



LEGEND, INC.

**DENVER
D-12 Laboratory
Flotation Machine**

**Installation & Operation
Instructions**

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LABORATORY SUB-A FLOTATION MACHINE

1. DESCRIPTION.

The Laboratory Sub-A Flotation Machines incorporate the same basic principle of operation as the commercial size Sub-A Flotation Machines. These machines can also be used as agitators or attrition scrubbers by the addition of an optional kit.

The Model D-12 machine is used for 250-, 500-, 1000- and 2000 gram tests. One 1000-gram acrylic tank is furnished with each machine. Other tanks (250-, 500-, 1000- and 2000-gram are stainless steel).

Each machine consists of the following: cast iron base; aluminum supporting column and arm; suspended type mechanism with totally enclosed anti-friction spindle bearing stainless steel shaft, stainless steel standpipe with air control valve, removable polyurethane diffuser and polyurethane receded disk impeller; drive guard; rubber base mat; 1/2-horse power, 1800 rpm, single-phase, 50-Hertz, 115/230,-volt, TEFC, ball-bearing motor; variable speed V-belt drive; white enamel vanning plaque; Hydrion pH indicator; set of sample reagents; small hand magnet; and acrylic plastic, recirculation collar (fluidizer). A switch mounting box, toggle switch, and cable with plug are furnished with each machine for connecting electrical power to the machine. Optional accessories for all machines are: a permanently mounted tachometer for providing a means for visual machine speed control; a stainless steel attrition scrubbing kit (consisting of: lower spindle bearing cap, one-piece double attrition propeller, and tank with splash cover) for attrition scrubbing tests; and an agitation kit (consisting of lower spindle bearing cap, single agitator propeller, a glass tank) for agitation tests.

Additional 250-, 500-, 1000- and 2000-gram stainless steel tanks are readily available if required. A 1000-gram acrylic tank is also readily available. The suspended type mechanism is spring-balanced and is easily raised or lowered with the hand crank on the side of the machine. The mechanism can be locked in any vertical position with the spring-loaded locking pin on the side opposite the hand crank. This pin must be pulled out and held when operating the hand crank. When the desired position is reached, release the pin and it will lock the mechanism in place.

2. RECEIVING INSPECTION.

The flotation machines are shipped assembled and packaged in a container. Loose items such as tanks, vanning plaque, etc., are usually shipped in one or more separate containers.

NOTE

DENVER SALA's responsibility for breakage, loss, or damaged goods ceases upon delivery of the merchandise to the transportation company from whom a receipt is received showing that the shipment was accepted in good condition. Immediately upon receipt, visually inspect all shipping containers and equipment for shortages or damages. If any of the material listed on the bill of lading is short, broken, or damaged, do not accept the shipment until the carrier's agent makes a notation of the shortage or damage on the bill of lading. Notify the transportation company's agent at once and request an inspection. This is absolutely necessary. Unless this is done, the transportation company will not entertain a claim for loss or damage. If the agent does not make an inspection, an affidavit should be made that he was notified (specify date) and failed to do so. This affidavit with other papers will properly support your claim.

3. INSTALLATION.

Install the flotation machine as follows:

- a. Place machine on table or bench.
- b. Clean all dust, salt deposits, etc., from machine.
- c. Level machine with leveling screws in base of machine.

CAUTION

To prevent possible damage to motor or machine, insure electrical power source connected to motor in step d corresponds with electrical power requirements for machine motor. Insure motor direction of rotation is such that motor will drive impeller in a clockwise direction when looking down on the impeller.

d. D-12 machines are prewired with toggle switch and cable with plug wired for 115vac, 1 phase. If 230vac, 1 phase, power is to be used toggle switch and cord must be removed and suitable wiring and a fusible disconnect switch installed.

4. OPERATION.

The following paragraphs contain information which will aid the user in the operation of the flotation machine. When performing tests, it is necessary to use the utmost care in keeping accurate records of all conditions present during the test which might influence the results or be of importance in interpreting the test data. If proper care is exercised, duplication of results is assured in an operating plant.

SPEED ADJUSTMENT.

Speed of the machine is adjusted by turning the knob located directly above the motor and connected to the variable speed sheave. To increase speed, turn the knob counterclockwise. To decrease speed, turn the knob clockwise. Adjust speed only when machine is running. The nominal speed required for each test is a factor within the control of the operator who by observation will quickly determine the proper speed for each operation. Machines furnished with tachometers are ideal for obtaining nominal speed during specific tests and can be used for setting speeds for comparative tests. Normal operating speeds are as follows:

250-,500-, or 1000-gram tests - Approximately 1300 rpm

2000-gram tests - Approximately 1200 rpm

AERATION CONTROL.

The machine produces its own air so it is not necessary to have an external air source. However, pressurized air can be added if desired. The air valve at the top of the standpipe is used for aeration control during the aeration and flotation operation. The valve is closed during conditioning and opened during the aeration and flotation period.

PREPARATION FOR OPERATION.

While there is little chance of contamination when using the flotation machine, the machine should be thoroughly cleaned between tests to avoid this possibility. The suspended type mechanism and separate tanks lend themselves to easy and complete cleaning. If ample precautions are taken, the weighed products from the test should check close to the original weight of the sample introduced into the cell. Should the weights not check, the trouble should be investigated. In many cases, certain ores and products are partially soluble or may contain a slight moisture content which accounts for such variations. All operations prior to and after flotation step should be handled with equal care if an accurate balance is to be obtained. Drying, for example, should be watched carefully to insure complete moisture removal and avoid overheating. Preparations of the various test products after drying and before obtaining chemical analysis should be carefully performed. This phase of the test program is sometimes underestimated or neglected.

FLOTATION OPERATION.

The Model 0-12 machine is usually set up for the 2000-gram tests and must be changed in order to perform the 250- to 1000-gram tests. To change the Model 0-12, replace impeller and diffuser on machine with the impeller and diffuser shipped loose (see section 5. MAINTENANCE).

The following paragraphs give a brief outline of several important factors that have a marked influence on flotation technique and results.

USE OF PLASTIC RECIRCULATION COLLAR FLUIDIZER FOR FLOTATION. The holes in the diffuser on the lower end of the standpipe permit recirculation of pulp to the impeller which enhances the aerating and mixing characteristics of the flotation machine. However, recirculation of low density pulp from the upper zone of the cell into the denser zone at the bottom of the cell is often desirable. This is particularly true for coarse or deslimed feeds as the fluidizing action created by recirculation of pulp from the upper zone of the cell minimizes stratification of sands and improves flotation results. The fluidizer furnished with each machine is used for upper-zone recirculation. Refer to section 5 (MAINTENANCE) for installation of the fluidizer. After the fluidizer is installed, it can be left on the machine. When the fluidizer is not needed for a test, it can be raised out of position and hung on the air valve using a small piece of wire. This makes it unnecessary to dismantle the machine each time the fluidizer is needed or not needed for a test. Also, comparative tests with and without the fluidizer can be conveniently performed or the principle advantage of upper recirculation readily determined.

OBTAINING THE SAMPLE AND GRINDING. The sample should be representative of the anticipated feed for commercial flotation since all laboratory results will pertain to the flotation characteristics of the test sample. A discrepancy in the material can lead to erroneous conclusions and thus effect the interpretation of the results. If drying is necessary, great care should be exercised to avoid unnecessarily high temperatures or prolonged heat. The same method should be used for grinding as will be used in practice. That is, if wet grinding is to be used, that method should be used in testing.

Another important factor is water. Water from the same source and at about the same temperature should be used in testing as will be used in the mill. While these points may be considered as refinements, it will be found that they will be of help in arriving at correct conclusions. The use of mine water should be avoided as much as possible because of its probable acidity and soluble salt content.

FINENESS OF GRIND. The degree to which a certain ore must be ground to secure a satisfactory extraction of a mineral depends upon the physical characteristics of the ore. Generally, the largest particle which can be floated commercially is minus 20-mesh, though a much coarser particle size may be circulated while floating the usually finer mineral values. Naturally, the coarsest grind in which the mineral is liberated from the gangue should be determined, and thus a saving in power and grinding media will result. A better extraction will be made if the ore is not over-ground. Tests should be made first at a coarse mesh, saving as much as possible at this size, and then the tailings reground for further tests to liberate the remaining values. It pays to remove the mineral as soon as liberated.

KIND AND QUANTITY OF REAGENTS. It is impossible to specify the reagents which will give good results on any ore. Many articles are published on reagents used on certain ores, but these can only be used as a guide because each ore has certain characteristics that can only be determined by test work. Refer to Denver Equipment Division Bulletin No. R1-B3 which describes most of the common flotation reagents available, their uses, and their characteristics. Literature available from reagent manufacturers is also helpful.

METHOD OF FEEDING. The quantity of reagent required is usually very small. It may, however, be found that the laboratory machine requires slightly more reagent than will be used in practice. The previously referenced bulletin (R1-B3) lists the usual quantities of specific reagents used in flotation. Liquid reagents should be introduced in the flotation cell drop by drop using an eye dropper. Water soluble dry reagents made up as a 1-percent solution, should be added with a graduate or pipette. All reagent quantities should be recorded as part of the test data. It is usually desirable to temporarily close the air valve while adding reagents so that a more thorough mixing of the reagent and pulp can be attained.

CONDITIONING. Conditioning is the time which the reagents must be in intimate association with the pulp in order to exert their full effect prior to flotation. In practice, the reagents may be added to the ball mill (or at some intermediate point in the mill circuit) thus allowing sufficient time for the reagent to take effect. In other instances, conditioning tanks with mechanical agitators are required for a longer conditioning period. The length of time (usually in the range of 5 to 15 minutes) can usually be determined in a laboratory machine by observing the time required after the addition of reagents and until a good froth appears. During this time, air may not be admitted through the air valve and the machine may be operated at a lower speed. During the conditioning period, it is sometimes advisable to have a pulp dilution of about 50-percent solids. After the reagents are thoroughly mixed, additional water is added and the air is controlled by the test engineer as required. The conditioning time should be recorded as a vital part of the test procedure.

HYDROGEN ION CONCENTRATION (pH). The pH scale is used to denote the acidity or alkalinity of the ore pulp. In general, the best flotation conditions exist when the pulp is slightly alkaline, but in some cases it may be undesirable or uneconomical to use an alkaline circuit. There are certain minerals that float much more readily in an acidic solution of pulp. In this instance, an acid circuit may be used. The pH indication should be recorded during the test. When flotation is to be conducted in an alkaline circuit the reagent (usually soda ash or lime) is added to the batch grinding mill.

DILUTION. Dilution is the ratio of water to solids in the pulp. Thus, 4:1 would indicate four parts water to one part dry solids by weight. This can also be expressed as 20-percent solids. Coarse flotation will require a higher pulp density than will be necessary if the ore is finely ground. For example, a condition where approximately 6 percent of the solids is retained on a 65-mesh screen with 60 percent passing a 200-mesh screen would indicate a pulp density of 2:1 or even 3:1 for good results. Where 25 percent of the solids is retained on a 48-mesh screen with 35 percent passing a 200-mesh screen, the pulp density would be approximately 1:1. These examples show the wide range of pulp densities sometimes encountered and illustrate that a coarse grind requires less water than when the ore is ground finer. These high pulp densities are frequently used in the Sub-A Unit Cells when they are installed in the ball mill-classifier circuit.

Table 4-1 lists the approximate tank volumes of the tanks supplied with the laboratory flotation machines.

TANK SIZE GRAMS*	TANK VOLUME			
	LESS MECHANISM	MACHINE RUNNING AND AIR ON		
		FULL	1-INCH BELOW LIP	2-INCHES BELOW LIP
250	1710 cc	1235 cc	970 cc	610 cc
500	3230 cc	2550 cc	2000 cc	1630 cc
1000	5780 cc	4980 cc	4300 cc	3520 cc
2000	10712 cc	9327 cc	8057 cc	6927 cc

*DRY SOLIDS WEIGHT, 2.7 SPECIFIC GRAVITY, AT APPROXIMATELY 20-PERCENT SOLIDS.

Table 4-1. Approximate Tank Volumes

FLOTATION TIME. A factor which governs the number of cells required in practice to treat a certain ore is the flotation contact time. In the laboratory, the pulp will be held in the machine until all the desired mineral has been floated. The froth concentrate is removed by skimming the froth with a hand paddle fabricated from wood or plastic. In most cases, the skimming should be performed at a uniform rate. This rate will normally be in the range of 5 to 20 minutes. The time will vary greatly with different ores and should be recorded as part of the test data. This time element can be determined in the laboratory. Knowing the retention time and the pulp density, it is possible to select the best size and number of flotation cells required for the commercial installation to handle a given tonnage of crude ore per day. Laboratory flotation work can involve a single flotation step to produce a rougher concentrate and tailing or can consist of multiple concentrates or intermediate products. Re grinding or desliming can also be a part of the procedure. It is impossible to cover this subject in detail here. Cleaning of the rougher concentrate is normally required to reject certain quantities of impurities that floated with the desired material. Cleaning is essentially only re flotation of the rougher concentrate with or without additional quantities of reagents. The rougher flotation concentrate will be produced in the 1000- or 2000-gram tanks and is usually cleaned at a lower pulp density than the rougher flotation, using the 250- or 500-gram tank. In some cases, the impurities are floated away from the desired product so that the tailing is actually the enriched product. As a general rule, it is preferable to float the component that is of the smallest weight, but this cannot always be done. In practice, flotation is not carried out in one large cell, but in a series of cells (preferably four or more) which divides the time necessary for flotation by the number of cells used. The largest number of cells in series gives not only more actual retreatment of the pulp (there by avoiding short circuiting), but also permits using cells for either roughing, cleaning, or recleaning purposes essential in making the high grade shipping product.

SUMMARY. From the preceding instructions, you will note that the laboratory flotation machine can be used to duplicate all the operations in large scale commercial flotation, such as, the conditioning of the pulp with reagents, the aeration of the pulp, and the production of the high grade mineral froth which can be removed at definite time intervals. The results obtained in testing can be compared to actual operating practice. If you have any questions, DENVER SALA maintains a staff of metallurgists who will work closely with you to solve all problems. All inquires and metallurgical results are held in strict confidence.

USE OF MACHINE AS AN AGITATOR. The flotation machine is easily converted to an agitator by following the instructions in section 5 (MAINTENANCE). The lifting mechanism can be positioned at any desired height for optimum agitation conditions depending on the tank used and the material being agitated. Also, the speed should be varied to give the most desirable agitating condition.

USE OF MACHINE AS AN ATTRITION SCRUBBER. The flotation machine is easily converted to an attrition scrubber by following the instructions in section 5 (MAINTENANCE). The opposed propellers of different blade pitch provide maximum movement and rubbing of the mineral particles. The attrition tank is equipped with a cover to prevent splashing or spillage due to violent agitation of the machine. High pulp densities in the order of 70- to 75 -percent solids at an approximate speed of 800 rpm are required for efficient scrubbing.

5. MAINTENANCE.

SUSPENDED MECHANISM SPRING ADJUSTMENT. If the suspended mechanism should become hard to raise or lower, adjust the spring tension as follows:

- a. Lower mechanism as far as it will go, turn hand crank until hole in side of spring housing cover lines up with hole in hand crank shaft, then insert a nail or pin through these holes.
- b. Remove four cap screws attaching spring housing cover to machine.
- c. Turn hand crank counterclockwise 1/4 to 1/2 turn, then install and tighten the cap screws removed in step b.
- d. Remove nail or pin installed in step a, then raise and lower mechanism and check for ease of movement. If mechanism is still hard to operate, repeat steps a through d until corrected.

IMPELLER, DIFFUSER AND FLUIDIZER REPLACEMENT.

Replace impeller, diffuser, and fluidizer as follows:

- a. Disconnect electrical cable from power source.
- b. Raise mechanism to its uppermost position.
- c. Hold V-belt drive and turn impeller (right hand thread) clockwise until removed from shaft.

NOTE

Perform step d only if fluidizer is installed on machine. Fluidizer can be removed from standpipe after diffuser is removed in step e.

- d. Remove rubber bands attaching fluidizer to diffuser.
- e. Hold standpipe and turn diffuser (left hand thread) counterclockwise until removed from standpipe.

NOTE

Perform step f only if fluidizer is to be installed on machine. Fluidizer has an inside bevel on one end so it will fit firmly against slope of diffuser. This bevel must face down.

- f. Slip fluidizer on standpipe with beveled end facing down.
- g. Install diffuser on standpipe and tighten hand tight.
- h. Install impeller on shaft and tighten hand tight.

NOTE

Perform step i only if fluidizer is installed on machine. i. Attach fluidizer to diffuser with three rubber bands as follows:

1. Pass one end of each rubber band down through fluidizer.
2. Loop these ends over three separate diffuser blades at approximately equal distances around diffuser.. .
3. Pull loose ends of rubber bands down and over outside of fluidizer and loop over the same diffuser blades used in step 2.

CONVERTING MACHINE TO AGITATOR.

Convert the machine to an agitator as follows:

NOTE

Machine can be converted only if the optional kit is furnished with machine.

- a. Disconnect electrical cable from power source.
- b. Raise mechanism to its uppermost position.
- c. Hold V-belt drive and turn impeller (right hand thread) clockwise until removed from shaft.

NOTE

If standpipe will not unscrew by hand, remove air valve and pipe plug from standpipe and insert two 1/8-inch pipe nipples in their place. Use these nipples to remove standpipe. Do not use a pipe wrench.

- d. Turn standpipe (left hand thread) counterclockwise until removed from machine.
- e. Install lower spindle bearing cap (from kit) in place of standpipe.
- f. Install single agitator propeller (from kit) on end of shaft.

CONVERTING MACHINE TO ATTRITION SCRUBBER.

Convert the machine to an attrition scrubber following instructions in paragraph 5-7 except that the one-piece double attrition propeller is installed on the shaft instead of the single agitator propeller.

BEARING REPLACEMENT.

REMOVAL. Remove bearings as follows:

- a. Disconnect electrical cable from power source.
- b. Raise mechanism to its uppermost position.
- c. Turn speed control knob to its uppermost position in drive guard.

NOTE

Perform step d only if tachometer is furnished with machine.

- d. Loosen set screw on side of tachometer adapter base to free flexible coupling.
- e. Remove acorn nut attaching drive guard to machine and remove drive guard.
- f. Loosen set screws attaching motor bracket to machine, slide motor toward machine, and remove V-belt.
- g. Hold shaft and turn impeller (right hand thread) clockwise until removed from shaft.

NOTE

If standpipe will not unscrew by hand, remove air valve and pipe plug from standpipe and insert two 1/8-inch pipe nipples in their place. Use these nipples to remove standpipe. Do not use a pipe wrench.

- h. Turn standpipe (left hand thread) counterclockwise until removed from machine.
- i. Remove upper spindle bearing cap (right hand thread).
- j. Place a piece of hardwood on the top of the shaft and carefully hammer the shaft downward to free it from the bearings, then remove shaft from machine.
- k. Remove bearings and inspect for damage or excessive wear. Replace as required.

INSTALLATION. Install bearings as follows:

- a. Thoroughly clean all parts to remove old grease, dirt etc.

NOTE

Bearings are attached to shaft by a firm pressure fit.

- b. Place lower bearing on shaft and insert shaft and bearing up into spindle bearing housing.
- c. Pack with grease (Mobilith AW2 or equivalent).
- d. Install standpipe on machine and tighten hand tight.
- e. Install upper bearing on shaft. Insure bearing is tight against shaft shoulder.
- f. Pack with grease and install spacers and upper spindle bearing cap. Tighten cap hand tight.
- g. Check shaft for end play or if it is too tight. If there is end play or shaft is too tight, remove or add spacers as required until there is no end play and shaft is not too tight.
- h. Install V-belt and adjust tension by sliding motor away from machine. Tighten set screws attaching motor bracket to machine when proper tension of V-belt is obtained.
- i. Install drive guard on machine with acorn nut. .

NOTE

Perform step j only if tachometer is furnished with machine.

j. Tighten set screw on side of tachometer base to secure flexible coupling.

LUBRICATION.

The bearings on the machine are sealed bearings and require no periodic lubrication. After prolonged use, it may be necessary to repack the bearings. Repack bearings in accordance with the instructions listed earlier.

6. RECOMMENDED SPARES.

Following is a list of parts and quantities recommended by DENVER SALA to be stocked as spares for the flotation machine:

DESCRIPTION	QTY	PART NUMBER
IMPELLER	1	201588
HOOD	1	500333
IMPELLER	1	200563
HOOD	1	500390
BEARING	2	524615 CUP; 524663 CONE
V-BELT	1	520329



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CONCENTRATOR, BUCKMAN TILTING	
CONVEYOR, BELT	4
CONVEYOR, SCREW	
CRUSHER, GYRATORY LAB.	
CRUSHER, JAW	
CRUSHER, ROLL	
DISTRIBUTOR, PULP, MOTORIZED	
DISTRIBUTOR, PULP, SELF ROTATING	
DRYER, ROTARY	
ELEVATOR, BUCKET	5
EMULSIFIER	
FEEDER, ORE, BELT	
FEEDER, REAGENT, DRY, BELT	
FEEDER, REAGENT, DRY, CONE TYPE	
FEEDER, REAGENT, WET	
FILTERS, DISC	
FLOTATION MACHINE & UNIT CELL	6
HOLO-FUTE PROCESSOR	
JIG, MINERAL, DENVER SELECTIVE	
JIG, PLUNGER, HARZ TYPE	
MILL, BALL AND ROD	
MILL, JAR, LABORATORY	
PAN, MECHANICAL, CONCENTRATING	7
PAN, MECHANICAL, CONCENTRATING, WITH TROMMEL UNIT	
PLACER, TROMMEL, JIG, UNIT	
PUMP, DIAPHRAGM, ADJUSTABLE STROKE	
PUMP, DIAPHRAGM, LOWHEAD	
PUMP, DIAPHRAGM, SUCTION PRESSURE	

PUMP, ORION, DENVER	8
PUMP, SRI	
PUMP, SAND, VERTICAL	
PUMP, VERTICAL, SUMP, & SRI-V	
SAMPLER, AUTOMATIC	
SAMPLER, HYDRAULIC,MODEL F2	
SAMPLER, VEZIN	
SCREEN, DILLON, DENVER	
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SCREEN, VIBRATING,DENVER	
SCRUBBER, ATTRITION	
TABLE, CONCENTRATING	
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EQUIPMENT MAINTENANCE

The proper lubrication of Ore Dressing and Process Equipment is an important factor in obtaining good performance and long service. Heavy loads, shocks and jars are typical of dressing and processing operations; therefore lubricants designed to withstand these conditions are essential to assure maximum efficiency.

The recommended lubricants which appear in the chart are made by Mobil Oil Corporation, with a cross reference to Exxon, Pennzoil, Shell and Texaco. Their Technical Hot Line phone numbers are provided for your convenience. Please use these numbers to confirm any cross reference from Mobil to other manufacturer's per your specific requirements. This manual is offered on the basis of careful scientific selection and proven suitability in service. A minimum number of lubricants will provide good dependable lubrication to fill the various requirements.

Grit and ore dust are always present and if allowed to penetrate, may quickly ruin bearings and gears of the best quality. It is desirable to take due precautions in this regard and keep abrasive material away from points where it may do harm. Fittings should be wiped clean before the grease gun is applied. Other points of application should be kept free of dirt. The tooth surfaces of open gears should be cleaned before they are re-lubricated because of the grit which collects from the air. To further ensure exclusion of dirt from the lubricants, all drums and containers should preferably be stored in a clean closed room and covers kept tightly closed when not in use. Plain sleeve bearings which are lubricated with grease should be pumped full to capacity and continue pumping until some of the old grease escapes at the bearing ends. This practice provides a desirable flushing action and also seals the bearing against penetration of foreign matter. The same instructions will apply to antifriction bearings (ball or roller) where excess grease within the housing is free to escape. If there is any doubt about this point, remove the grease fitting or filler plug and let the bearing run until the excess lubricant has been eliminated. Sealed bearings, where grease cannot readily escape, will usually require minimal application at infrequent intervals. Keep in mind that regular intervals of application are essential to successful results. Operating conditions will largely determine just how often each part must be serviced, but generally speaking frequent application of lubricants in small quantity is preferred to heavy dosage at longer or irregular intervals. Where the lubricant is continuously reused, such as enclosed worm gear units, etc., the oil should be changed regularly to maintain the necessary purity and freedom from moisture and abrasive matter. Proper interval for changing the oil will depend upon the amount and severity of service, but in no case should the intervals exceed one year.

STANDARD ABBREVIATIONS

APPLICATION METHOD

ABBREVIATION

TERM

AL	AUTO LUBE SYSTEM
CO	CONTINUOUS OILING
FC	FILLER CAP
GG	GREASE GUN
HL	HAND LUBRICATE
OB	OIL BATH
PL	PIPE LINE
RO	RING OILED
SD	SPLASH, DRIP
WP	WASTE PACK
WW	WASTE WICKED

STANDARD WORD

ADJ	ADJUSTING
AMB	AMBIENT
ANG	ANGLE
APPL	APPLICATION
BRG	BEARING
ECC	ECCENTRIC
ENCL	ENCLOSED
EX	EXTRA
HD	HEAD
HVY	HEAVY
LIT	LITERATURE
LT	LIGHT
MECH	MECHANICAL
MFR	MANUFACTURER'S
MDM	MEDIUM
MTHD	METHOD
PL.	PLATE
SHFT	SHAFT
SPCL	SPECIAL
THR	THRUST

TECHNICAL SERVICE PHONE NUMBERS

MOBIL	1-800-662-4525
EXXON	1-800-233-9966
PENNZOIL	1-800-843-8910
SHELL	1-800-231-6950
TEXACO	1-800-782-7852

LUBRICANT RECOMMENDATIONS

<u>EQUIPMENT TO BE LUBRICATED</u>	<u>APPL. MTHD.</u>	<u>RECOMMENDED LUBRICANTS</u>	
		<u>AMB. <100°F</u>	<u>AMB. >100°F</u>

AGITATORS & CONDITIONERS

Worm Gear Reducers	OB	Mobilgear 634	Mobilgear 636
Output Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Spindle Brg.	GG	Mobilith AW 2	Mobilith AW 2
Lifting Screw	HL	Mobilith AW 2	Mobilith AW 2

See the Manufacturer's Literature for Lube requirements for Reducers other than SVEDALA.

AMALGAMATION UNITS

Trunnion Brg.	GG	Mobilith AW 2	Mobilith AW 2
Gear & Pinion Brg.	GG	Mobilith AW 2	Mobilith AW 2
Gear & Pinion Teeth	AL,HL	Mobiltac 375	Mobiltac 375

CLASSIFIERS, HYDRO

Worm Gear Reducers	OB	Mobilgear 634	Mobilgear 636
Reducer Brg.	GG	Mobilith AW 2	Mobilith AW 2
Jackshaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Lifting Screw	HL	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

CLASSIFIERS, SPIRAL

Cyclo Reducer		See Mfr. Lit.	
Gudgeon Brg.	GG	Mobilith AW 2	Mobilith AW 2
Submerged Brg.	GG	Mobilith AW 2	Mobilith AW 2
Lifting Screw	HL	Mobilith AW 2	Mobilith AW 2
Lifting Screw Thr. Brg.	GG	Mobilith AW 2	Mobilith AW 2
Hydraulic Lift	FC	Vactra Lt.	Vactra Mdm.

CONCENTRATOR, BUCKMAN TILTING

Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Tilting Cam	OB	Mobilgear 634	Mobilgear 636
Rollers & Pins	HL	Mobiltac 375	Mobiltac 375
Chain Drives	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

EQUIPMENT TO BE LUBRICATED**APPL.
MTHD.****RECOMMENDED LUBRICANTS
AMB. <100°F AMB. >100°F****CONVEYOR, BELT**

Hd. & Tail Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Troughing & Return Idlers	GG	Mobilith AW 2	Mobilith AW 2
Takeup Screws & Guides	HL	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Open Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Shaft Mounted Reducers	OB	Mobilgear 634	Mobilgear 636

CONVEYOR, SCREW

Ball & Roller Brg.	GG	Mobilith AW 2	Mobilith AW 2
Gudgeon Brg.	GG	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Open Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

CRUSHER, GYRATORY LAB.

Ball & Roller Brg.	GG	Mobilith AW 2	Mobilith AW 2
Thrust Brg.	OB	Vactra Ex.Hvy.	Vactra BB

CRUSHER, JAW

Ball & Roller Brg.	GG	Mobilith AW 2	Mobilith AW 2
Bronze Brg.	GG	Mobilith AW 2	Mobilith AW 2
Bronze Brg	WW,RO	Vactra AA	Vactra HH
Bronze Bumper Brg.	SD	Vactra AA	Vactra HH

CRUSHERS, ROLL

Roll Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Open Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

DISTRIBUTOR, MOTORIZED PULP

See Mfr. Lit.

DISTRIBUTOR, PULP, SELF ROTATING

Spindle Brg.	GG	Mobilith AW 2	Mobilith AW 2
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DRYER, ROTARY

Tire Roller Brg.	GG	Mobilith AW 2	Mobilith AW 2
Gear & Pinion Teeth	HL,AL	Mobiltac 375	Mobiltac 375
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Open Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

EQUIPMENT TO BE LUBRICATED**APPL.
MTHD.****RECOMMENDED LUBRICANTS
AMB. <100°F****AMB. >100°F****ELEVATOR, BUCKET**

Hd. & Tail Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Takeup Screw & Guides	HL	Mobilith AW 2	Mobilith AW 2

EMULSIFIER

Spindle Brg.	GG	Mobilith AW 2	Mobilith AW 2
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FEEDER, ORE BELT

Hd. & Tail Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Takeup Screw & Guides	HL	Mobilith AW 2	Mobilith AW 2
Belt Idlers	GG	Mobilith AW 2	Mobilith AW 2
Adjusting Screw & Cam	HL	Mobilith AW 2	Mobilith AW 2
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636

FEEDER, REAGENT, DRY BELT

Hd.,Tail,Paddle Shft.Brg.	GG	Mobilith AW 2	Mobilith AW 2
Takeup Screws & Guides	HL	Mobilith AW 2	Mobilith AW 2
Belt Idlers	GG	Mobilith AW 2	Mobilith AW 2
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Worm Gear Reducers	OB	Mobilgear 634	Mobilgear 636

**FEEDER, REAGENT,
DRY, CONE TYPE**

Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636
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FEEDER, REAGENT, WET

Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636
Miter Gear	HL	Mobiltac 375	Mobiltac 375
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

FILTERS, DISC

Trunnion Brg.	GG	Mobilith AW 2	Mobilith AW 2
Valve Cap to Wearing Pl.	GG	Mobilith AW 2	Mobilith AW 2
Valve Cap Thrust Brg.	GG	Mobilith AW 2	Mobilith AW 2
Agitator Mech. Brg.	GG	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Worm Gear Drive	OB	Mobilgear 634	Mobilgear 636

<u>EQUIPMENT TO BE LUBRICATED</u>	<u>APPL. MTHD.</u>	<u>RECOMMENDED LUBRICANTS</u>	
		<u>AMB. <100°F</u>	<u>AMB. >100°F</u>

FLOTATION MACHINE & UNIT CELL

Spindle Brg.	GG	Mobilith AW 2	Mobilith AW2
Paddle Shaft Brg.	GG	Mobilith AW 2	Mobilith AW2
Paddle Shaft Worm Reducer	OB	Mobilgear 634	Mobilgear 636

HOLO-FLITE® PROCESSORS

Reducers & Drives		See Mfr. Lit.	
Timing Gear	HL	Mobiltac 375	Mobiltac 375
Bronze Shaft Brg	GG,AL	Mobilgrs Spcl	Mobilgrs Spcl
Carbon Brg.		Not Lubricated	
Spherical Roller Brg.**	GG	Mobilith AW 2	Mobilith AW 2
Oil Bath Timing Gears	OB	Tex Meropa 1500	Tex Meropa 1500
Duff-Norton Rotary Joints	GG	Tex Polystar RB2 Code #1915	Tex Polystar RB2 Code #1915

** In mid-1990 SVEDALA began to produce a Spherical Roller Brg. for Holo-Flites. If the Brg. provided on the Holo-Flite is other than a SVEDALA Brg., consult the Manufacturer's Literature.

**JIG, MINERAL,
DENVER SELECTIVE**

Eccentric Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Ecc. Ball or Bronze Brg.	GG	Mobilith AW 2	Mobilith AW 2
Walking Beam Bushing	GG	Mobilith AW 2	Mobilith AW 2
Rotating Valve Bearing	GG	Mobilith AW 2	Mobilith AW 2

JIG, PLUNGER, HARZ TYPE

Eccentric Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Eccentric	GG, Cup	Mobilith AW 2	Mobilith AW 2

MILL, BALL & ROD

Trunnion Brg.	WP	Viscolite AA	Viscolite HH
Trunnion Brg.	CO	Vactra BB	Vactra AA
Pinion Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Gear & Pinion Teeth	AL,HL	Mobiltac 375	Mobiltac 375

MILL, JAR, LABORATORY

Roll Brg.	GG	Mobilith AW 2	Mobilith AW 2
Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

EQUIPMENT TO BE LUBRICATED**APPL.
MTHD.****RECOMMENDED LUBRICANTS
AMB. <100°F****RECOMMENDED LUBRICANTS
AMB. >100°F****PAN, MECHANICAL, CONCENTRATING**

Pump	GG,Cup	Mobilith AW 2	Mobilith AW 2
Gasoline Engines		See Mfr. Lit.	
Eccentric Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Eccentric Brg.	GG	Mobilith AW 2	Mobilith AW 2
Pedestal Brg.	Cup	Mobilith AW 2	Mobilith AW 2

**PAN, MECHANICAL, CONCENTRATING,
WITH TROMMEL UNIT**

Same as above			
Trommel Support Brg.	GG	Mobilith AW 2	Mobilith AW 2

PLACER, TROMMEL, JIG, UNIT

See DENVER Jig for Lub.

Pump	GG,Cup	Mobilith AW 2	Mobilith AW 2
Gasoline Engines		See Mfr. Lit.	
Drive & Jackshaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Trommel Support Rollers	GG	Mobilith AW 2	Mobilith AW 2

**PUMP, DIAPHRAGM
ADJUSTABLE STROKE**

Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636
Connecting Rod Brg.	GG	Mobilith AW 2	Mobilith AW 2
Plunger Rod Brg.	GG	Mobilith AW 2	Mobilith AW 2
Rocker Arm Brg	GG	Mobilith AW 2	Mobilith AW 2
Hand Wheel Brg	GG	Mobilith AW 2	Mobilith AW 2
Adj. Screw & Guides	HL	Mobilith AW 2	Mobilith AW 2

PUMP, DIAPHRAGM, LOWHEAD

Eccentric Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Eccentric	GG	Mobilith AW 2	Mobilith AW 2
Encl. Chain Drive	OB	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Open Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

PUMP, DIAPHRAGM, SUCTION PRESSURE

Eccentric Shaft Brg	GG,Cup	Mobilith AW 2	Mobilith AW 2
Eccentric	GG,Cup	Mobilith AW 2	Mobilith AW 2
Walking Beam	GG,Cup	Mobilith AW 2	Mobilith AW 2
Worm Gear Reducer	OB	Mobilgear 634	Mobilgear 636

EQUIPMENT TO BE LUBRICATED**APPL.
MTHD.****RECOMMENDED LUBRICANTS
AMB. <100°F****RECOMMENDED LUBRICANTS
AMB. >100°F****PUMP, ORION, DENVER**

Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
Centrifugal Gland Seal	GG	Mobilith AW 2	Mobilith AW 2
Full & Low Flow Seal	PL	Water only	Water Only

PUMPS, SRL, SRL-C

Shaft Brg.(Both Brg.)	OB	Vactra Ex.Hvy.	Vactra BB
Shaft Brg.(Both Brg.)	GG	Mobilith AW 2	Mobilith AW 2

PUMP, VERTICAL, SAND

Spindle Brg.	GG	Mobilith AW 2	Mobilith AW 2
Lower Grease Seal	GG	Mobilith AW 2	Mobilith AW 2

PUMP, VERTICAL, SUMP, & SRL-V

Ball Brg.	GG	Mobilith AW 2	Mobilith AW 2
Ball Brg.	OB	Vactra Ex.Hvy.	Vactra BB
Lower Cutless Rubber Brg.	PL	Water	Water

SAMPLER, AUTOMATIC

Gearmotor		See Mfr. Lit.	
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.

SAMPLER, HYDRAULIC MODEL F2

Hydraulic Motor Reducer		See Mfr. Lit.	
Flange Brg.	GG	Mobilith AW 2	Mobilith AW 2
Chain Drive	HL	Vactra Hvy.Mdm.	Vactra Ex.Hvy.
Sample Collector Gearmotor		See Mfr. Lit.	
Flange Brg.	GG	Mobilith AW 2	Mobilith AW 2

SAMPLER, VEZIN

Gearmotor or Reducer		See Mfr. Lit.	
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SCREEN, DILLON, DENVER

Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
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SCREEN, SHAKER, SIEVE

Drive Shaft Brg.	GG	Mobilith AW 2	Mobilith AW 2
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EQUIPMENT TO BE LUBRICATED**APPL.
MTHD.****RECOMMENDED LUBRICANTS
AMB. <100°F****RECOMMENDED LUBRICANTS
AMB. >100°F****SCREEN, TROMMEL**

See "Placer, Trommel, Jig Unit" for Trommel Lube

SCREEN, VIBRATING, DENVER

Shaft Brg.

OB

Vactra Ex.Hvy.

Vactra BB

SCRUBBER, ATTRITION

Spindle Brg

GG,AL

Mobilith AW 2

Mobilith AW 2

Top Output Shaft Brg.

GG

Mobilith AW 2

Mobilith AW 2

Bottom Output Shaft Brg.

GG

Mobilith AW 2

Mobilith AW 2

DENVER Vertical Reducer

OB

Mobilgear 634

Mobilgear 636

TABLE, CONCENTRATING

Head Motion

OB

Vactra Hvy.Mdm.

Vactra Hvy.

Deck Support Brg.

OB

Vactra Hvy.Mdm.

Vactra Hvy.

Deck Rocker Brg.

OB

Vactra Hvy.Mdm.

Vactra Hvy.

Deck Slipper Brg.

WP

Viscolite AA

Viscolite HH

THICKENER, MECHANISM, DRIVE

Worm Brg.

OB

Mobilgear 634

Mobilgear 636

Worm & Bull Gear

OB

Mobilgear 634

Mobilgear 636

Shaft Mounted Reducers

See Mfr. Lit.

Lifting Jack Reducer

See Mfr. Lit.

Lifting Jack Drive R. Ang.

GG

Mobilith AW 2

Mobilith AW 2

Turntable Brg.

GG

Mobilith AW 2

Mobilith AW 2

Turntable Seal

GG

Mobilith AW 2

Mobilith AW 2

Lower Shaft

GG

Mobilith AW 2

Mobilith AW 2

NOTES

LUBRICANT DESCRIPTIONS

MOBILGEAR 634 & 636

These two lubricants are premium quality, heavy duty, industrial gear lubricants intended for enclosed gear sets including worm gears, operating under severe service conditions and where severe shocks and overloads are encountered. They are formulated with rust and corrosion protection, enhanced oxidation stability, resistance to foaming and new sulfur-phosphorus extreme pressure additives which provide much improved antiwear and friction reducing characteristics and help to minimize the temperature rise in heavily loaded gear sets, thus contributing to the reduction in the rate of oxidation of the lubricant.

Mobilgear 634 - AGMA 7 EP Grade Oil

Mobilgear 636 - AGMA 8 EP Grade Oil

MOBIL VACTRA OIL

This group of oils is a high quality, general purpose oil used for the lubrication of intermittently oiled bearings where the intervals between application require the use of an oil that will adhere strongly to metallic surfaces and maintain effective lubrication even though only an extremely thin film of oil is present. These oils are also used in circulation systems and as hydraulic fluids where the exceptionally high resistance to oxidation of D.T.E. oils cannot be justified. In addition to film strength additives, these relatively high viscosity oils contain an effective rust inhibitor. The following grades are available:

<u>GRADES</u>	<u>VISCOSITY – SUS</u>		<u>AGMA NO.</u>	<u>ISO VISCOSITY GRADES</u>
	100°F.	210°F.		
Light	150	43	-	32
Medium	205	46	1	46
Heavy Mdm.	290	51	2	68
Heavy	430	56	3	100
Extra Hvy.	645	67	4	150
BB	940	79	5	220
AA	1575	104	6	320

MOBIL VISCOLITE OIL AA & HH

These two oils are dark brown lubricants, especially designed for the Lubrication of heavy duty machinery where bearings are supplied by means of a drop-feed cup, wick-feed devices, or waste-packed oil wells. Their tacky, adhesive, and cohesive characteristics enable them to cushion shock loads and render effective lubrication with a minimum amount of leakage. The following Grades are available:

<u>GRADES</u>	<u>VISCOSITY – SUS</u>		<u>ISO VISCOSITY GRADES</u>
	100°F.	210°F.	
Viscolite Oil AA	1860	105	320
Viscolite Oil HH	2850	125	460

MOBILTAC 375

Mobiltac 375 replaces Mobiltac E. This is a black viscous lubricant having EP properties and specifically developed to meet the diversified requirements for the lubrication of open gears, racks and slides encountered in the construction and similar heavy machinery. A solvent is added to reduce its viscosity sufficiently to facilitate application. It is available for sale directly to commercial and industrial consumers.

Mobiltac 375 adheres tenaciously to the surfaces being lubricated, and therefore returns long service at low consumption rates. In addition, when correctly applied, it resists water wash, cracking and flaking at low temperatures and annoying throw-off. Shortly after application, evaporation of the solvent causes the exterior surface of the lubricant film to "set" to such a degree that pick up of dust is greatly minimized.

Heating of Mobiltac 375 before application is normally not required or recommended. Under extremely cold conditions, it may be warmed to increase its mobility, but should not be heated above 70°F. (21°C.). This product is available in spray cans. Spray cans should **NOT** be heated.

MOBILITH AW 2

Mobilith AW 2 replaces Mobilux EP 2. Mobilith AW 2 is a smooth/tacky lithium-complex, soap based, EP grease that satisfies the need for a multiservice, extreme pressure product to lubricate both antifriction and plain bearings under wet and dry conditions, in a temperature range of -40°F. to 350°F. The smooth texture and excellent low temperature pumping characteristics make this product ideal for central dispensing systems. Its superior resistance to oxidation is combined with the ability to protect against corrosion. It is particularly recommended for bearings subjected to heavy and shock loads.

Product Number	64353-6
NLGI Grade	2
Color	Green
Structure	Smooth/Tacky
Soap Type	Lithium Complex
Mineral Oil Viscosity	
cSt @ 40°C	150
cSt @ 100°C	13
SUS @ 100°F	750
SUS @ 210°F	70
ISO Viscosity Grade	150
Penetration at 23°C (77°F), worked	280
Dropping Pt, ASTM D 2265, °F	500

MOBILGREASE SPECIAL

Mobilgrease Special is a NLGI No. 2, unleaded, extreme pressure, lithium complex soap base grease. The lithium complex soap base ensures good resistance to softening under severe working, good water resistance, and uniform consistency over the recommended operating temperature range.

Mobilgrease Special contains micronized molybdenum disulfide which plates out from the grease and forms an adhering film on metallic surfaces, reducing the coefficient of friction. The film provides protection against scoring and wear under boundary lubrication conditions.

Other formulation characteristics provide superior water tolerance, high-temperature oxidation resistance, and low-temperature pumpability.

Product Number	53030-3
NLGI Grade	2
Soap Type	Lithium Complex
Structure	Smooth
Color	Gray-Black
Viscosity, cSt @ 40°C	220
cSt @ 100°C	17.5
Dropping Point, °C (°F), min	250 (500)

LUBRICATION CROSS REFERENCE

<u>MOBIL</u>	Mobilgear 634	Mobilgear 636	Mobiltac 375
<u>EXXON</u>	Spartan EP 460	Spartan EP 680	Surett N 80K
<u>SHELL</u>	Omala 460	Omala 680	Not Available
<u>PENNZOIL</u>	Sup.Maxol EP 460	Sup.Maxol EP 680	Pennztac FI. 5000
<u>TEXACO</u>	Meropa 460	Meropa 680	Crater 2X Fluid
<u>MOBIL</u>	Vactra Lt.	Vactra Medium	Vactra Hvy. Mdm.
<u>EXXON</u>	Teresstic 33	Teresstic 46	Teresstic 68
<u>SHELL</u>	Turbo T 32	Turbo T 46	Turbo T 68
<u>PENNZOIL</u>	Pennzbell RO 32	Pennzbell RO 46	Pennzbell RO 68
<u>TEXACO</u>	Regal R&O 32	Regal R&O 46	Regal R&O 68
<u>MOBIL</u>	Vactra Hvy.	Vactra Ex. Hvy.	Vactra BB
<u>EXXON</u>	Teresstic 100	Teresstic 150	Teresstic 220
<u>SHELL</u>	Turbo T 100	Turbo T 150	Turbo T 220
<u>PENNZOIL</u>	Pennzbell RO 100	Pennzbell RO 150	Pennzbell RO 220
<u>TEXACO</u>	Regal R&O 100	Regal R&O 150	Regal R&O 220
<u>MOBIL</u>	Vactra AA	Viscolite AA	Viscolite HH
<u>EXXON</u>	Teresstic 320	Teresstic 320	Teresstic 460
<u>SHELL</u>	Turbo T 320	Turbo T 320	Turbo T 460
<u>PENNZOIL</u>	Pennzbell RO 320	Sup.PennztacEP320	Sup.PennztacEP460
<u>TEXACO</u>	Regal R&O 320	Regal R&O 320	Regal R&O 460
<u>MOBIL</u>	Mobilith AW 2	Mobilgrease Special	
<u>EXXON</u>	Ronex MP	Beacon Q 2	
<u>SHELL</u>	Alvania EP 2	Super Duty Grease	
<u>PENNZOIL</u>	707L Grease	Adhezoplex EP 2	
<u>TEXACO</u>	Starplex 2	Molytex EP 2	
<u>SPECIALTY PRODUCTS</u>		Black Magic 2	