

TRIPLE/S DYNAMICS

Model 24 Husky

Granulator

October 2009

INSTALLATION, SAFETY & MAINTENANCE MANUAL

SAFETY NOTICE

DO NOT PROCEED WITHOUT READING AND UNDERSTANDING THE CONTENTS OF THIS PAGE

Triple/S Dynamics takes its customers' safety very seriously. Every aspect of our design has been tailored to provide the safest working environment possible. Although the danger of injury will always exist, adhering to the safe working procedures below will reduce the likelihood of one. This list should not be considered an exhaustive list of all dangers. It is intended, rather, to present some of the risks inherent in and encountered when installing, operating, and maintaining this unit.

-
- NEVER**
- Work without strictly adhering to OSHA lockout and tag-out procedures
 - Climb on or into the machine without following lockout and tag-out procedures
 - Use worn or improper tools that can cause both personal injury and property damage
- NEVER**
- Rush procedures or perform shortcuts when working on this machine
 - Allow unqualified or untrained personnel to operate or to maintain this equipment
 - Energize this equipment without first clearing and alerting all surrounding personnel
- NEVER**
- Operate this machine without functioning safety devices, e.g. guards and limit switches
 - Defeat any of the safety limit switches or sensors
 - Work on this machine alone
- NEVER**
- Work on this machine with inadequate or unapproved man-lift devices
 - Modify any design, or ancillary equipment without consulting with this manufacturer

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- ALWAYS**
- Wear eye and ear protection when working on or around this machine
 - Keep all body parts, clothing, and hair clear of all moving parts
 - Ensure that the hoist and operators are qualified to perform rigging procedures
- ALWAYS**
- Ensure that proper rigging procedures are strictly enforced
 - Ensure that all safety equipment is properly maintained and functioning
 - Store hazardous materials in a remote location
- ALWAYS**
- Install electrical equipment per applicable national, state, and local electrical codes
 - Provide periodic, redundant, safety training
 - Contact our service department and obtain professional advice when deemed necessary
- ALWAYS**
- Strictly adhere to bolt size, grade, location, and torque designations per design prints
 - Torque every bolt to the proper torque schedule as provided in the appendix
 - Perform the preventive maintenance at least as often as provided in the schedules included
-

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1.0

GENERAL INFORMATION

The Triple/S Dynamics Model 24 Husky Granulator is a heavy-duty rotary cutting machine designed for granulating and stripping insulated copper or aluminum wire and cable; granulating heavy scrap plastic sections or purgings, or shredding a variety of other non-ferrous materials.

The basic Granulator consists of a cutting chamber, a rotor, a grate, a set of stationary or bed knives, and a set of rotor knives. The cutting chamber is fed from the top through a 24" x 16" opening, and the granulated product is discharged through a perforated grate, having the same projected area as the inlet. The rotor, located between the inlet and the grate, has an axis of rotation which spans the 24-inch dimension and is mounted in spherical roller bearings, which are press fit in removable cartridge-type housings and slip fit on the rotor journals.

The bed knives are mounted in the cutting chamber on machined seats which are in a horizontal plane through the axis of rotation. They are held securely, under a heavy clamp bar, by high-strength bolts. The clearance between bed knives and rotor knives is set and held by means of jack screws and back-up screws which bear against the rear edge of the bed knife. The rotor is machined from a solid forged billet of alloy steel, heat treated for wear resistance, and provided with deep "pockets" between the lobes on which the rotor knives are mounted.

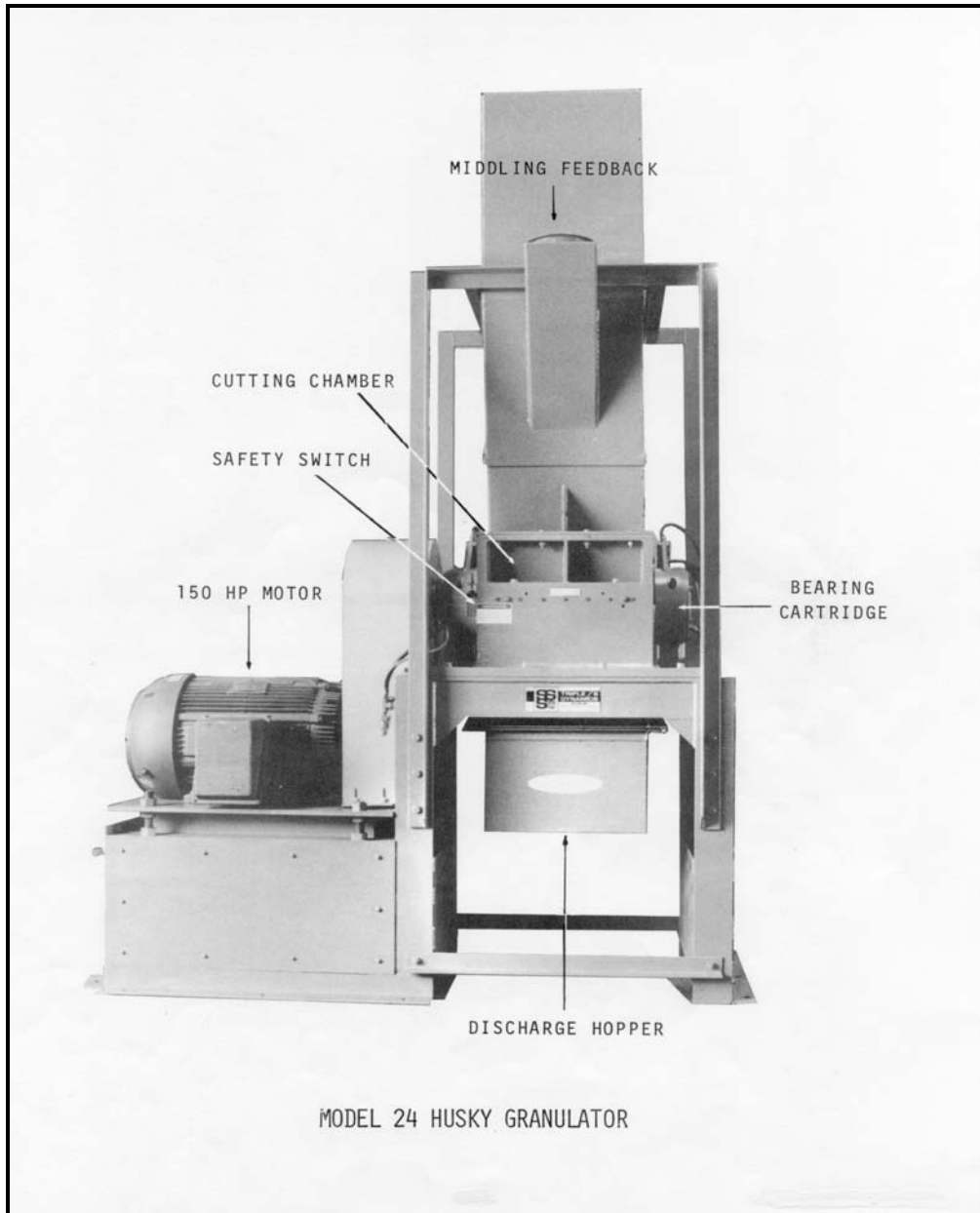
Primary Granulators have three-lobe rotors; secondary models have five. Both bed knives and rotor knives are 24 inches long. Thus, the primary models require knife sets comprising two bed knives and three rotor knives; secondary models require two bed knives and five rotor knives.

The rotor is V-belt driven, at a speed of about 1051 RPM, by one 125 or 150 HP (depending on the application), 1200 RPM electric motor of normal (Design "B") torque characteristics.

The motor base is mounted on four vertical screws which provide the means for adjusting belt tension.

The precision spherical roller bearings are protected against foreign material intrusion from the cutting chamber in two ways: (1) a wear plate between the cutting chamber & bearing housing open space, (2) a double seal between the bearing housing open space & spherical bearing.

The wear plate, mounted to the bearing housing with small clearance at rotor, allows only small particles to enter the air space in the bearing housing and fall to the bottom of the housing. A small by-pass chute under a hole in the bottom of bearing housing is provide to carry these small particles back to the material stream in the discharge hopper. **Periodically fluff can collect in the open space behind the wear plate and will need to be cleared by applying air pressure to purge the open space.**



The bearings are lubricated with a filtered, circulating oil system which injects a continuous stream of clean, cooler oil into the bearing races. The oil is pumped from the reservoir to each bearing through a cartridge-type filter, and returned through the cooler by a scavenge pump. Both supply and scavenge pumps are separately driven by electric motors.

A considerable amount of heat is generated by friction in the cutting chamber, and this heat must be removed to keep the temperature of all surfaces within the cutting chamber below the melting point of the plastic being granulated (about 300° - 350°F for PVC). In the Model 24 Husky Granulator, the heat is dissipated by radiation to the surrounding environment, by conduction to the material being processed, by conduction to cooling water circulating through internal passages in the side walls under the knife seats. Connections for cooling water are provided but not pump, hoses or heat exchanger.

The same provisions for water cooling are made in all models, however cooling is not usually required in Primary Granulators due to their larger grate openings and lower cutting rates.

A one-piece grate is bolted to the underside of the cutting chamber. Grate openings, round holes, may vary from as large as three inches down to one-eighth inch diameter. All grates are interchangeable.

Access into the cutting chamber is by opening the upper chamber of the granulator. It is opened and closed by two hydraulic cylinders. A hydraulic power supply, consisting of an oil scavenge pump, filter and selector valve assembly, is mounted to the hydraulic/lubrication unit.

2.0

INSTALLATION

MOVING THE EQUIPMENT

Use only qualified personnel, experienced with safety practices and standards, including but not limited to rigging procedures contained in the "Handbook For Riggers", W.G. Newberry, and OSHA standard 1910, Subpart N, Material Handling & Storage. Ensure that all appropriate safety standards are followed. Failure to use qualified personnel or to follow appropriate safety standards may result in serious injury or death of personnel.

INSPECTION

Make a careful inspection for accidental shipping damage immediately upon receipt of the Granulator. Should the unit be damaged, file a claim with the carrier, and advise Triple/S Dynamics immediately if the extent of damage requires replacement parts.

MOUNTING

The weight of the Model 24 Husky Primary and Secondary Granulators, complete with sub-base and motor, is approximately six tons.

Mounting holes are provided in the Granulator sub-base for one-inch (1") diameter anchor bolts. The Granulator should be carefully leveled and grouted. ***It is imperative that the Granulators be firmly anchored.***

ELECTRICAL REQUIREMENTS

The Model 24 Husky Granulator is driven by one 125 or 150 HP (depending on the application), 1200 RPM motor, which is V-belt connected to one end of the rotor.

Before startup, the operator must check the stationary knife clamp bolts and rotor knife hold down bolts to make sure they meet proper torque specifications.

Startup must be made with an empty cutting chamber, and acceleration is very rapid to no-load current at operating speed. Standard across-the-line starting equipment, appropriately rated to match the electrical characteristics as shown on the motor data plate, can be used.

Primary Granulators are furnished with a low-speed sensor, which turns off the drive motor to protect the V-belt drive from damage in the event of a full stall of the granulator rotor due to overload.

The sensor requires connection to a 110 v. control current source. The sensor is adjusted to actuate a relay when the granulator RPM drops below approximately 200. This relay is wired to instantly drop out the motor starter. See Drawing 13000-450 in the Appendix for connection.

One micro-switch is mounted adjacent to the granulator's upper chamber for activation when the chamber is closed. This micro-switch must, for compliance with OSHA requirements, be wired into the motor control circuit to inactivate the motor starter when the chamber is open.

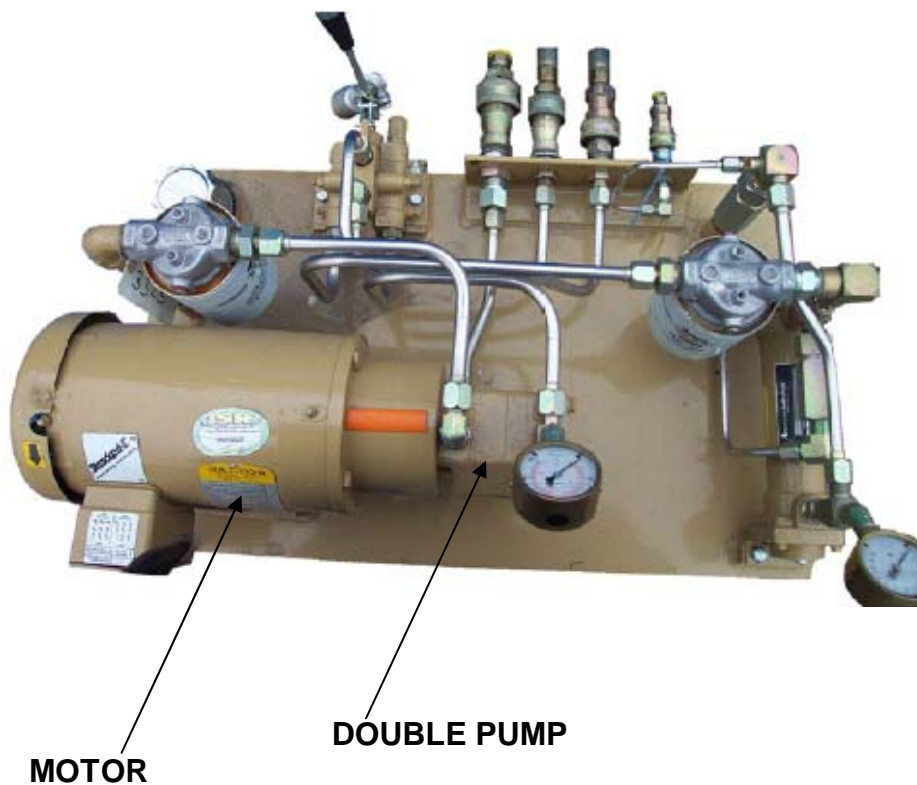
A double pump, driven by a single 2 HP electric motor, provides circulating oil supply and scavenging. This system is fitted with a low-pressure alarm switch which should be wired into the motor control circuit as described in the Lubrication System section below.

An optional cross-flow discharge aspirator may be mounted to the granulator discharge hopper and powered by a 1 HP electric motor with controls wired to start automatically with the granulator drive motor. In a complete Triple/S

Dynamics wire granulating system, the motor controls should be wired to start automatically with the main exhaust blower motor.

LUBRICATION SYSTEM

Model 24 Husky Granulators are equipped with a self-contained circulating oil system comprising a reservoir with submerged pump; pressure relief valve; scavenge pump; oil/water cooler, and connecting piping to conduct the oil to and from the granulator bearings. A low-pressure cutoff switch is provided in the oil pump pressure line to prevent the granulator from starting before oil is circulating, and to activate an alarm if pressure is lost during operation. **Do not use the control switch to shut down an operating granulator.**



LUBRICATION SYSTEM

The 2 HP motor is to be connected to a power supply source having characteristics that match those on the motor data plate (usually specified at the time of purchase). The low-pressure alarm switch is to be connected as follows:

- 1.) To connect safety switch to make contact, connect the wires from the alarm system to the wires marked "com" and "N.O."
- 2.) To connect safety switch to break contact, connect the wires from the alarm system to the wires marked "com" and "N.C."

The oil system should operate at 15-25 psi at normal operating temperatures (120° - 180°F).

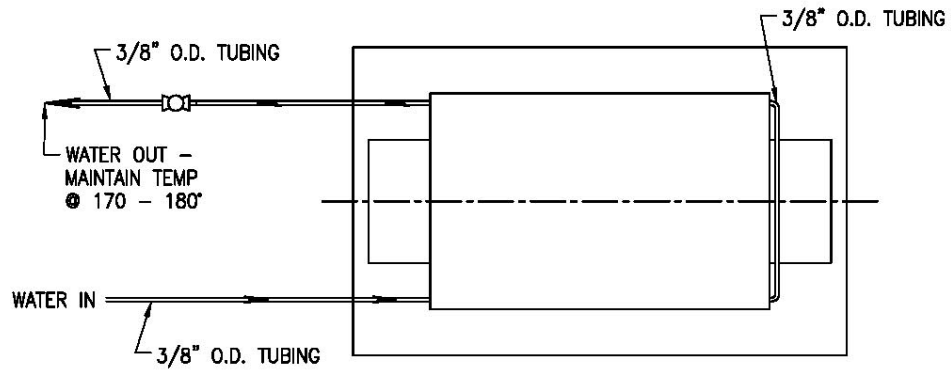
WATER COOLING SYSTEM

Water Jackets

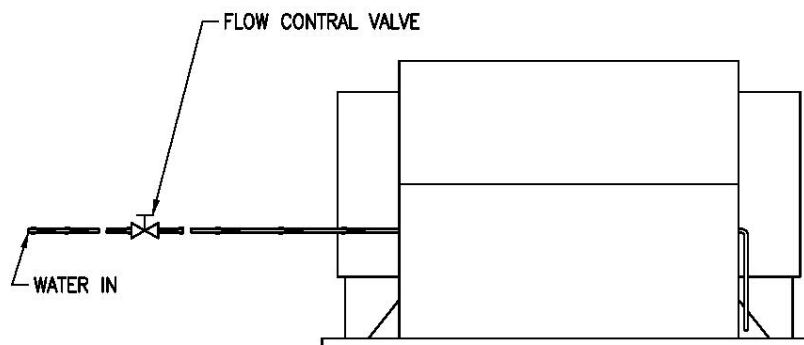
Water cooling passages are provided in the sidewall castings under each stationary knife seat. There are two inlet and two outlet connections to be made to the water supply and drain systems. There is one pair at each sidewall, in the end castings near the bearing housings. (See Figure 1). Water supply requirement is 5 gpm per unit, at inlet temperatures up to about 75° F. A single globe valve should be provided in the outlet header to regulate the flow from the four independent branches.

On starting, set the globe valve wide open. After the granulator has come up to normal operating temperature (allow four hours under load), close the valve until the temperature difference between inlet and outlet headers stabilizes at about 15° F.

It is advisable to leave the water cooling system in operation for a few minutes after the line is shut down to prevent any residual heat build-up.



PLAN VIEW



ELEVATION VIEW

WATER COOLING SCHEMATIC

FIGURE 1

CROSS-FLOW ASPIRATOR (OPTIONAL)

The cross-flow aspirator, mounted integrally with the granulator discharge hopper, has a blast gate which spans the full width of the inlet aperture in the hopper, and a spiral-end discharge transition which is mounted on the opposite side of the hopper. The fan wheel shaft is driven from a 1 HP electric motor.

The motor is to be connected to a power supply having characteristics that match the nameplate data on the motor (usually specified in the Purchase Order). It may be wired to start independently by the operator, or to start automatically with the exhaust system blower

The exhaust should be connected to an exhaust branch with blast gate capable of handling 2000 CFM at about 3 inch W.G. suction.

During operation, the blast gate in the exhaust branch should be opened wide, and the gate on the blower side should be opened until the air begins to blow out the granulator discharge hopper, then closed slightly to establish inflow to the hopper. If significant amounts of copper are found in the solids discharged from the exhaust collection system, the airflow should be reduced in gradual decrements, following the sequence described, until the copper disappears from the collected waste.

3.0

SAFETY

The granulators do not operate within the acceptable limits of noise level under the Walsh-Healey standards for full-time operator exposure. ***Operators working near the granulators must be provided with and required to wear protective earmuffs as a safeguard against permanent hearing loss as a result of extended exposure.***

Safety glasses should be provided for and worn by all personnel in the vicinity of the granulators, as there may be occasional fly-back of metal fragments from the cutting chambers, despite the care with which the feed chutes have been designed to contain the material. Safety glasses must also be worn during maintenance operations.

Guards have been provided for each part of the granulator requiring safety protections. ***Be sure that these guards are in place any time the equipment is in operation!***

Be sure that electrical controls and interlocks are correctly wired and operative.

4.0

GRANULATOR PERFORMANCE VARIABLES

PRIMARY GRANULATOR

The Primary Granulator makes the first reduction in size of the incoming scrap wire and cable. Stiff cable must be cut to lengths not exceeding 24 inches in a Triple/S Dynamics' RotaGator or a shear. Communication wire and flexible telephone cable should be similarly cut or if in coils may be dispersed loosely on the feed conveyor. Intact coils, regardless of wire gauge, should not be dumped into the granulator. An immediate stall will result from high instantaneous loading. The infeed material should be kept free of tramp steel which could break or chip the knives.

Two variables govern granulator performance. They are grate hole size and knife condition.

- 1.) Grate size - The size of the discharged product is controlled by the size of the openings in the grates. The following grate openings are recommended for the product indicated.

PRODUCT DESCRIPTION	GRATE SIZE
Fine copper wire	5/8"
Mixed copper wire	3/4"
Heavy gauge copper wire (12 ga & up)	1"
Insulated aluminum wire	1"
ACSR (Aluminum cable-steel reinforced)	1 3/4"

The grate furnished with the Model 24 Husky Granulator is bolted in position. To change the grate, remove the discharge chute and disengage the clamping bolts. The grate will drop straight out, and the replacement can be inserted. Torque bolts to 150± 10 lb.-ft.

- 2.) Knife condition and gap - Maintaining sharpness and gaps between rotating knives and stationary knives is of utmost importance for best performance. See Maintenance Section for knife servicing instructions.

SECONDARY GRANULATOR

The Secondary Granulators complete the liberation of the metal from the insulation. As with the Primary Granulator, there are two basic adjustments that are required to maintain optimum results.

- 1.) Grate size - The size of the discharged product is controlled by the size of the openings in the grates. The following grate openings are recommended for the product indicated.

PRODUCT DESCRIPTION	SECONDARY GRATE SIZE	TERTIARY* GRATE SIZE
Fine copper wire	1/4"	1/8"
Mixed copper wire	5/16"	3/16"
Heavy gauge wire	3/8"	1/4"
Insulated aluminum wire	3/8"	1/4"

To change the grate, remove the discharge hopper and disengage the clamping bolts. The grate will drop straight out and the replacement can be inserted. Torque bolts to 150+/-10 lb.-ft.

- 2.) Knife condition and gap – Same as for Primary Granulator. See Maintenance Section for knife servicing instructions.

** A typical wire system will be equipped with three Secondary Granulators. The third one, termed the "Tertiary" Granulator, receives the middlings and unstripped wire returned from the gravity separators, as well as a fraction of the new flow metered to it from an adjustable conveyor.*

5.0

MAINTENANCE

LUBRICATION

The spherical roller bearings are lubricated with **Lubsoil AW 100** hydraulic oil or similar brand with same properties. See Appendix for oil specifications.

After the first 50 hours of operation, change the oil and filter. It is recommended that the oil and filter be changed at about six-month intervals thereafter. Filters may need to be changed more often.

The main drive motor bearings should be lubricated in accordance with the instructions of the motor manufacturer.

DRIVE

Check the V-belt drive for proper tension after the first 100 and 500 hours of operation. Inspect the belt at monthly intervals thereafter.

Replace worn or damaged belts as required, but always in full matched sets.

KNIFE SERVICING

To gain access to the knives, the four holddown bolts on the upper chamber must first be removed so that the upper chamber can move freely.

The hydraulic cylinders that open the chamber can then be activated. Next, open the chamber lid.

The most expedient procedure for knife removal and new knife installation is as follows:

- 1.) Beginning on the downstroke side: remove the clamping bolts and the clamping bar. Disengage the adjusting screws and back-up screws and lift out the stationary knife.
- 2.) Remove the upstroke side stationary knife in the same way.
- 3.) Take out the rotor knives by removing the holddown bolts.
- 4.) Blow out all residual debris from knife seats and threaded holes before mounting new knives. **Knife seats must be clean, dry and free of lubricant.** Use oil-free solvent to wipe seats clean. (Safety glasses should be worn during this and other maintenance operations.)
- 5.) Insert rotor knives on shaft. Snug bolts down and tap knives back with a brass or other soft hammer so that they are butted up as tightly as possible against the seat. Torque bolts to 365+/- 10 lb.-ft. Check the run-out from knife to knife with a last word indicator. The maximum allowable difference is .002".
- 6.) Insert upstroke side stationary knife. Be sure to start adjustment screws into threads at rear of knife before installing clamp bar. The adjusting screws have left-hand threads.
- 7.) Roughly position stationary knives and clamping bar. Run back-up bolts out and clamping bar in as far as possible while still allowing enough flexibility for adjustment.
- 8.) The upstroke side stationary knives are now ready for fine adjustment. As previously stated, the recommended clearance range for the Primary Granulator is .000" to .004". Strive for the closer setting.

To obtain this clearance, set knives point to point at one end as shown in Figure 3 on the following page. Put a .002" feeler gauge between the knives and adjust knife out (using only adjustment screws) until stationary knife contacts the gauge. (Be sure gauge is not jammed in). Set the other end of the knife in the same way.

The rotor to stationary knife clearance must be checked across the entire knife length, not just at the ends, to obtain final setting.

After the knives have been set, snug down all the clamping bolts and run out all the back-up screws until they are butted tightly against the knife. At this point, turn the rotor through one or more revolutions to be sure all rotor knives will clear the bed knives.

All of the rotor knives will not necessarily have the same clearance as the one before it or after it, but all should fall within the above range if properly installed.

- 9.) Tighten the stationary knife clamping bolts to 600+/-10 lb.-ft.
- 10.) Recheck all clearances to insure that no interference occurs between rotor and stationary knives. ***Listen and "feel" for knives touching together.***
- 11.) Set the downstroke side knife in the same manner.

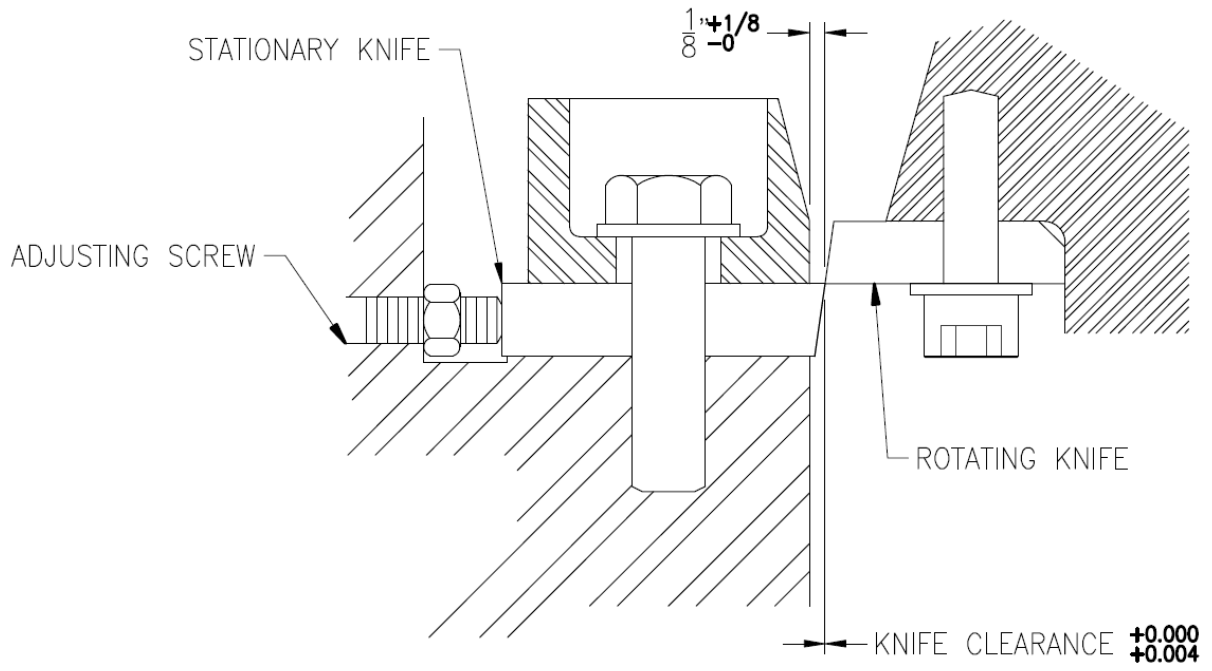


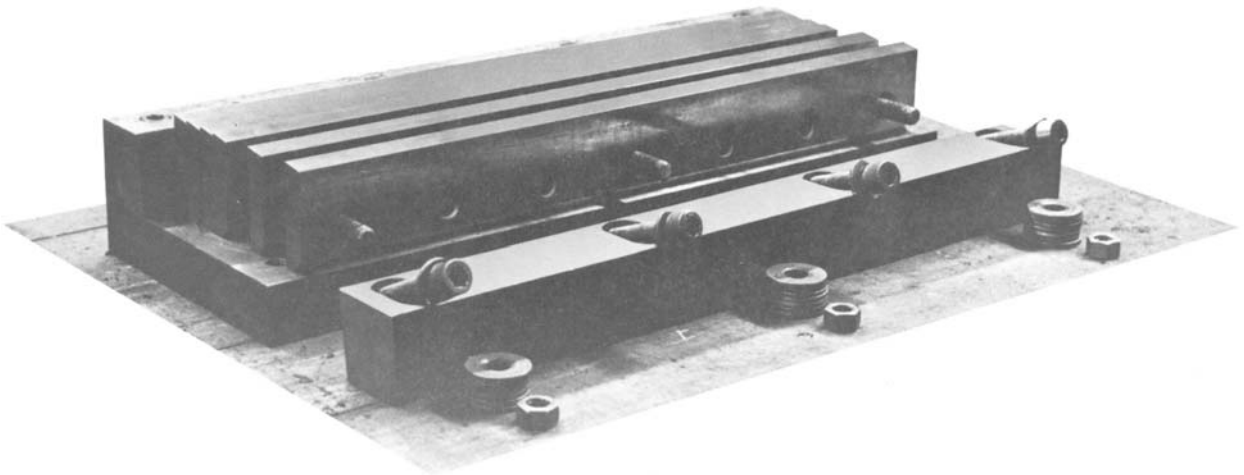
FIGURE 3 GRANULATOR KNIFE CLEARANCE DIAGRAM

KNIFE SHARPENING

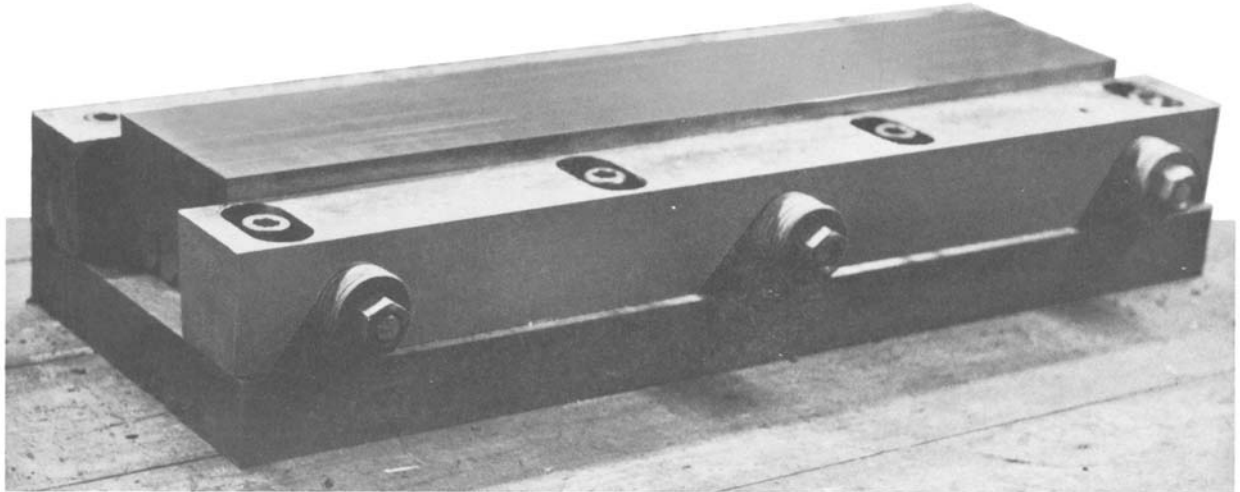
Intervals between knife sharpenings, in copper wire granulating service, can be expected to extend to about 400,000 lbs. of system throughput. Allowable intervals will vary according to wire gauge (longer for coarse wire); type of insulation; rate of throughput; degree of freedom from iron-bearing foreign material; and size of grate aperture, i.e. larger sizes are more tolerant of knife conditions.

Dull knives can be costly in downtime due to overheating, costly in product loss and reduced production. Dull knives smash the wire instead of neatly cutting it. This smashing creates intense heat that will eventually melt the insulation and blind the grates, leading to unnecessary downtime. Smashing the wire also creates fines that are so minute that they will not be recovered. The fines can add up to a serious copper loss; and excessive unstripped wire, which recycles as middlings, will reduce capacity of the system.

The knives may be ground to renew the cutting edge. The stationary knives may be ground as a set or individually, but the rotary knives must be ground as a set to maintain uniform radial clearances. Knives should be ground in the Triple/S Dynamics Grinding Fixture (Part No. 13000-359) to maintain the 8°-clearance angle and to provide for holding $\pm .001$ " parallelism from end to end and $\pm .0005$ " between the knives of any one set. Approximately 80% of the knife edge should be renewed -- leave deep nicks to gain longer knife life.



DISASSEMBLED KNIFE FIXTURE



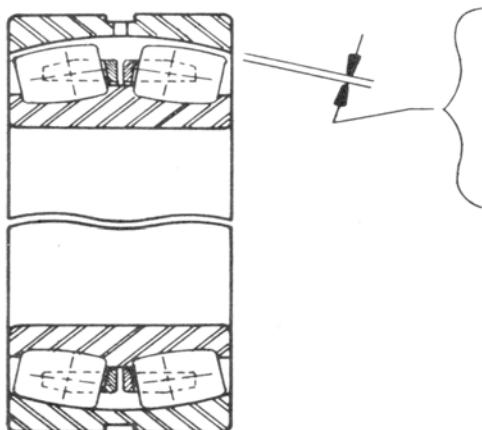
ASSEMBLED KNIFE FIXTURE

ROTOR BEARINGS

The rotor bearings are double row, self-aligning spherical roller bearings, which are press, fit in bearing cartridges, with integral seals, and slip fit on the rotor shaft.

To remove bearing on the drive end of the granulator:

- 1.) Remove belt guard, belts, sheave, flywheel and oil lines. Open end-cover. Check seal and wiper in the cover. Replace if needed.
- 2.) Remove bearing cartridge. The rotor will rest on the grate when the bearing cartridge is out.
- 3.) Press bearing out of cartridge and remove seal.
- 4.) Clean cartridge and replace seal with open side to bearings. Seals should be replaced whenever the bearings are removed.
- 5.) Press in new bearing after checking diametral clearance between rollers and outer race (.0048" min. - .0061" max.).
- 6.) Recheck diametral clearance on installed bearing (.0016" min. - .0035" max.).
- 7.) Replace parts by reverse procedure.



DIAMETRAL CLEARANCE		
Bearing Bore	Before Installation	After Installation
130 MM	.0048 Min .0061 Max	.0016 Min .0035 Max

Rotate complete bearing assembly, measuring clearance on 90° radials, four places.

To remove bearing on closed (non-drive) end of the granulator:

- 1.) Disconnect lines and remove cover.
- 2.) Remove locked-end retainer plate from shaft.
- 3.) Remove bearing cartridge.
- 4.) Repeat procedures 4 through 7.
- 5.) Reinstall bearing cartridge.
- 6.) Reinstall end retainer and safety wire bolts.
- 7.) Reinstall cover and oil lines.

After bearing replacement, the knife gap must be rechecked and adjusted if necessary.

ROTOR

To remove rotor:

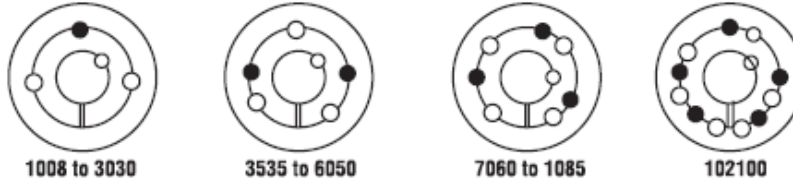
- 1.) Open Chamber lid.
- 2.) Remove bearing housing.
- 3.) Disconnect cylinder end of hydraulic cylinders from brackets and swing cylinders out of the way.
- 4.) Remove top half of bearing housing mounting lugs.
- 5.) Remove rotor.
- 6.) Replace or install in the opposite sequence.

The rotor may be removed with bearings and housing attached by removing the bearing housing bolts, the cylinders, the mounting lug tops, then lifting out as a unit.

APPENDIX



IMPORTANT NOTE: Please follow the instructions on this sheet in order for the *Martin* bushing to perform satisfactorily.



INSTALLATION

- 1 Clean all oil, dirt, and paint from shaft, bushing bore, outside of bushing and component (sprocket, sheave...etc.) bore.
- 2 Insert bushing into component. Match the hole pattern, not the threaded holes (each hole will be threaded on one side only.)
3. Thread set or cap screws into those half threaded holes indicated by ○ on above diagram. Mount assembly on shaft.
4. Alternately torque set or cap screws* to recommended torque setting in chart below.
5. On 3535 and larger bushings use a block, sleeve or drift and hammer large end of bushing (do not hammer bushing directly).
6. Repeat steps 4 and 5 until torque wrench reading, after hammering, is the same as before hammering.
7. Fill all unoccupied holes with grease.

REMOVAL

1. Remove all set or cap screws.
2. Insert set or cap screws in holes indicated by ● on drawing. Loosen bushing by alternately tightening set or cap screws.
3. To reinstall, complete all seven (7) installation instructions.

RECOMMENDED TORQUE TABLE

Bushing No.	Set or Cap Screw	Wrench Torque in. / lbs.
1008, 1108	1/4 - 20 Socket Set Screw	55
1210, 1215, 1310	3/8 - 16 Socket Set Screw	175
1610, 1615	3/8 - 16 Socket Set Screw	175
2012	7/16 - 14 Socket Set Screw	280
2517, 2525	1/2 - 13 Socket Set Screw	430
3020, 3030	5/8 - 11 Socket Set Screw	800
3535	1/2 - 13 Socket Head Cap Screw	1,000
4040	5/8 - 11 Socket Head Cap Screw	1,700
4545	3/4 - 10 Socket Head Cap Screw	2,450
5050	7/8 - 9 Socket Head Cap Screw	3,100
6050, 7060, 8065	1-1/4 - 7 Socket Head Cap Screw	7,820
10085, 120100	1 - 1/2 - 6 Socket Head Cap Screw	13,700




* If two bushings are used on same component and shaft, fully tighten one bushing before working on the other.

CAUTION

WARNING: USE OF ANTI-SEIZE LUBRICANT ON TAPERED CONE SURFACES OR ON BOLT THREADS WHEN MOUNTING MAY RESULT IN DAMAGE TO SHEAVES AND SPROCKETS. THIS VOIDS ALL MANUFACTURER'S WARRANTIES.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions given above must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. All rotating power transmission products when used in a drive are potentially dangerous and must be guarded by the user as required by applicable laws, regulations, standards, and good safety practice. (Refer to ANSI Standard B15.1.)

BOLT TORQUES

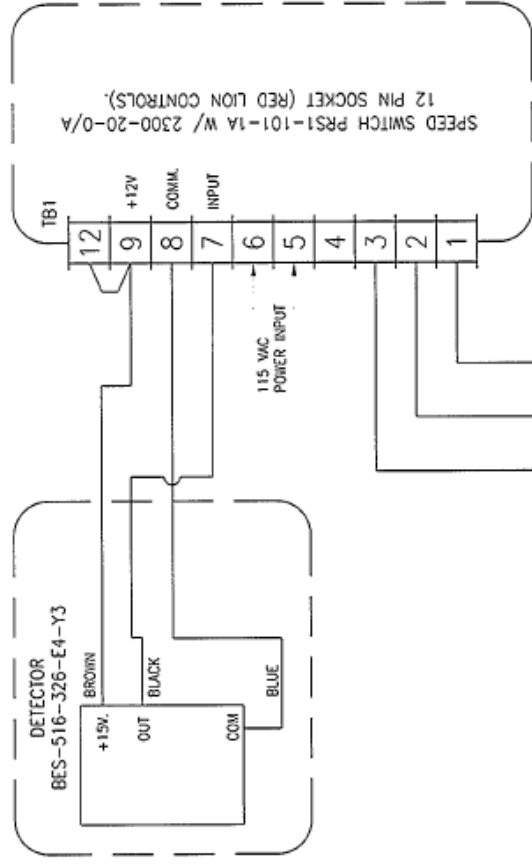
Head Marking	Grade and Material
 No Markings	Grade 2 Low or medium carbon steel
 3 Radial Lines	Grade 5 Medium Carbon Steel, Quenched and Tempered
 6 Radial Lines	Grade 8 Medium Carbon Alloy Steel, Quenched and Tempered

RECOMMENDED TORQUE FOR BOLTS

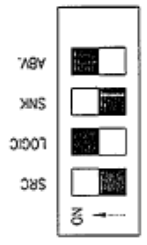
Bolt Diameter									
1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Grade 3									
9	17	30	47	69	103	145	234	372	551
Grade 5									
9	18	31	50	75	110	150	250	378	583
Grade 8									
13	28	46	75	115	165	225	370	591	893
All torques in lb. -ft. +/- 5% and threads NC									

TORQUE DATA	
Rotor Knife Bolts	365 +/-10 lb.-ft.
Stationary Knife Bolts	600 +/-10 lb.-ft.
Grate Bolts	150 +/-10 lb.-ft.
Triple/S Dynamics Model 24 Husky Granulator	Plate No. 22240

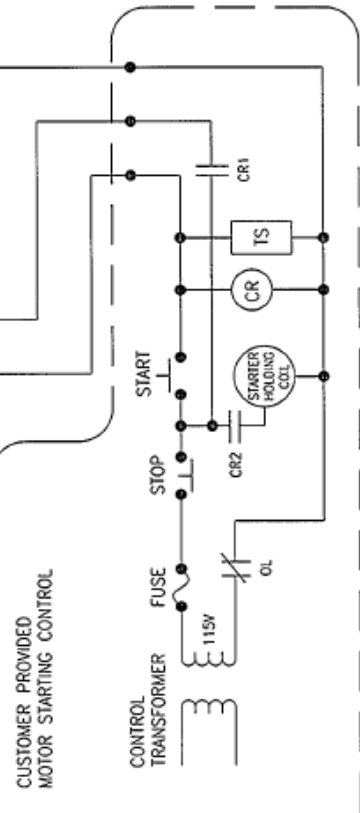
SYM	REVISION	DR	CK	DATE	MICROFILMED
A	ADDED 'CR' & 'TS'	GWC		5-22-80	
B	DETECTOR WAS HALL EFFECT SWITCH #103SR13A-1	CJ	GDU	2-13 1986	
C	REVISED DETECTOR WIRING	CJ	GDU	10-15-88	
D	SENSOR WAS A2910-159-1	CJ	GDU	3-16-88	
E	REVISED SWITCH CONFIGURATION	CJ	GDU	8-14-90	
F	REDRAWN IN CAD	BDT		1-30-02	



CR: SQUARE 'D' CLASS 8501 TYPE LO-20 RELAY WITH 120V COIL, OR EQUAL.
 TS: SQUARE 'D' CLASS 8501 TYPE LA-2 TRANSIENT SUPPRESSOR, OR EQUAL.



SPEED SWITCH SET-UP CONFIGURATION



CHK'D BY: _____ DRAWN BY: D. McCLEAVER DATE: 1-22-79
 FILE PATH: G:\DRAWINGS\TRIPLE_S_DYN\ELECTRICAL\RMU-SCHEMATIC.DWG MICROFILMED:
RPM SENSOR SCHEMATIC
TRIPLE/S DYNAMICS, INC
 1031 S. HASKELL AV., DALLAS, TEXAS 75223-2925
 TELE: 214-828-8600 FAX: 214-828-8638
 SCALE: NONE SHEET 1 OF 1 DWG. NO.: B13000-450 REV. NO.: F

Installation And Removal Instructions

Since the torque is transmitted by contact pressure and friction between the frictional surfaces, the condition of the contact surfaces and the proper tightening of the locking screws are important.

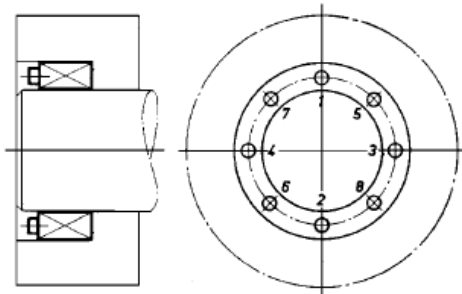


Figure 1: Tightening Sequence
Tightening sequence for locking screws.

INSTALLATION

- 1 Verify that all contact surfaces, including the screw threads and screw head bearing surfaces are clean and lightly oiled.

Note: Do NOT use Molybdenum Disulfide, “Molykote” or any other similar lubricants.

- 2 Slide the locking assembly onto the shaft and into the hub bore, aligning them as required.
- 3 Tighten the locking screws gradually in the sequence illustrated in [Figure 1: Tightening Sequence](#) as follows:
 - a Hand-tighten 3 or 4 equally spaced locking screws until they make contact. Align and adjust the connection.
 - b Hand-tighten and take up all remaining locking screws.
 - c Use a torque wrench to tighten the screws further to approximately one-half the specified torque (M_A).
 - d Using the torque wrench tighten the screws to full tightening torque (M_A).
 - e Verify that the screws are completely tight by applying the specified tightening torque (M_A).

Ringfeder® Locking Assemblies RfN 7012 & RfN 7012-IN 

REMOVAL

Ringfeder® locking assemblies are not self-locking. The individual rings are tapered so that the inner and outer rings spring apart after the last screw has been loosened.

- 1 Loosen the locking screws in several steps following a diametrically opposite sequence. Do not remove the screws completely.
- 2 Remove the hub and locking assembly from the shaft.

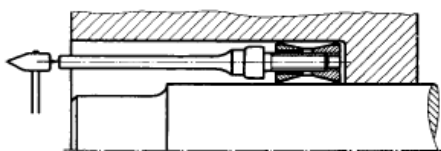


Figure 2: Rear Thrust Ring Jams
If the rear thrust ring jams, tap lightly against the screw heads to make it snap back.

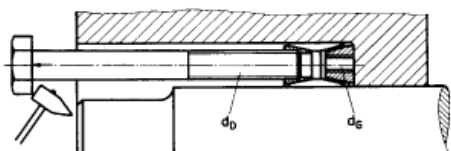


Figure 3: Front Thrust Ring Jams
If the front thrust ring jams, remove the three zinc-plated screws to expose the pull-out threads (d_D) of the front thrust ring. Screw in suitable bolts or threaded rods and lightly tap in an outward direction to release the front thrust ring. The pull-out threads have only 3 to 5 effective threads; they are unsuitable for strong pulling forces and should be used only to remove the locking assembly.

INSTALLATION TOOLS

- Standard torque wrench with either 1/4", 3/8", 1/2" or 3/4" square drive and suitable torque range; see [Table 1: Locking Assembly Tightening Data](#) for specified tightening torques (M_A).
- Metric hexagonal-bit socket ([Figure 4: Square Drives](#)) for torque wrench with suitable dimension across flats (s); see [Table 1: Locking Assembly Tightening Data](#).
- Metric hexagonal key with across flats dimension (s).

REMOVAL TOOL

- Three pull-out bolts or threaded rods with metric thread (d_D) long enough for the specific application; see [Table 1: Locking Assembly Tightening Data](#).



Figure 4: Square Drives
1/4", 3/8", 1/2" or 3/4" square drive

Ringfeder® Locking Assemblies RfN 7012 & RfN 7012-IN



Table 1: Locking Assembly Tightening Data

Locking Assemblies		Tightening Torque/Screw M _A		Screw Size (d _G) Metric	Hex Key Size (s) (mm)	Square Drive Size	Pull-Out Thread (d _D) Metric
RfN 7012 Metric Series	RfN 7012-IN Inch Series	(lb-ft)	(Nm)				
20x47 to 40x65	1 to 1-1/2	10.13	14	M 6	5	1/4"	M 8
42x75 to 65x95	1-5/8 to 2-9/16	25.32	35	M 8	6	1/4"	M10
70x110 to 95x135	2-3/4 to 3-3/4	50.63	70	M10	8	3/8"	M12
100x145 to 160x210	3-15/16 to 6	90.41	125	M12	10	3/8"	M14
170x225 to 200x260	6-1/2 to 7-7/8	137.43	190	M14	12	1/2"	M16
220x285 to 260x325		213.37	295	M16	14	1/2"	M20
280x355 to 300x375		292.94	405	M18	14	1/2"	M22
320x405 to 340x425		419.51	580	M20	17	3/4"	M24
360x455 to 420x515		564.17	780	M22	17	3/4"	M27
440x545 to 1000x1110		723.30	1000	M24	19	3/4"	M30

Installation Instructions for Heavy Duty Limit Switches

PK 81116

MOUNTING

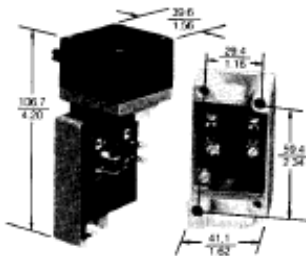
All Heavy Duty Limit Switches (HDLS) have exactly the same mounting dimensions. Mount by either of two methods: (a) use two #10 screws from the front, or (b) use two #10-32 UNF screws from the back. HDLS offers the advantage of front mount construction. The electrician will find a complete switch, with no parts missing and ample wiring space.

With plug-in construction, wiring and conduit connection is made to the base receptacle. This feature also reduces downtime, since plug-in unit can be removed without disconnecting wiring or conduit.

To mount either switch, merely tighten mounting screws, tighten plug-in unit or cover screws, and make sure conduit section is sealed. Use of sealant (teflon tape, pipe dope, etc.) is recommended to seal conduit connection.

Because of moisture condensation problems, it is not good practice to mount the switch upside down or at the low point of conduit runs.

Single-Pole - Plug-in Type



Double-Pole - Non Plug-In Type



Key: 0,0 = mm
0.00 = in.

Dimensions shown are for reference only.

WIRING

Use size #12AWG or smaller solid or stranded wire to connect to the pressure type connector terminals. Spades may be up to .312" wide, rings up to .312" dia. With spade or ring type connections, preinsulated connectors or heat-shrinkable tubing should be used to provide insulation between terminals. Circuit diagram is shown on the nameplate.



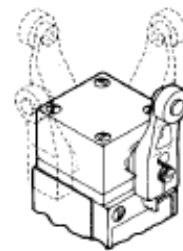
Figure 1

It will be easier to wire the double-pole units by connecting lead wires to the terminals nearest the conduit opening first. A grounding screw is located in the housing near the conduit opening.

Switch units with an indicator light in the cover are furnished with the lead wires from the light connected to the normally-open male terminals (#3 and #4) unless otherwise specified on the order. Wires can be unsoldered and reconnected to the normally-closed male terminals or they can be ordered connected to the normally-closed terminals by using a modification code (refer to Catalog 40). Always connect these wires to the same set of terminals used for the load. Across the normally open male terminals (#3 and #4) the light will be On (Fig. 1). Across the normally-closed terminals (#1 and #2) the light will be Off.

ADJUSTING INSTRUCTIONS

Actuator Head. For application flexibility, actuator head may be positioned in any of four directions. Loosen the four captive head screws, place head in the desired position, and then securely tighten the four screws.



Reversing the roller lever. Except for the offset roller levers, the roller arm may be reversed to face the roller to the inside or outside of the arm.

Heavy Duty Limit Switches

Positioning Lever.

Lever on rotary actuated units is adjustable through 360° around the shaft. Loosen the screw with a 9/64 inch hexagon key wrench, move lever to desired position and securely tighten the screw until "teller tab" can no longer be moved by hand. Then tighten the screw another 1/8 to 1/4 turn to assure lever is tight on the shaft. Hexagon key wrenches are provided in adjusting tool set LSZ4005 for this purpose.

Teller Tab



Figure 2

Adjustable Length Levers. A hexagon key wrench is required to adjust length of adjustable levers.

Top Roller Plunger.

Position top roller plunger in desired roller plane by adjusting the head as explained under Actuator Head (see page 1).



Side Roller Plunger.

Grasp roller with pliers and rotate it to desired horizontal or vertical plane.

Figure 3

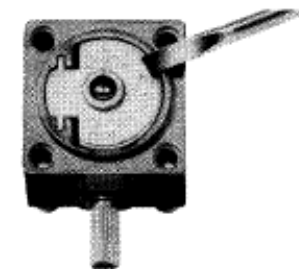


Figure 4

Cam Lobes For CW And CCW

CHANGING DIRECTION OF ACTUATION

Side Rotary. LSM (center neutral) and LSN (maintained) listings operate in both directions and cannot be changed. Listings with the first three letters LSA, LSH, LSL, LSP, LSU, and LSR may be changed to operate clockwise, counter-clockwise or both. NOTE: Instructions for adjusting switch operation are cast into the hinged cover (Fig. 2). To change, follow these steps:

1. Loosen the head screws and remove the head from the switch housing.
2. On the bottom of the head, insert a screwdriver in slot provided (Fig. 2) and lift open hinged cover.
3. Referring to Fig. 3, slide cam all the way back, so cam is free to rotate on the shaft.
4. Using a screwdriver or similar tool, rotate cam to desired actuating position (Fig. 4, 5, and 6.)
5. Slide cam all the way forward to its original position, and close hinged cover.
6. Replace operating head on switch housing and securely tighten head screws.

Figure 5

Cam Lobe For CW

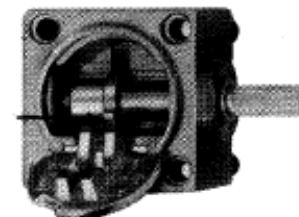
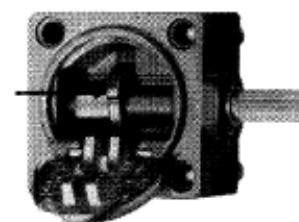


Figure 6

Cam Lobe For CCW



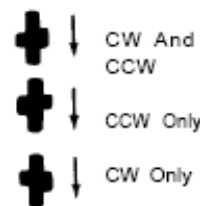
Top Rotary. Follow these steps to change operating direction of LSB type switches:

1. Loosen head screws and remove head from the switch housing.
2. From bottom of head grasp end of pin plunger and remove pin. It may be necessary to rotate actuating shaft to expose end of pin plunger.
3. Refer to Fig. 8 and select correct pin plunger position for desired direction of actuation.
4. Insert the pin plunger in the position providing desired direction of actuation.
5. Replace the operating head on switch housing and securely tighten head screws.

Figure 7



Figure 8 Actuation



REPLACEMENT PARTS

Should your specific switch catalog listing not appear in this parts list, contact nearest MICRO SWITCH Authorized distributor or MICRO SWITCH sales office.

For ease of making switch adjustments which may be necessary on various switch listings, order LSZ4005 (lever and switch adjusting tool set). This set consists of a special 3/32" open wrench and necessary hexagon key wrenches to adjust all types of levers.

Hex head screws. If you prefer to loosen and tighten lever with a pliers or screwdriver, order 15PA164-LS (packet of 50 hexhead screws with screwdriver slot) to replace screws furnished with the lever.



Plug-in Type				
Catalog Listing* on Switch Nameplate	Complete Plug-in Unit Base Receptacle	Plug-In Base Recept. Only	Operating Head Only	Contact Block (Basic Switch Only)
LSA1A	LSZ7A1A	LSZ4001	LSZ1A	LSZ3A
LSA1J	LSZ7A1J	LSZ4001	LSZ1A	LSZ3J
LSA2B	LSZ7A2B	LSZ4002	LSZ1A	LSZ3B
LSB1A	LSZ7B1A	LSZ4001	LSZ1B	LSZ3A
LSC1A	LSZ7C1A	LSZ4001	LSZ1C	LSZ3A
LSJ1J	LSZ7C1J	LSZ4001	LSZ1C	LSZ3J
LSD1A	LSZ7D1A	LSZ4001	LSZ1D	LSZ3A
LSD1J	LSZ7D1J	LSZ4001	LSZ1D	LSZ3J
LSD2B	LSZ7D2B	LSZ4002	LSZ1D	LSZ3B
LSF1A	LSZ7E1A	LSZ4001	LSZ1E	LSZ3A
LSF1J	LSZ7E1J	LSZ4001	LSZ1E	LSZ3J
LSF2B	LSZ7E2B	LSZ4002	LSZ1E	LSZ3B
LSF1A	LSZ7F1A	LSZ4001	LSZ1F	LSZ3A
LSF1J	LSZ7F1J	LSZ4001	LSZ1F	LSZ3J
LSF2B	LSZ7F2B	LSZ4002	LSZ1F	LSZ3B
LSH1A	LSZ7H1A	LSZ4001	LSZ1H	LSZ3A
LSH1J	LSZ7H1J	LSZ4001	LSZ1H	LSZ3J
LSH2B	LSZ7H2B	LSZ4002	LSZ1H	LSZ3B
LSJ1A-7A	LSZ7J1A-7A	LSZ4001	LSZ1JGA	LSZ3A
LSJ1A-7M	LSZ7J1A-7M	LSZ4001	LSZ1JGM	LSZ3A
LSJ2B-7A	LSZ7J2B-7A	LSZ4002	LSZ1JGA	LSZ3B
LSJ2B-7M	LSZ7J2B-7M	LSZ4002	LSZ1JGM	LSZ3B
LSK1A-8A	LSZ7K1A-8A	LSZ4001	LSZ1KHA	LSZ3A
LSK2B-8A	LSZ7K2B-8A	LSZ4002	LSZ1KHA	LSZ3B
LSL2C	LSZ7L2C	LSZ4002	LSZ1L	LSZ3C
LSM2D	LSZ7M2D	LSZ4002	LSZ1M	LSZ3C
LSN1A	LSZ7N1A	LSZ4001	LSZ1N	**
LSN2B	LSZ7N2B	LSZ4002	LSZ1N	**
LSP1A	LSZ7P1A	LSZ4001	LSZ1P	LSZ3A
LSP1J	LSZ7P1J	LSZ4001	LSZ1P	LSZ3J
LSP2B	LSZ7P2B	LSZ4002	LSZ1P	LSZ3B
LSR1A	LSZ7R1A	LSZ4001	LSZ1R	LSZ3A
LSR1J	LSZ7R1A	LSZ4001	LSZ1R	LSZ3J
LSH2B	LSZ7R2B	LSZ4002	LSZ1R	LSZ3B
LSU1A	LSZ7U1A	LSZ4001	LSZ1U	LSZ3A
LSV1A	LSZ7V1A	LSZ4001	LSZ1V	LSZ3J
LSV1J	LSZ7V1J	LSZ4001	LSZ1V	LSZ3A
LSV5A	LSZ7V5A	LSZ4001	LSZ1V	LSZ3A
LSV8A	LSZ7V8A	LSZ4001	LSZ1V	LSZ3A

Replacement Levers. To order replacement levers, order the same part number that is metal stamped on either lever or lever hub. For other lever variations, refer to HDLS in Catalog 40.

Non Plug-in Type		
Catalog Listing on Switch Nameplate	Operating Head Only	Contact Block (Basic Switch Only)
LSA3K	LSZ1A	LSZ3K
LSA4L	LSZ1A	LSZ3L
LSB3K	LSZ1B	LSZ3K
LSB4L	LSZ1B	LSZ3L
LSC3K	LSZ1C	LSZ3K
LSC4L	LSZ1C	LSZ3L
LSD3K	LSZ1D	LSZ3K
LSD4L	LSZ1D	LSZ3L
LSF3K	LSZ1E	LSZ3K
LSF4L	LSZ1E	LSZ3L
LSG3K	LSZ1F	**
LSH3K	LSZ1H	LSZ3K
LSH4L	LSZ1H	LSZ3L
LSJ3K-7A	LSZ1JGA	LSZ3L
LSJ3K-7M	LSZ1JGM	LSZ3K
LSJ4L-7A	LSZ1JGA	LSZ3L
LSJ4L-7M	LSZ1JGM	LSZ3L
LSK3K-8A	LSZ1KHA	LSZ3K
LSK4L-8A	LSZ1KHA	LSZ3L
LSL4M	LSZ1L	LSZ3M
LSM4N	LSZ1M	LSZ3M
LSN3K	LSZ1N	**
LSN4L	LSZ1N	**
LSP3K	LSZ1P	LSZ3K
LSP4L	LSZ1P	LSZ3L
LSR3K	LSZ1R	LSZ3K
LSR4L	LSZ1R	LSZ3L
LSU3K	LSZ1U	LSZ3K

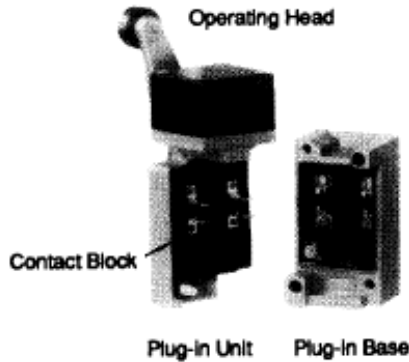
*Only the listing portion which determines the replacement part is shown. Listings with -7A, -7M, or -8A are complete listings.

**Not user-replaceable.

Heavy Duty Limit Switches

PK 81116

REPLACEMENT PARTS - Continued

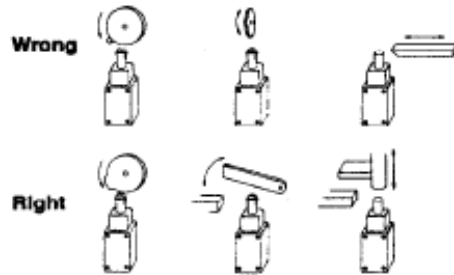


Replacement Parts for gravity return LSS1H, extra/low torque LST1H and two examples of a standard size rotary LSA1A type (LSYAC1A with Viton seals and LSYAB1A low temperature version) are listed below.

Catalog Listing	Plug-In Units Only	Base Recept.	Oper. Head	Contact Block
LSS1H	LSZ7S1H	LSZ4001	LSZ1S	LSZ3H
LST1H	LSZ7T1H	LSZ4001	LSZ1T	LSZ3H
LSYAB1A	LSZ7YAB1A	LSZ4001	LSZ1AB	LSZ3A
LSYAC1A	LSZ7YAC1A	LSA4001	LSZ1AC	LSZ3A

PROPER APPLICATION OF LIMIT SWITCHES

To achieve greatest reliability and longest life possible, limit switches should be installed as outlined in NEMA ICS2-225.

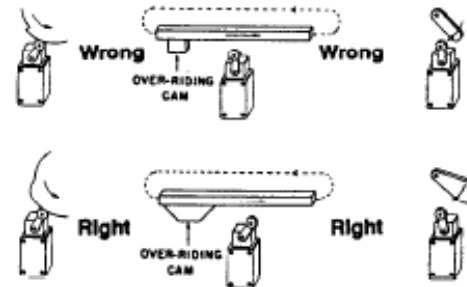
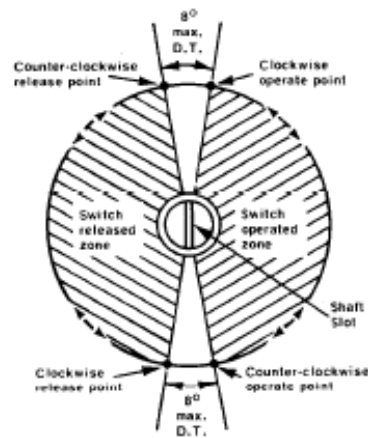


For limit switches with pushrod actuators, apply actuating force as nearly as possible in line with pushrod axis.

GRAVITY RETURN HDLS

Listings beginning with LSS are gravity return devices. During installation and setup, note the following:

1. Operate and release points exchange locations when shaft is rotated 180° (Fig. 9).
2. Switch is near operate-release points when shaft slot is parallel to switch's long axis (Fig. 9).
3. The switch should be installed so gravity return of the actuator releases the switch.



Cam or dog arrangements should be such that the actuator is not suddenly released to snap back freely.

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YOUNG RADIATOR COMPANY

RACINE, WISCONSIN 53404

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR YOUNG HEAT EXCHANGERS

INSTALLATION INSTRUCTIONS

Young Radiator Company Heat Exchangers are designed to give the optimum heat transfer rate for given flow conditions. Ordinarily the most viscous fluid is piped to the shell side while the least viscous is piped to the tube side. The shell side of the Exchanger is baffled and therefore the shell fluid is required to make many changes of direction in its travel through the Exchanger. This breaks up the surface film which would otherwise prevent the transfer of heat. The next important consideration in the piping of the fluids to the Exchanger pertains to temperature. A single pass Exchanger should be piped counter flow for greatest heat transfer as this will give the greatest mean temperature difference over the entire length of the Exchanger. True counter flow exists where the two fluids flow in opposite directions in the Exchanger and is possible in the single pass Exchanger only.

In connecting a multi-pass Exchanger, the shell fluid should enter the Exchanger at the same end at which the tube fluid enters.

Strainers

In making up the pipe on the lube oil side of a Heat Exchanger for lubricating oil cooling it is essential to install a strainer on the outlet side of the Heat Exchanger. This is to collect foreign matter which may have entered the Exchanger in shipping and piping, preventing its entry into the engine. Consult your Young Radiator Company representative or write the factory directly for strainer recommendations.

Water Regulating Valves

In the interest of conserving water, a water regulating valve should be installed ahead of the Heat Exchangers in which water is used for cooling another fluid. Normally the regulating valve is temperature controlled and the control bulb for the valve is placed in the stream of fluid being cooled. Consult Young Radiator Company or a reputable manufacturer of this equipment for recommendations.

Pressure Relief Valve

When there is a possibility of surge pressures, above the design pressure of the Heat Exchanger a pressure relief or regulating valve should be installed to protect the Exchanger from bursting pressures. Consult Young Radiator Company factory or a reliable manufacturer of such equipment for recommendations.

SERVICE RECOMMENDATIONS

The Heat Exchanger, when shipped from the factory, is clean and should require no on-the-job cleaning. It is recommended that the Exchanger be inspected thoroughly on both the shell and tube side making sure that no foreign matter entered while in shipment. This inspection can be made without removing the end bonnets of the Exchanger. It is also recommended that the bolts holding the end bonnet to the end casting be checked and pulled down so as to insure tightness. The Exchanger should be mounted solidly in place and the pipe connections made up, being sure that all connections are tight. If the Exchanger is to be stored for any length of time before use, shell and bonnet openings should be kept sealed to prevent the entry of dirt or other foreign matter.

When the Exchanger is first installed, sufficient data should be taken to establish the temperature and pressure drops. Similar data recorded at regular intervals by the operator will serve to detect any accumulation of sediment or scale, and from such data the proper interval between cleanings can be established.

When an Exchanger is disassembled for cleaning, new gaskets should be used upon reassembly. This is important in both the Fixed and Removable Tube Bundle Exchangers.

Care should be taken when removing or handling the tube bundle of a Removable Tube Bundle Exchanger to protect the baffle plates and tubes from being bent or damaged. The result of bent baffle plates is bypassing of fluid with an accompanying decrease in heat transfer rate.

Corrosive and Scale Forming Fluids

In many sections of the country raw water is extremely corrosive or scale forming and should be treated to prevent damage to the Heat Exchanger and to prolong periods between cleanings. Before piping fluids to a Heat Exchanger, they should be analyzed as to what action they will have on the metals in the Exchanger.

If salt water is used as a cooling medium, zinc pencils should be used in the Heat Exchanger on the salt water side to prevent corrosion of the Exchanger. Parts in contact with the salt water should be of Admiralty metal, cast iron, or copper-nickel alloys.

Water Treatment - Closed System

In a closed water system, such as an engine jacket system, Young Cooling System Treatment No. 3-1-2 should be added to prevent corrosion and control scale deposits. This treatment is effective under normal operating conditions for a period of six months, after which the system should be drained and refilled with a new solution of Young No. 3-1-2.

Draining

A Heat Exchanger mounted horizontally will not completely drain until it is tipped at a slight angle.

Therefore, in draining, it is important to purge or blow out the tubes with compressed air.

If the Heat Exchanger is installed where there is chance of freezing on shutdown, the water circuit should be completely drained or an antifreeze should be added.

Cleaning Engine Jacket Water or Raw Water Circuit

Young "Cooling System Cleaner" No. 585, in the proportion of one pound to six gallons of water, should be used to remove oil, grease, rust, and scale. The solution should be circulated at normal rate and at a temperature between 180 to 200 F for a period of from one to three hours. (Do not allow solution to boil). After this has been done, open drain cocks in the water system and flush thoroughly with clean water. The Exchanger water connections should then

be reversed and fresh water-cleaner solution circulated, again for one to three hours. After draining, the unit should be thoroughly flushed with fresh water and then reconnected for service.

Severely fouled tubes can also be cleaned by use of a rotary brush, similar to a shotgun cleaner, in conjunction with an air or electric rotating tool. This type of equipment is available commercially.

Cleaning Lube Oil Passages

Formation of oil sludge and other deposits about the tubes decreases the efficiency of the Exchanger and it is important that a cleaning medium be used which is suitable for removing such sludge.

Benzol, trichlorethylene and various commercial solvents are suitable for this operation. Benzol, and the hydrocarbon derivatives, are inflammable and should be used with due regard for open flames and the "sparking" of tools.

Benzol and trichlorethylene vapors are also toxic in "harmful" concentrations. Ample ventilation must be provided in the working area, supplying fresh air and exhausting all fumes to an outdoor location.

The solvent should be circulated through the Exchanger in the reverse direction to the normal flow for approximately fifteen minutes, after first soaking for about ten minutes. The length of time of circulation depends on the degree of dirt deposit.



YOUNG RADIATOR COMPANY

2825 Four Mile Road Racine, Wisconsin 53404
Plants at: Racine, WI, Mattoon, IL and Centerville, IA





Product Data Sheet

Manufacturer Information:

Tulco Oils, Inc.
5240 E. Pine Street
Tulsa, Oklahoma 74115

SUPER HYDRAULIC A.W. OILS

LUBSOIL SUPER HYDRAULIC A.W. Oils are superior anti-wear hydraulic and circulating fluids specifically formulated with high quality base stocks and improved thermally stable additives. These oils offer outstanding resistance to sludge formation, are chemically stable, and exhibit excellent anti-wear protection.

Qualities:

- **LUBSOIL SUPER HYDRAULIC A.W.** Oils are made from top quality base stocks and contain all the necessary additive components to offer trouble free service in high-pressure, high-output industrial hydraulic circuits. **LUBSOIL SUPER HYDRAULIC A.W.** Oils have these outstanding properties:
- **LUBSOIL SUPER HYDRAULIC A.W.** Oils utilize the latest in thermally stable zinc-type additives. This virtually eliminates the formation of heat-related sludging in sensitive electro-hydraulic servos associated with conventional zinc-type oils. These oils are wholly suitable for N/C machine tools and other high-output equipment where sustained heat is prevalent.
- These oils exhibit superior hydrolytic stability in the presence of water and will not contribute to either the formation of metal-etching acids or corrosive reactants.
- **LUBSOIL SUPER HYDRAULIC A.W.** Oils offer the optimum in anti-wear protection to pumps, motors, valves, and other hydraulic circuit components. They meet and exceed the most stringent testing requirements. These oils carry the official approval from Cincinnati Milacron for their P-68, P-69 and P-70 specifications. This is reflected in Cincinnati's test reference numbers 9801050, 9801051 and 9801052 respectively. These oils also meet and exceed the specifications for Denison HF-0, Vickers M-2950-S and I-286-S
- **LUBSOIL SUPER HYDRAULIC A.W.** Oils resist foaming and will not foster abnormal air entrapment in properly designed hydraulic circuits. The oils also readily and rapidly separate water permitting sump drain-off of the contaminating water.

Applications:

- **LUBSOIL SUPER HYDRAULIC A.W.** Oils are recommended for service in vane, piston, and gear pumps when used in accordance with the manufacturers' recommendations. The oils are designed to provide maximum service life to these pumps as well as to other circuit components such as motors and servos.
- **LUBSOIL SUPER HYDRAULIC A.W.** Oils are also recommended for use as gear and bearing lubricant in industrial applications where rust and oxidation inhibited oils are required.
- **LUBSOIL SUPER HYDRAULIC A.W.** Oils meet the general physical and performance requirements of the European classifications as follows:
DIN 51524 Part 2(HLP) ISO-VG Grades 22-220

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TYPICAL SPECIFICATIONS							
PROPERTIES	LUBSOIL SUPER HYDRAULIC A.W. ISO GRADES						
	22 (0490)	32 (0492)	46 (0494)	68 (0496)	100 (0486)	150 (0488)	220 ()
GRAVITY	31.9	31.3	30.4	29.6	29.0	28.2	28.0
POUNDS PER GAL	7.21	7.24	7.28	7.31	7.34	7.40	7.40
FLASH POINT, °F (C)	433(233)	414(212)	468(242)	464(240)	475(246)	471(244)	471(240)
VISCOSITY, cP @ 0°C (1)	-	-	-	-	-	-	-
VISCOSITY cSt @ 40°C	21.5	32	46	68	98	150	220
VISCOSITY cSt @ 100 °C	4.2	5.5	6.8	8.5	10.9	14	
VISCOSITY SUS @ 100°F	113	171	237	352	514	781	
VISCOSITY SUS @ 210°F	40.5	45	49	55	63	77	
VISCOSITY INDEX	97	100	102	94	94	94	94
POUR POINT, °F (°C)	-45(-43)	-33(-34)	-27(-32)	-20(-29)	+5(-15)	+5(-15)	+5(-15)
COLOR, ASTM D-1500	L 1.0	L 1.0	L 1.0	L 1.5	L 3.0	L 4.0	L 4.0
EMULSION TEST D-1401 (2)	--	38-39-3	39-40-1	40-40-0	40-40-0	40-40-0	40-40-0
HYD. PUMP TEST (3) 2000 PSI, 100HR, 175°F MGS RING + VANE LOSS	--	25	25	28	28	28	28
OXIDATION TEST ASTM D-943 HRS.	4000	5000	5000	5000	3000	2500	2500
RUST TEST, A, B (4)	PASS	PASS	PASS	PASS	PASS	PASS	PASS
MEETS VICKERS M-2950-S (5)	YES	YES	YES	YES	--	--	--
MEETS VICKERS M-286-S (6)	YES	YES	YES	YES	--	--	--
MEETS DENSON HF-O	YES	YES	YES	YES	YES	YES	YES
MEETS CINCINNATI MILACRON REQ.	-	P- 68	P- 70	P- 69	-	-	-
DIN 51524 PART 2 GRADE	HLP 22	HLP 32	HLP 46	HLP 68	HLP 100	N/A	N/A
ISO VG NUMBER	22	32	46	68	100	150	220

Notes:
 (1) ASTM D-2893 BROOKFIELD VISCOSITY.
 (2) 30 MINUTES MAX. SEPERATION TIME.
 (3) TEST UTILIZES VICKERS 104c OR 105c VANE PUMP.
 (4) PASS-NO RUST.
 (5) THIS REQUIREMENT UTILIZES VICKERS 35VQ25A VANE PUMP TEST FOR MOBILE EQUIPMENT.
 (6) THIS REQUIREMENT UTILIZES VICKERS 104c OR 105c VANE PUMP TEST, ASTM D 2882 AND IS FOR INDUSTRIAL, STATIONARY SYSTEMS.

When in doubt about the appropriate product for a specific application, always contact your Tulco Oils, Inc. company representative.
 For safety information see the Lubsoil Material Safety Data Sheet and the product label.
 For more information and availability please call 1-800-375-2347

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MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name: Super Hydraulic AW 100 (0486)

Manufacturer Information:
 Tulco Oils, Inc.
 5240 E. Pine Street
 Tulsa, Oklahoma 74115

Product Use: Industrial Hydraulic Oil

Emergency Phone Numbers:
 Chemtrec
 Tulco Oils, Inc. (800) 375-2347

Information:
 Product Safety Information (800) 375-2347

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Amount (Vol%)
SEVERELY SOLVENT REFINED HEAVY PARAFFINIC PETROLEUM OIL	64741-88-4	>99 – 100
PROPRIETARY ADDITIVES	PROPRIETARY	<1-100

EXPOSURE GUIDELINES (SEE SECTION 15 FOR ADDITIONAL EXPOSURE LIMITS)

CAS No.	Governing Body	Exposure Limits

3. HAZARDS IDENTIFICATION

- EMERGENCY OVERVIEW**
 Poses little or no immediate hazard.

Hazards Ratings:
 Key: 0 = least, 1 = slight, 2 = moderate, 3 = high, 4 = extreme

	Health	Fire	Reactivity	PPI
NFPA	0	1	0	
HMIS	0	1	0	X

- POTENTIAL HEALTH EFFECTS**
 - PRE-EXISTING MEDICAL CONDITIONS**
 The following diseases or disorders may be aggravated by exposure to this product: Skin,
 - INHALATION**
 No acute effects expected.
 LC50 (mg/l): no data
 LC50 (mg/m3): no data

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LC50 (ppm): no data

- **SKIN**
Practically non-toxic if absorbed through the skin. May cause minimal skin irritation.

Draize Skin Score: no data Out of 8.0

LD50 (mg/kg): no data

- **EYES**
No eye effect expected.
- **INGESTION**
Practically non-toxic if ingested.

LD50 (g/kg): no data

4. FIRST AID MEASURES

- **INHALATION**
No specific treatment is necessary since this material is not likely to be hazardous by inhalation. If exposed to excessive levels of dusts or fumes, remove to fresh air and get medical attention if cough or other symptoms develop.
- **SKIN**
Wash with soap and water. Get medical attention if irritation develops or persists. Wash clothing before reuse.
- **EYES**
Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. If eye irritation persists, obtain medical treatment.
- **INGESTION**
Material is practically non-toxic. Induction of vomiting is not required. Get medical attention immediately.

5. FIRE FIGHTING MEASURES

- **EXTINGUISHING MEDIA**
Water spray Regular foam Dry chemical Carbon dioxide
- **FIRE FIGHTING INSTRUCTIONS**
Wear structural fire fighting gear. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

FLAMMABLE PROPERTIES

	Typical	Minimum	Maximum	Text Result	Units	Method
Flash Point		475			F	COC
Autoignition Temperature				725 ESTIMATED	F	N/A
Lower Explosion Limit				no data	%	N/A
Upper Explosion Limit				no data	%	N/A

6. ACCIDENTAL RELEASE MEASURES

Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Use appropriate personal protective equipment as stated in Section 8 of this MSDS. Advise the Environmental Protection Agency (EPA) and appropriate state agencies, if required. Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Vacuum or sweep up material and place in a disposal container.

7. HANDLING AND STORAGE

- **HANDLING**
Wash thoroughly after handling.

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- **STORAGE**
NFPA class IIIB storage. Flash point is greater than 200 degrees F.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Consult With a Health and Safety Professional for Specific Selections

- **ENGINEERING CONTROLS**
Use with adequate ventilation. Ventilation is normally required when handling or using this product to keep exposure to airborne contaminants below the exposure limit. Mechanical ventilation recommended.
- **PERSONAL PROTECTION**
 - **EYE PROTECTION**
Safety glasses (with side shields) recommended. Splash proof chemical goggles are recommended to protect against the splash of product.
 - **GLOVES or HAND PROTECTION**
Protective gloves are recommended when prolonged skin contact cannot be avoided. The glove(s) listed below may provide protection against permeation. Gloves of other chemically resistant materials may not provide adequate protection. Neoprene; Nitrile; Viton;
 - **RESPIRATORY PROTECTION**
Concentration in air determines the level of respiratory protection needed. Use only NIOSH certified respiratory equipment. Respiratory protection is not usually needed unless product is heated or misted.. Half-mask air purifying respirator with dust / mist filters or HEPA filter cartridges is acceptable for exposures to ten (10) times the exposure limit. Full-face air purifying respirator with dust / mist filters or HEPA filter cartridges is acceptable for exposures to fifty (50) times the exposure limit. Protection by air purifying respirators is limited. Use a positive pressure-demand full-face supplied air respirator or SCBA for exposures greater than fifty (50) times the exposure limit. If exposure is above the IDLH (Immediately Dangerous to Life and Health) or there is the possibility of an uncontrolled release, or exposure levels are unknown, then use a positive pressure-demand full-face supplied air respirator with escape bottle or SCBA. Wear a NIOSH/MSHA-approved (or equivalent) full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.
 - **OTHER**
Where splashing is possible, full chemically resistant protective clothing (e.g., acid suit) and boots are required. Polyvinyl alcohol (PVA); The following materials are acceptable for use as protective clothing: Polyvinyl chloride (PVC); Neoprene; Nitrile; Viton; Polyurethane; Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Remove contaminated clothing and wash before reuse. For non-fire emergencies, respiratory protection may be necessary and wear appropriate protective clothing to avoid contact with material.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Property	Typical	Units	Text Result	Reference
Appearance		N/A	DARK AMBER FLUID.	
Boiling Point		F	no data	
Bulk Density	7.34	lb/gal	no data	
Melting Point		F	no data	
Molecular Weight		g/mole	No data	
Octanol/Water Coefficient		N/A	no data	
pH		N/A	no data	
Specific Gravity	0.87	N/A		
Solubility In Water		wt %	NIL	
Odor		N/A	LITTLE ODOR.	
Odor Threshold		ppm	no data	

Vapor Pressure		mmHg	<0.0001	@ 20 C
Viscosity (F)	514	SUS		@ 100 F
Viscosity (C)	98	CsT		@ 40 C
% Volatile		wt %	NIL	

10. STABILITY AND REACTIVITY

- **STABILITY**
Stable
- **CONDITIONS TO AVOID**
Avoid heat, sparks and open flame.
- **INCOMPATIBILITY**
Strong oxidizers
- **HAZARDOUS DECOMPOSITION PRODUCTS**
Combustion may produce carbon monoxide, carbon dioxide and other asphyxiants.
- **HAZARDOUS POLYMERIZATION**
Will not polymerize.

11. ECOLOGICAL INFORMATION

No data available

12. DISPOSAL CONSIDERATIONS

Follow federal, state and local regulations. This material is not a RCRA hazardous waste, if not contaminated. If material has been "used", RCRA criteria (ignitability, reactivity, corrosivity and toxicity) must be determined. Do not flush material to drain or storm sewer. Contract to authorized disposal service.

13. TRANSPORT INFORMATION

<u>Governing Body</u>	<u>Mode</u>	<u>Proper Shipping Name</u>		
DOT	Ground	Petroleum Lubricating Oil		
<u>Governing Body</u>	<u>Mode</u>	<u>Hazard Class</u>	<u>UN/NA No.</u>	<u>Label</u>
DOT	Ground	N/A	N/A	Not Regulated

14. REGULATORY INFORMATION

<u>Regulatory List</u>	<u>Component</u>	<u>CAS No.</u>

Title III Classifications Sections 311,312:

- Acute: **NO**
- Chronic: **NO**
- Fire: **NO**
- Reactivity: **NO**
- Sudden Release of Pressure: **NO**

15. OTHER INFORMATION

Limits for the product- 5mg/m³, Oil Mist Limit, (OSHA PEL/ACGIH TLV) WHMIS Classification: not controlled.
Please refer to the material safety data sheet for complete information.