding or removing shims under the frame feet. Correction sidewise is obtained by removing the dowels, loosening the foot bolts and tapping the feet until the desired movement is obtained. Tighten the foot bolts before rechecking the alignment. After correct alignment is obtained drill new dowel holes and insert the dowels.

The flexible couplings used may be any of several different types depending upon the manufacturer of the motor generator set.

The "Fasts" flexible coupling, used on some sets, is not a universal joint and the same care must be taken in alignment of the coupling as for the solid coupling. In addition to checking the gap between coupling halves, check the hubs for concentricity by placing a straightedge on the rims of the hubs. Insert shims, if necessary, so that

Keep the motor clean and free of dirt and oil by following the general instructions given for alternating current motors.

If the compressor does not pump the required amount of air without running excessively, check the air piping for possible leaks. If the cylinders lack compression, examine the condition of the valves and clean, if necessary, as described in the manufacturer's bulletin. CAUTION: DO NOT ATTEMPT TO REMOVE THE DISCHARGE VALVE CAPS UNTIL THE AIR HAS BEEN BLED FROM THE SYSTEM.

The motor starting switch is provided with thermal overload relays to protect the motor against overheating. If the overload relays continually open the magnetic switch, examine the compressor for hot bearings or stuck valves. DO NOT REPLACE THE RELAY HEATERS WITH HEATERS OF LARGER SIZE.

Short circuit protection is obtained by the use of a circuit breaker or fuses in the supply line. Other motors may be connected to the same circuit breaker; therefore, in case the breaker opens, investigate all circuits to determine the cause of the trouble before resetting the circuit breaker or replacing the fuses.

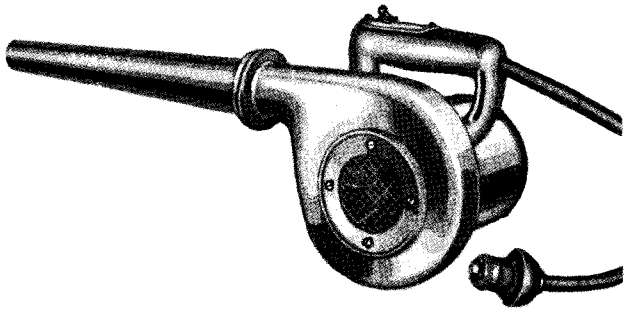
The Care of Motor and Generator Insulation

The following instructions regarding the care and maintenance of motor and generator insulation are of the utmost importance and should be followed very carefully in order to obtain the best results and continuous service from your machine. In the care of electric motors and generators, the feature having the greatest influence on operation, life and general well-being is the care given insulation.

Motors and generators that have been long in transit in moist atmosphere, or have been idle for an extended period without heat to prevent the accumulation of moisture, should be thoroughly dried out before being placed in service. Machines may also become wet by accident, or they may "sweat" as a result of a difference in their temperature and that of the surrounding air, just as cold water pipes "sweat" in warm, humid atmosphere. This condition is very injurious and should be prevented, particularly in the case of large and important motors and generators, by keeping them slightly warm at all times. Current at a low voltage can be passed through the windings or electric heaters can be used with tarpaulins stretched over the motor or generator to maintain the proper temperature.

A systematic and periodic inspection of motors and generators is necessary to ensure best operation. Some machines are installed where conditions are ideal, where dust, dirt and moisture are not present to an appreciable degree; but most motors are located where some sort of dirt accumulates in the windings, lowering the insulation resistance and cutting down creepage distances. Stone or coal dusts are highly abrasive and actually cut the insulation in being carried through by the ventilating air. If conditions are extremely severe, open motors and generators may require a certain amount of cleaning each day. For less severe conditions weekly inspection and partial cleaning is sufficient. Most machines require a complete overhauling and thorough cleaning about once a year.

The best method for cleaning the insulation is air at low pressure. The Bucyrus-Erie Company offers a portable blower delivering a good volume of air at the correct pressure which is very convenient for the periodic cleaning of insulation.



Once each week, or oftener if required by extremely dusty conditions, blow out the accumulated dust and dirt in the windings. Oil or grease is extremely detrimental to the insulation and must not be allowed to remain on the windings. Wipe off any accumulation of grease and clean with carbon tetrachloride. Be sure there is good ventilation, because the fumes are dangerous.

If small cracks appear in the insulation, apply a coat of insulating varnish after thoroughly cleaning the winding. Suitable varnish for this purpose may be obtained from the nearest dealer or the electrical equipment manufacturer. On most motors and generators, windings are accessible, and the air can be properly directed to prevent damage to them.

Disconnect the wires connected to terminals 26 and 4 on all three regulator panels (hoist, swing and crowd). Thus, the voltage and current feedbacks have been disconnected. It is also desirable to disconnect the reference circuit control winding. To do this, the wire connected to terminal 19 on the regulator panels must be disconnected.

8. At the hoist motor, open the commutator cover and visually trace the armature lead which connects directly to the armature brushes. Observe also that the remaining armature lead is connected to the commutating pole. The lead connecting directly to the armature brush should be lead A1. If it is marked A2 in error, interchange the armature cable marking tags. Also, double check the armature leads between the generators and the motors to make sure that terminal A1 on the motor is connected to terminal A2 on the generator which should go directly to the armature of the generator. Open the A1 motor lead at each motor.

   NOTE: It is important that the motor armature leads are properly identified and that the proper generator lead is connected to the proper motor lead or damage to the system may result.

9. Having disconnected the hoist motor, duplicate the procedure for the crowd and swing motors and disconnect one of the two field leads at each of the hoist, crowd and swing motors. When more than one swing motor is used, it will be necessary to check to see that both A2 and A4 go to the swing generator armature directly and to open both leads going to A1 on each swing motor.

10. Check the ganerator fields for proper connections and the generator armatures, fields and thermistors for grounds. All connections to the generator being checked, that eventually lead back to the control panels including those going to the thermistor, must be disconnected before meggering.

11. Check the thermistor ohms for each generator. Resistance should be as called for on the "C" sheets.

E. Adjust resistor 3RH for the "C" sheet value of current with block by-passed.

The above test should be done with caution and the controller should be moved slowly. Care should be taken at this point to check system stability. It is possible to have an instability and not notice the characteristic oscillation of the generator armature current. For this reason, the output current and voltage of the SCR amplifiers should be observed at this point. Should a consistent oscillation in either SCR output voltage current or generator output current occur under any conditions of controller movement at this point, it is possible to stabilize the system by turning the anti-hunt tap switch. Turning from 1 to 9 increases the effectiveness of the anti-hunt. Should a change in the setting of the tap switch be necessary to stabilize the amplifier, it will be necessary to recheck the overlap voltage. Should a bias adjustment be necessary, this in turn will necessitate a check of no load voltage and in turn a recheck of the stall setting with the block by-passed.

F. Remove the jumper from terminal 1 to 2 and adjust rheostat 5RH (hoist or crowd) and 6RH (lower or retract) for maximum stall current with the controller in the maximum position.

G. Adjust 7RH for a resistance equal to 5RH, wires 14 to 35. Return the jumper from 1 to 2 and repeat Step E since the adjustment in Step F will affect those in Step E. Should readjustment of the stall with the block by-passed be required, it may be necessary to repeat Step F.

H. This procedure may have to be repeated several times for the hoist until the proper values are obtained for both conditions without adjustment between readings.

Twice a year, or when temperature changes make it necessary, drain the propel gear case and cat drive gear cases immediately after propelling, and fill with gear lubricant of correct grade. Refer to Lubrication Manufacturers' Charts.

Note 6. Swing Roller Path and Swing Rack - Keep the roller path and swing rack thinly coated with gear compound. Check daily. If dirt accumulates, wash off the old lubricant and apply a fresh coat.

Note 7. Keep the steering clutches free of dirt, clay, etc. These clutches must be kept clean as their return into the engaged position is by spring action.

UPPER WORKS LUBRICATION

Most of the bearings for the upper works have grease fittings tapped directly into the bearing. Location of these fittings as well as other points requiring lubrication are shown on the Upper Works Lubrication Chart.

Reference Notes -- Upper Works

Note 1. Shovel Hoist or Dragline Drag - The first reduction gears are enclosed in oil tight cases. The gear case may be either oil or compound lubricated. Refer to Upper Works Lubrication Diagram.
The gear case is provided with a slight level gauge, a drain plug and an opening for filling the case. If gear compound is used the excess can be removed through a special opening provided.

The open gears should be checked twice a shift and compound applied as required.

Note 2. Swing - An air filter on the breather pipe prevents dirt entering the oil, however, the gear case should be drained and refilled after approximately one month's operation. Thereafter, drain and refill as indicated on chart.

In order to insure proper lubrication fo the upper first intermediate shaft bearing an impellor oil pump is placed in the shaft. If necessary to disassemble shaft be sure that ball check and spring are assembled correctly. The vertical swing shaft upper bearing is oil lubricated and the lower bearing is lubricated through a standard grease fitting brought out to a convenient location on the revolving frame deck.

Note 3. Crowd - Before placing machine in operation check to be sure that the clutch grease guard is in place. This guard protects the crowd clutch from lubricant accidentally getting on the clutch lining.

Note 4. Electric Controls - The master switches, levers, and chains in electrical control box located in operator's cab should be serviced once a week.

All the levers have grease fittings and normally only one or two shots of grease will suffice.

Occasionally a few drops of light oil should be placed on the roller chains to insure smooth operation.

SCOPE:

Lubricant performance requirements for Multi-Purpose Oil.

APPLICATION:

The addition of a lubricant to the compressed air system, hand oil cans etc.

GENERAL REQUIREMENTS:

1. Must be fluid at temperature applied
2. Should contain rust inhibitor
3. Motor oil - API service classification "MS".

VISCOSITY RECOMMENDATIONS:

1. Air Line Lubricant

Ambient Temperature	SAE Number
Below - 10°F	5W
Above - 10°F	10W

2. Hand Oil Can

Viscosity to be suitable for application and temperature.

These performance requirements are benchmarks and not a specification. Therefore meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.

COMPOUNDING

Suitable for producing an extreme pressure adhesive coating of a lubricant on the drag ropes.

SPECIFIC REQUIREMENTS FOR ALL TYPES OF LUBRICANT

1. Must pass the United States Steel Retention Test using a Timken tester.

2. Shell Four Ball EP. - (ASTM D-2596)
   Load wear index, kg., min. - 40
   Load weld kg., min. - 250

3. Shell Four Ball Wear - (ASTM D-2266)
   Wear scar diam, mm., max. - 0.60

4. Timken OK., load lbs., min (ASTM D-2782) - 45

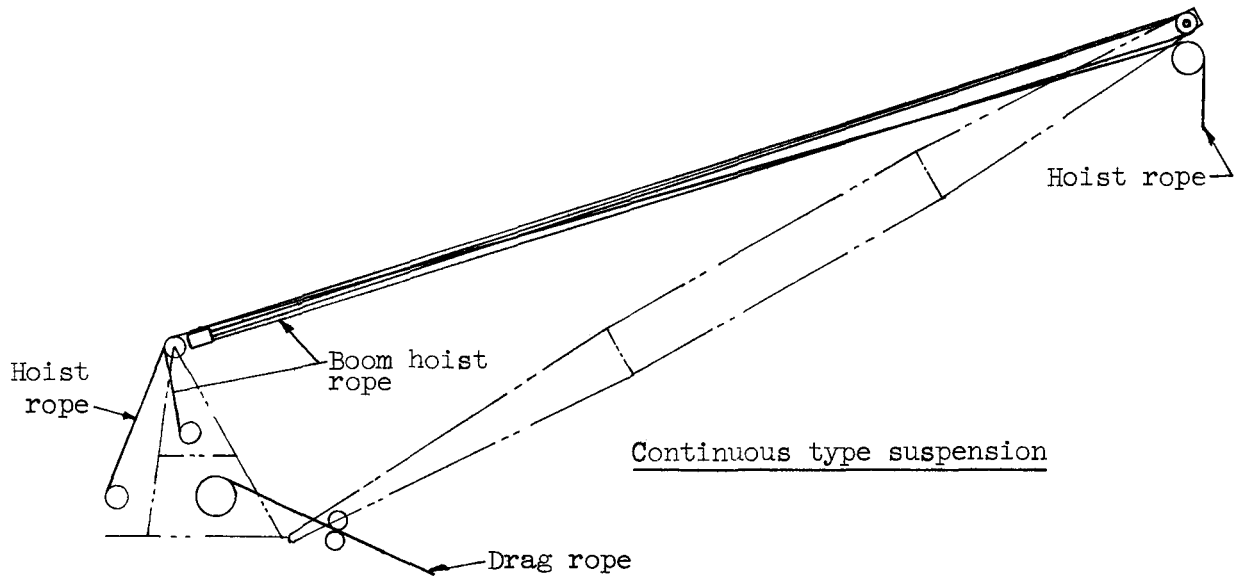
5. Copper strip corrosion - (ASTM D-130) - pass

6. Suggested Application Temperature Ranges

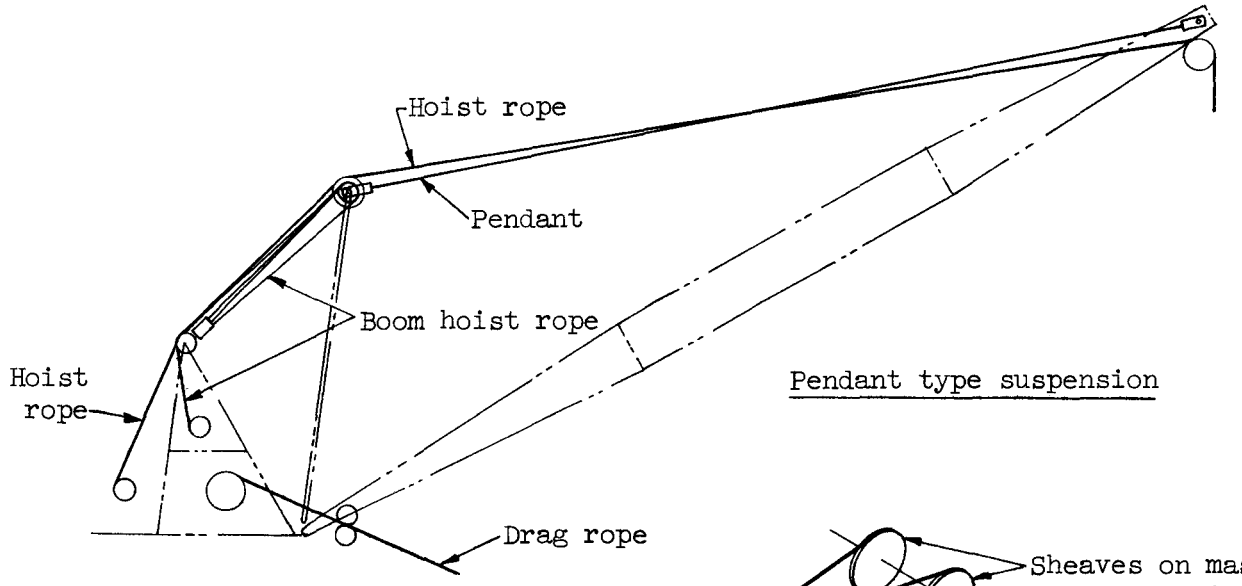
   There should be a lubricant for each of the following temperature ranges.

   110° to 30°F 40° to 0°F 10° to -50°F

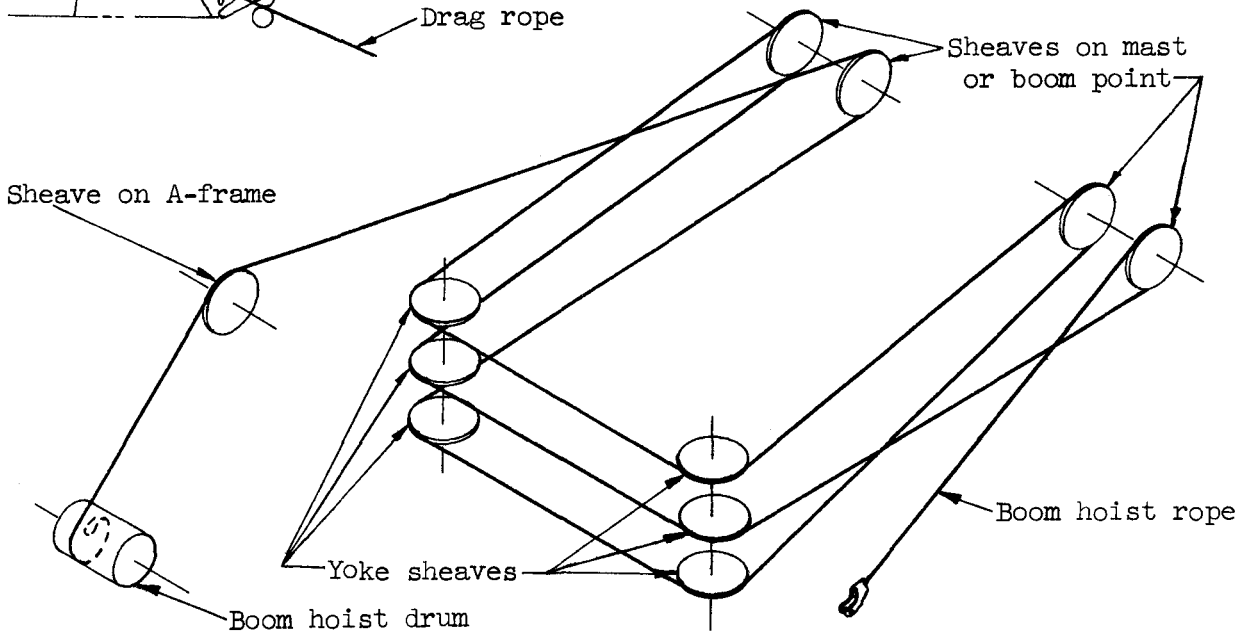
These performance requirements are bench marks and not a specification. Therefore, meeting these limits as described above, does not relieve the supplier of the responsibility associated with brand name products.



Continuous type suspension



Pendant type suspension



JULY, 1964

DRAGLINE ROPES

REF. DWG. 238498

Dust laden air enters the Rotonamic inlet tube (A), the deflector vanes (B) instigate a cyclonic action. The whirling air travels along the primary chamber (C), dust particles are centrifuged against the wall and eliminated at the nozzle (D) by the high velocity bleed-off air. The remaining air (90%) spirals back around discharge tube (E) and centrifuges the remaining dust particles. Clean, filtered air exits at (F).