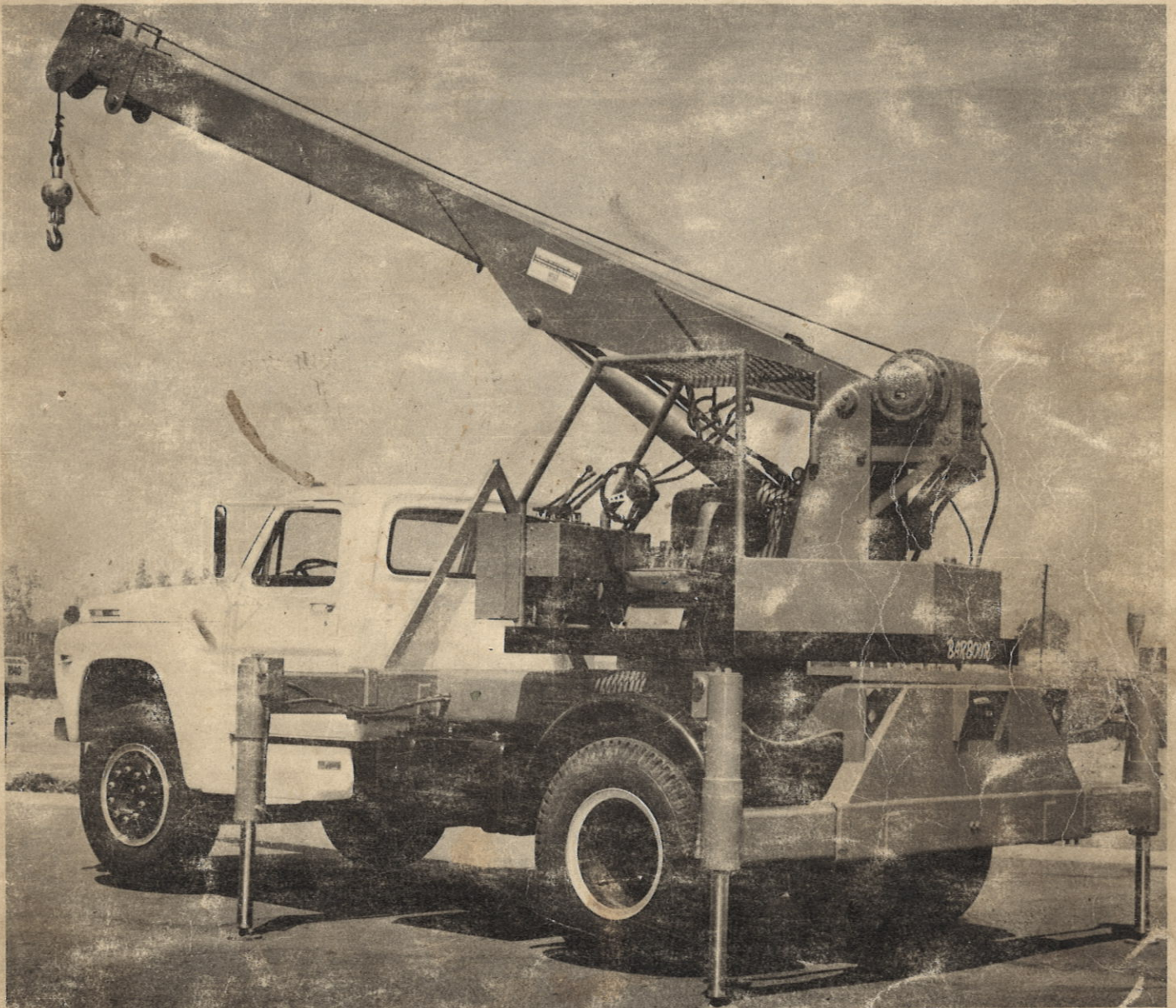


KEY #16

BT287

# BARBOUR Model HP5 HYDRAULIC CRANE OPERATION & MAINTENANCE MANUAL

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**ECKMAN MANUFACTURING INC.**

**1640 BON VIEW STREET**

**ONTARIO, CALIFORNIA**



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# INTRODUCTION

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THE BARBOUR H.P.5 TRUCK MOUNTED HYDRAULIC CRANE HAS BEEN DESIGNED AND CONSTRUCTED COMBINING ADVANCED METHODS OF STEEL DESIGN AND FABRICATION WITH THE MOST RELIABLE MECHANICAL AND FLUID POWER COMPONENTS AVAILABLE.

THIS MANUAL WILL OUTLINE OPERATING PROCEDURES TO FOLLOW IN ORDER TO ACHIEVE SAFE AND TROUBLE-FREE OPERATION. BY OPERATING CAREFULLY, MAINTENANCE WILL BE MINIMIZED. WITH PROPER CARE, THIS CRANE WILL PROVIDE YEARS OF TROUBLE-FREE OPERATION. A MAINTENANCE SCHEDULE SHOULD BE SET-UP AND FOLLOWED.

THE PARTS AND VARIOUS COMPONENT REMOVAL PROCEDURES ARE HEREIN OUTLINED. A QUALIFIED MECHANIC WILL FIND THE SYSTEMS SIMPLE AND EASY TO REPAIR AND MAINTAIN. DISTRIBUTOR, AND OR FACTORY ASSISTANCE, IS AVAILABLE AT ANY TIME.

DUE TO ITS VERSATILITY, MANEUVERABILITY, AND LOW MAINTENANCE, THIS 5-TON CAPACITY CRANE WILL, BY COMPARISON, PRODUCE MORE PROFIT PER DOLLAR OF INVESTMENT.

MECHANICAL & FLUID POWER DESIGNER      LLOYD BARBOUR  
YORBA LINDA, CA.

STRUCTURAL ENGINEERING      CARL HART, STRUCT. ENGR.  
SIGNAL HILL, CA.

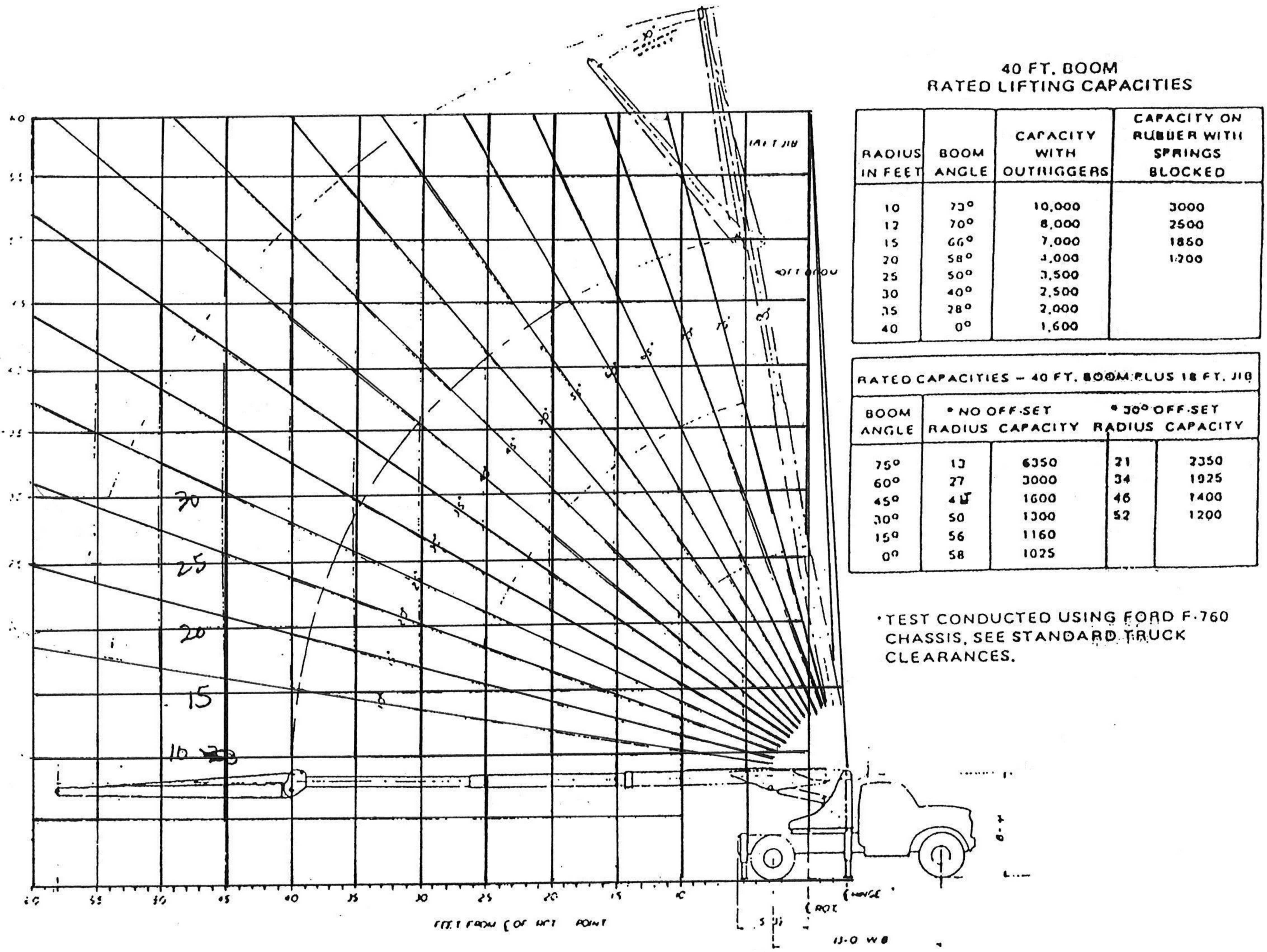
TESTING AGENCY      CO-ORDINATED TESTING FACILITY  
WILMINGTON, CA.

MANUFACTURER      ECKMAN MFG. INC.  
ONTARIO, CA.



# LOAD CHART

## RATED LIFTING CAPACITIES



40 FT. BOOM  
RATED LIFTING CAPACITIES

RADIUS IN FEET	BOOM ANGLE	CAPACITY WITH OUTRIGGERS	CAPACITY ON RUBBER WITH SPRINGS BLOCKED
10	75°	10,000	3000
12	70°	8,000	2500
15	66°	7,000	1850
20	58°	4,000	1200
25	50°	3,500	
30	40°	2,500	
35	28°	2,000	
40	0°	1,600	

RATED CAPACITIES - 40 FT. BOOM PLUS 18 FT. JIB				
BOOM ANGLE	* NO OFF-SET		* 30° OFF-SET	
	RADIUS	CAPACITY	RADIUS	CAPACITY
75°	13	6350	21	2350
60°	27	3000	34	1925
45°	41	1600	46	1400
30°	50	1300	52	1200
15°	56	1160		
0°	58	1025		

\*TEST CONDUCTED USING FORD F-760 CHASSIS, SEE STANDARD TRUCK CLEARANCES.

1. Tabulated capacities are based on freely hung loads and are the maximum warranted loads with the equipment on a firm and level surface.
2. Capacities will not exceed 85% of tipping.
3. Ratings "with outriggers extended" are based on the maximum extension of the outriggers with the feet of the outriggers in firm contact with the surface.
4. Ratings "on rubber with springs blocked" depends on the condition of the tires and their capacity. These loads may be transported over a surface that is firm, level and smooth at a speed of less than 3 miles per hour.
5. Due to operating conditions at some jobs, rated loads may have to be decreased. Surface conditions, wind, weather and the experience of personnel operating the equipment affect the

6. Excessive boom lengths create a tipping condition. Retract boom proportional to load chart.
7. Load handling devices are to be considered as part of the lifted load.
8. For loads over 7000 pounds use a full boom or with end section of boom retracted.
9. Single line capacity 5000 pounds, use 2 part line for over 5000 pounds to 10,000 pounds
10. Rated capacities are governed by tipping. Use of a truck chassis different than specified may result in structural capacities becoming critical.
11. Use jib on single line service only.



# MAINTAINANCE & LUBRICATION CHART

## MAINTENANCE AND LUBRICATION

ITEM:	WHEN:	LUBRICATION:
2 SHEAVES AT BOOM HEAD (2 FITTINGS)	DAILY	CHASSIS GREASE
TRUCK ENGINE OIL	DAILY	PER MFG. RECOMMENDATION
IND. ENGINE OIL	DAILY	PER MFG. RECOMMENDATION
TRUCK POWER STEERING	DAILY	PER MFG. RECOMMENDATION
IND. ENGINE RADIATOR ANTIFREEZE	DAILY	PER MFG. RECOMMENDATION
CABLE, CLAMPS & LOADLINE	DAILY	
TRUCK TRANSMISSION	WEEKLY	PER MFG. RECOMMENDATION
BOOM LIFT CYLINDER END PINS (2 FITTINGS)	WEEKLY	CHASSIS GREASE - DAILY UNDER EXTREME CONDITIONS
BOOM WEAR PADS	WEEKLY	CHASSIS GREASE
BOLTS FOR WINCH AND SWING GEAR	WEEKLY	TIGHTEN
CRANE MOUNTING BOLTS TO TRUCK CHASSIS	WEEKLY	TIGHTEN
ROTEC BEARING (4 FITTINGS)	WEEKLY	CHASSIS GREASE
BOOM MOUNTING PIN (1 FITTING)	WEEKLY	CHASSIS GREASE
SWING GEAR BOX OIL	WEEKLY	90 WT. GEAR OIL
PUMP GEAR BOX OIL	WEEKLY	90 WT. GEAR OIL
RESERVOIR FOR HYD. SYSTEM KEEP 3" - 5" FROM TOP (1 FITTING)	WEEKLY	HIGH GRADE HYD. OIL
WINCH GEAR BOX	WEEKLY	SEE TULSA WINCH LITERATURE
ROTEC BEARING BOLTS	WEEKLY	TIGHTEN - 250 FT. #
REMOTE SHIFT RESERVOIR	WEEKLY	½ HYD. OIL AND ½ DIESEL OIL
REMOTE THROTTLE RESERVOIR	WEEKLY	BRAKE FLUID
SWIVEL BOLTS	WEEKLY	
*RETURN LINE FILTERS	ANNUALLY	USE 25 MICRON FILTER CARTRIDGE SAF59
RUBBER SPIDER AT COUPLING SWING MOTOR TO GEARBOX	6 MONTHS	CHECK CONDITION OF RUBBER SPIDER
2 15/16 PIN CONNECTING BOOM TO TURNTABLE	MONTHLY	CHASSIS GREASE

\* RETURN LINE FILTERS SHOULD BE REPLACED AT END OF WARRANTY PERIOD (6 MOS.)  
 A COMPLETE CHECK UP OF ENTIRE CRANE IS RECOMMENDED AT THE END OF THE 6 MOS. WARRANTY PERIOD



# SAFETY RULES

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## SAFETY RULES

THE FOLLOWING SAFETY RULES ARE LISTED FOR THE OPERATOR TO FOLLOW. OPERATING THE MACHINE SAFELY IS THE OPERATOR'S PRIMARY RESPONSIBILITY.

### 1. PREPARE YOUR EQUIPMENT

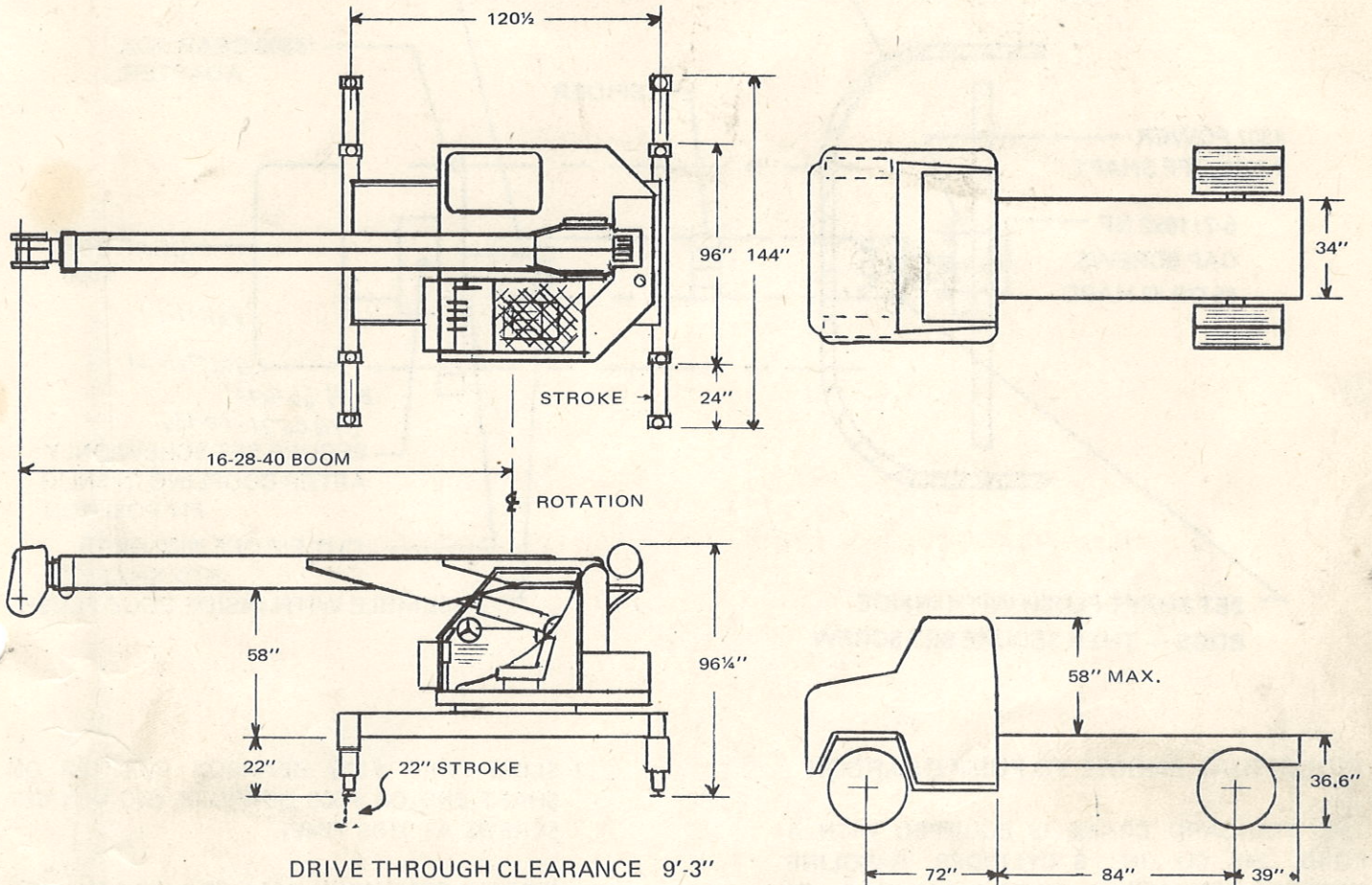
- A. FOLLOW DAILY MAINTENANCE PROCEDURES.
- B. CHECK CABLES AND CLAMPS – REPLACE ANY CUT OR WORN CABLES – TIGHTEN CLAMPS.
- C. CHECK ALL HYDRAULIC SYSTEMS.
- D. CHECK REMOTE CONTROL OPERATIONS.
- E. KEEP MACHINE CLEAN.

### 2. OPERATION

- A. KEEP BOOM AT LEAST 10 FEET AWAY FROM POWER LINES.
- B. DO NOT PUSH DOWN OR SIDEWAYS WITH BOOM. CRANE IS DESIGNED FOR VERTICAL LOADING ONLY.
- C. KNOW YOUR LOAD CHART AND CRANES ABILITIES. EXCELLENCE IN OPERATION COMES FROM CONFIDENCE IN YOUR EQUIPMENT GAINED THROUGH KNOWLEDGE OF YOUR MACHINE'S ABILITIES.
- D. USE YOUR OUTRIGGERS IN ACCORDANCE WITH LOAD CHART. SET SPRING LOCKOUTS AS A REGULAR PART OF YOUR PREPARATION FOR HOOK WORK.
- E. USE 2 PART LINE PER LOAD CHART REQUIREMENTS.
- F. KNOW YOUR CRANES HEIGHT AND WIDTH CLEARANCES.
- G. IF A DIFFERENT TRUCK IS USED OTHER THAN LISTED ON THE BROCHURE, YOU WILL NEED A NEW LOAD CHART. HAVE CRANE CERTIFIED IN ACCORDANCE WITH LOAD CHART BASED ON TRUCK MOUNTING. SEE DIMENSIONS TO CLEARANCES SECTION FOR BOOM STRUCTURAL CAPABILITIES.
- H. ON CRANES EQUIPPED WITH ROLLING OUTRIGGERS – REMEMBER WHEN TRUCK WHEELS ARE OFF THE GROUND, OR NEARLY SO, YOU HAVE NO BRAKING POWER.



# MOUNTING DIMENSIONS AND CLEARANCES



CRANE SHIPPING WEIGHT APPROXIMATELY 14,000 LBS.

USE OF A TRUCK CHASSIS EXCEEDING THESE SPECIFICATIONS USED FOR LOAD CHART TESTING MAY RESULT IN STRUCTURAL STRENGTH, NOT TIPPING, GOVERNING RATED LIFTING CAPACITIES.

#### ALLOWABLE BENDING MOMENTS:

TOP END SECTION = 603,000 in. lbs.  
 MIDDLE SECTION = 1,161,000 in. lbs.  
 BOTTOM SECTION = 1,980,000\* in. lbs.

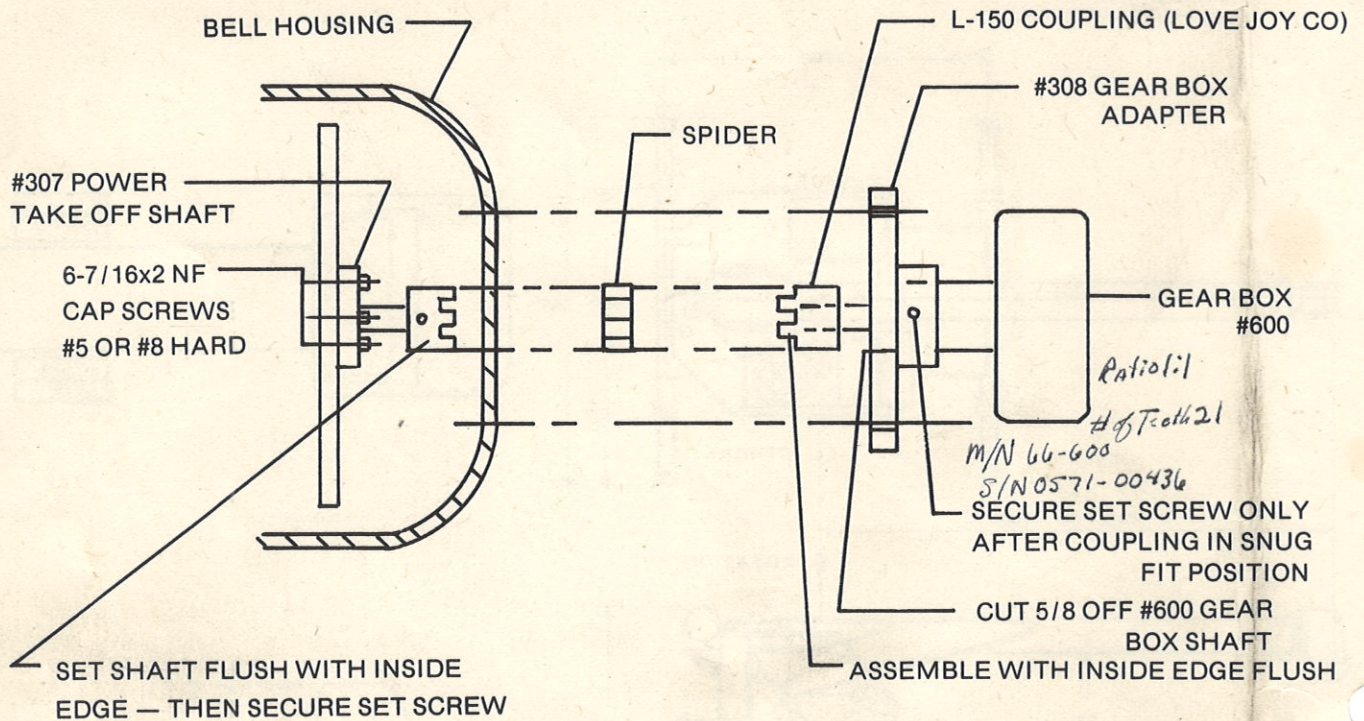
\*@ 30" TOWARD BOOM END FROM LIFT CYLINDER ATTACHMENT.

TRUCK USED FOR LOAD CHART IS A FORD F-760, SINGLE AXLE, 156" WHEELBASE, 391 CU. IN. ENGINE, HEAVY DUTY AIR BRAKES, 4-SPEED AUTOMATIC TRANSMISSION, POWER STEERING, 10:00 x 20 TIRES ON 10 HOLE WHEELS, BASE CURB WEIGHT = 6035 #, G.V.W. 27500 # - 9000# FRONT AXLE, 18,500# REAR AXLE, REINFORCED FRAME WITH 19.2 in<sup>3</sup> SECTION MODULUS.



# INDUSTRIAL ENGINE & PUMP GEAR BOX

## PUMP GEAR BOX TO INDUSTRIAL ENGINE



## INDUSTRIAL ENGINE TO PUMP GEARBOX

THE STANDARD CRANE IS EQUIPPED WITH A FORD, 240 CU. IN., 6 CYLINDER, GASOLINE POWERED INDUSTRIAL ENGINE RATED @ 104 HORSEPOWER @ 2400 R.P.M. WITH A TORQUE RATING OF 225 FT. LB. @ 2400 R.P.M. REFER TO FORD INDUSTRIAL MANUAL FOR REPAIR, MAINTENANCE AND WARRANTY.

THE PUMP GEARBOX IS #600 HUB CITY STANDARD GEARBOX. GEARBOX CONNECTS TO THE ENGINE AS FOLLOWS:

1. ATTACH PART #307 P.T.O. SHAFT TO FLY-WHEEL WITH 6 - 7/16 x 2 N.F. GRADE 5 CAP SCREWS.
2. INSTALL L-150 COUPLING HALF ON P.T.O. SHAFT. SECURE WITH SET SCREW. COUPLING SHOULD BE FLUSH FIT.

3. SLIDE PART #308 GEARBOX ADAPTER ON SHAFT END OF #600 GEARBOX. (DO NOT SET SCREWS AT THIS TIME).
4. INSTALL REMAINING HALF OF L-150 COUPLING ON #600 GEAR BOX SHAFT. SAME PROCEDURE AS NO. 2.
5. INSTALL RUBBER SPIDER ON ONE END OF COUPLING.
6. FIT GEAR BOX, 308 ADAPTER, AND COUPLING TO ENGINE BELL HOUSING AS A UNIT. TIGHTEN BOLTS TO FORD SPECS. SEE ENGINE MANUAL.
7. PUSH GEARBOX THRU #308 ADAPTER UNTIL BOTH SIDES OF COUPLING ARE SNUG AGAINST RUBBER SPIDER, TIGHTEN SET SCREWS ON #308 ADAPTER. INSTALL FLYWHEEL DUST COVER.

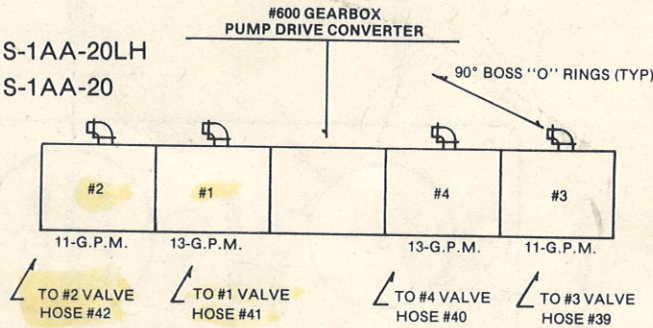


# HYDRAULIC PUMPS & CONTROL VALVES

## PUMPS

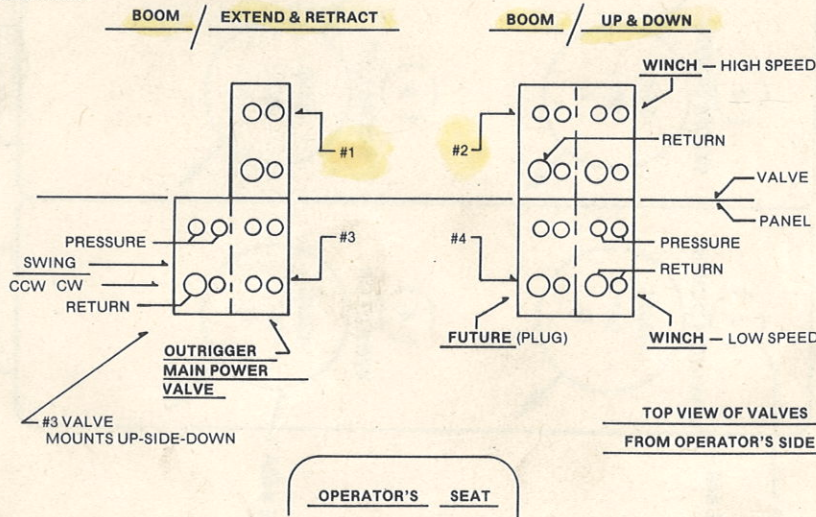
1-V2020-IF-13S-11S-1AA-20LH

1-V2020-IF-13S-11S-1AA-20



*spools in valves can also use U Cup seals Pt.# 885-21 from Hercules Hyd*

## CONTROL VALVES



*Townier Meyer 272-1356 #4 Kit for valves 8017-001 8-119 for spools 7001 A 1 1/8 x 2 1/8 x 1/8 O-ring*

## CONTROL VALVES

1. BOOM EXTENSION - GRESEN 25P-TT-4.
2. WINCH HIGH SPEED OR BOOM LIFT - GRESEN 25P-TT-4-4.
3. SWING OR MASTER OUTRIGGER CONTROL - GRESEN 25P-TT-4-4.
4. WINCH LOW SPEED OR FUTURE USE - GRESEN 25P-TT-4-4.

VALVES 1 THRU 4 ARE 3 POSITION - SPRING - CENTERED - 4 WAY - DIRECTIONAL CONTROL VALVES.

VALVES SET AT 2250 PSI @ 1800 ENGINE R.P.M. EXCEPT MASTER OUTRIGGER CONTROL VALVE SET AT 1500 PSI. CUSHION VALVE LIMITS SWING PRESSURE AT 1000 PSI.

VALVES RATED @ 2500 PSI AND 35 G.P.M. SPOOLS CUSTOM METERED BY ECKMAN MFG. CHECK WITH MFG. BEFORE SUBSTITUTING.

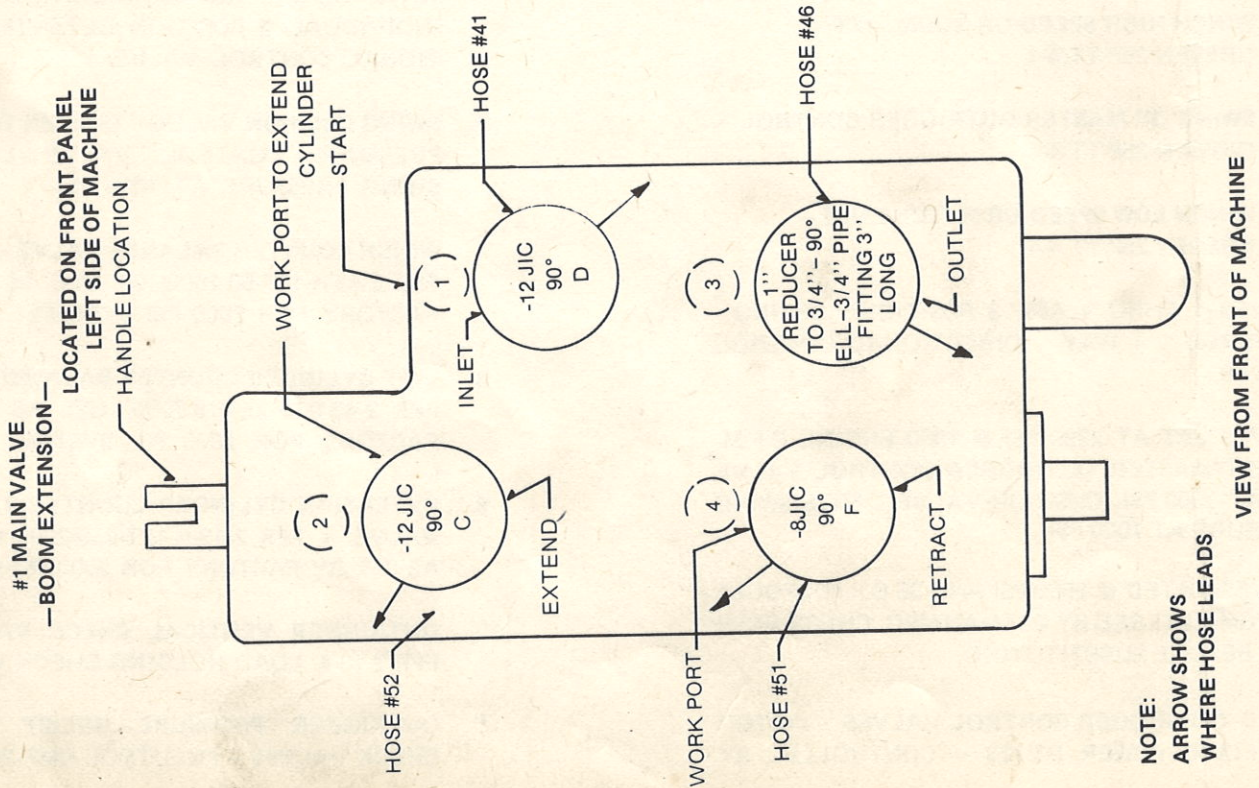
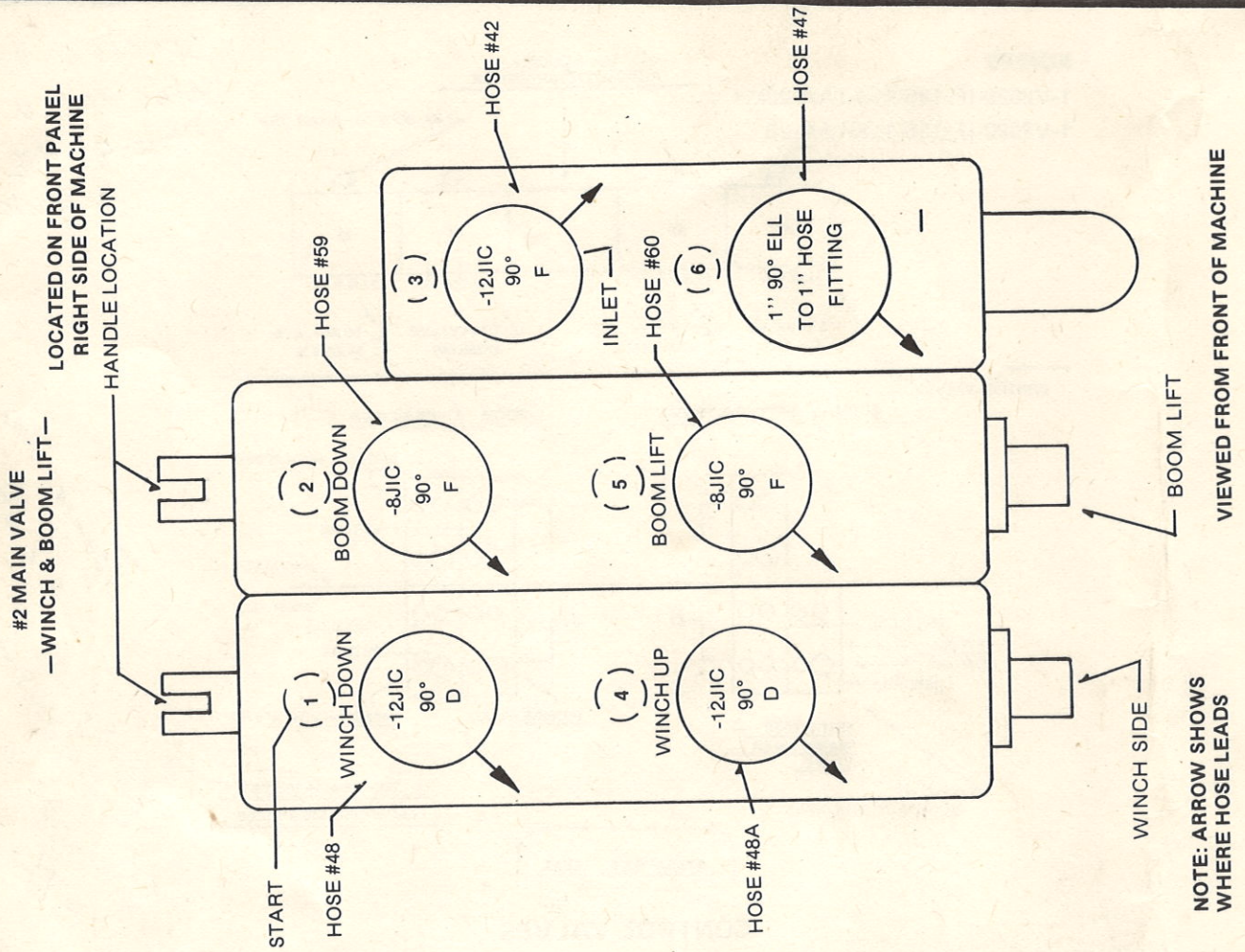
5. 6-OUTRIGGER CONTROL VALVES - VICTOR FLUID POWER DV123 - CONTROLLED BY

MASTER CONTROL VALVE IN CONJUNCTION WITH BLACK KNOBS OPERATING, EACH INDIVIDUAL 3 POSITION DETENTE DIRECTIONAL CONTROL VALVE.

6. SWING CUSHION VALVE - GRESEN DLV-50-D. PRESSURE CONTROL VALVE LIMITING SWING PRESSURE AT 1000 PSI.
7. WINCH COUNTER BALANCE VALVE - FPS 2-43-A-16T-50-1500-100. USE AS SET BY FACTORY FOR 2000 PSI SYSTEM.
8. LIFT CYLINDER COUNTER BALANCE VALVE FPS 2-43-C-6P-25-075-2000. USE AS SET BY FACTORY FOR 2000 PSI SYSTEM.
9. EXTENSION CYLINDER COUNTER BALANCE VALVE - FPS 2-43-A-12T-050-2000-100. USE AS SET BY FACTORY FOR 2000 PSI SYSTEM.
10. OUTRIGGER VERTICAL CHECK VALVES - FPS 2-10-4. LOAD HOLDING CHECK VALVES.
11. OUTRIGGER PRESSURE RELIEF SYSTEM CHECK VALVES - PNEUTROL GMF-20-B.

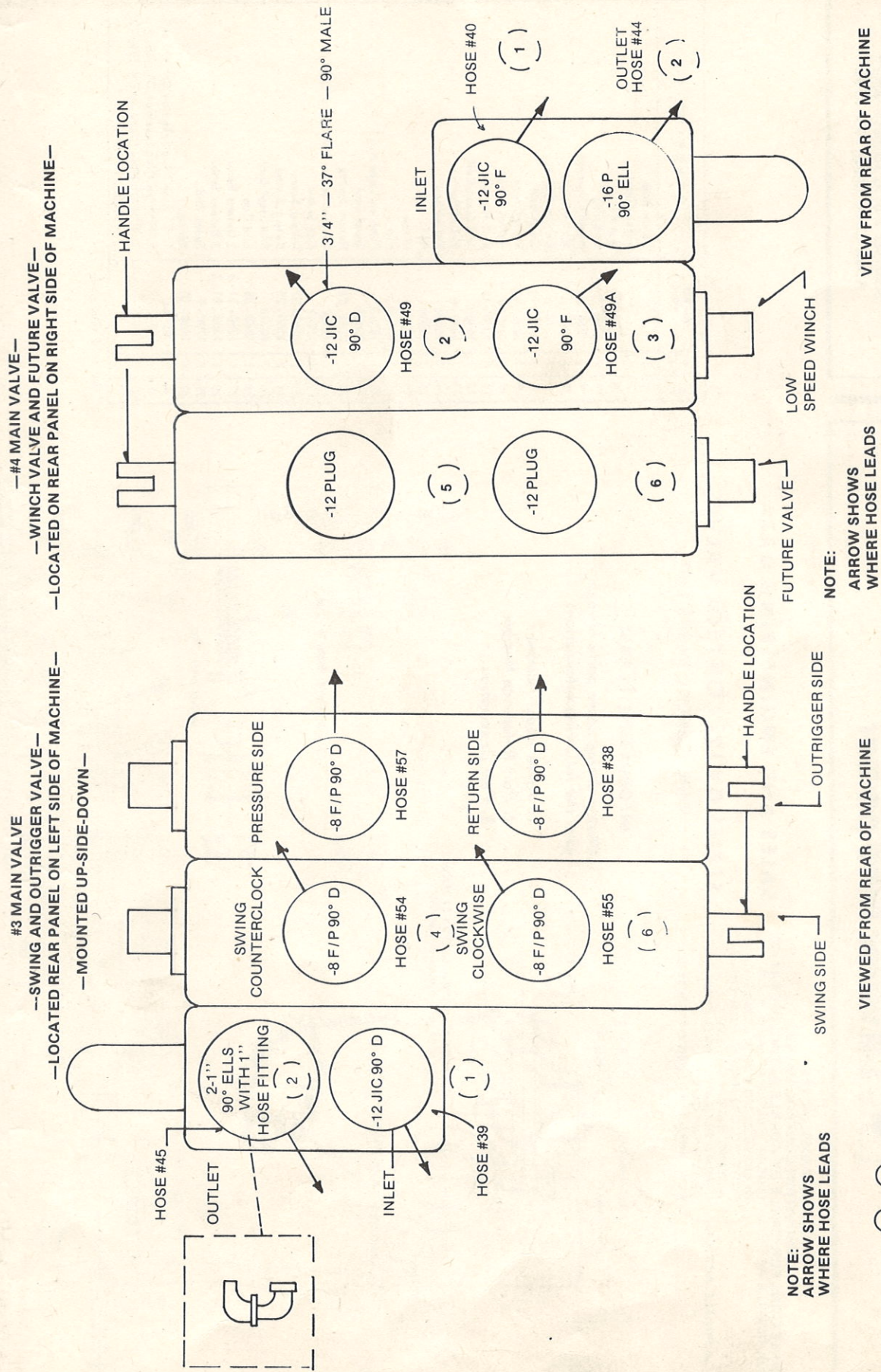


# HYDRAULIC PUMPS & CONTROL VALVES





# HYDRAULIC PUMPS & CONTROL VALVES



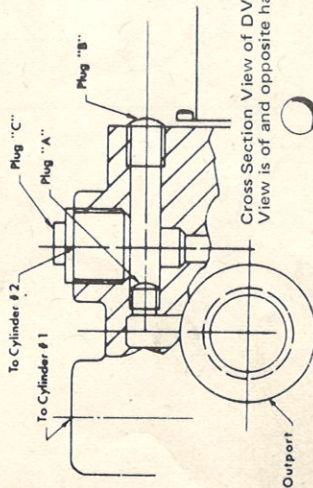


**OUTRIGGER CONTROL VALVES**  
**victor fluid power**

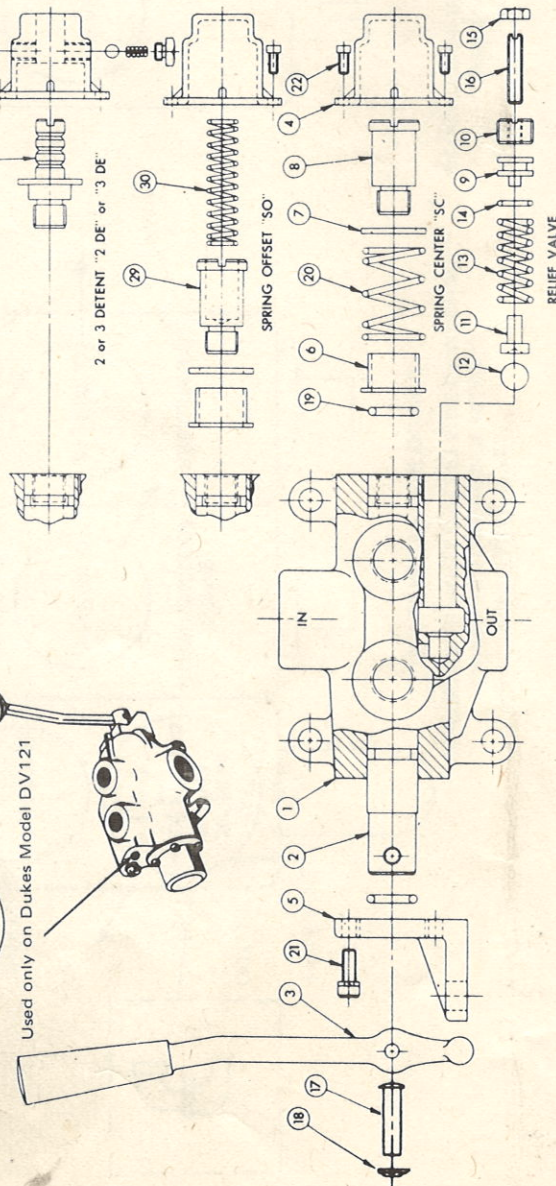
3999 North 25th Avenue  
 Schiller Park, Illinois 60176  
 Area Code (312) 678-5795

**DUKES MODEL DV 121**

**COMBINATION CONTROL VALVE**  
**DIRECTIONS FOR SINGLE OR DOUBLE ACTING OPERATION**  
 FOR DOUBLE ACTION: INSERT PLUG "A", AND PLUG "B", REMOVE PLUG "C", & CONNECT "C" PORT TO CYLINDER. FOR DOUBLE ACTING INSTALLATION, FOR DOUBLE ACTION, INSERT PLUG "B" AND PLUG "C", LEAVE "A" OUT. FOR SINGLE ACTING CYLINDER.



Used only on Dukes Model DV121



**SALES AND ENGINEERING DATA**  
**SERIES DV 12 - CONTROL VALVES**  
 REPLACEMENT PARTS LIST

**INFORMATION PLEASE!**

When ordering spare parts always give the following information:

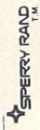
1. Valve Model Number
2. Part Reference Number
3. Part Description

REF.	QTY.	PART NO.	DESCRIPTION
1	1	*	Valve Body
2	1	*	Valve Spool
3	1	1260-3	Handle
4	1	1280-5	End Cap
5	1	1250-3	Handle Bracket
6	1	1200-3	Spacer
7	1	1250-6	Return Washer
8	1	1250-11	Spool End
9	1	1250-10	Relief Spool
10	1	1250-7	Relief Plug
11	1	1260-15	Ball Retainer
12	1	10188	1/2 Steel Ball
13	1	1250-8	Relief Spring
14	1	25008	Relief Seal
15	1	10050	Nut
16	1	10261	Screw
17	1	10512	Pin
18	1	10503	Push on Lock Nut
19	2	25015	Spool Seal
20	1	1250-12	Return Spring
21	2	10467	Special Screw 1/4 - 20 x 5/8
22	4	10137	Cap Screw
23	2	1260-32	Detent Screw
24	2	1260-25	Detent Spring
25	2	10236	1/4 Steel Ball
26	1	1260-30	End Cap
27	1	1260-31-2	2 Detent Spool
28	1	1260-31-3	3 Detent Spool
29	1	1700-9	Spool End
30	1	1700-10	Spring
A	1	10036	1/8" Pipe Plug (used on DV 121 only)
B	1	10037	1/4" Pipe Plug (used on DV 121 only)
C	1	10029	1/2" Pipe Plug (used on DV 121, 127, 128, 129 only)

\* Not sold separately



# HYDRAULIC PUMPS & CONTROL VALVES



## VICKERS® HIGH PERFORMANCE DOUBLE PUMPS

SERIES V2020

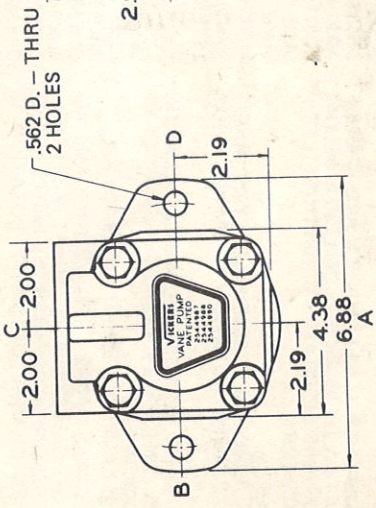
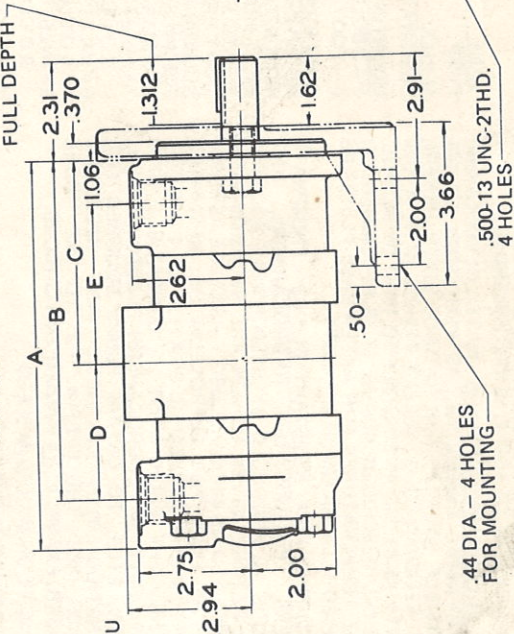
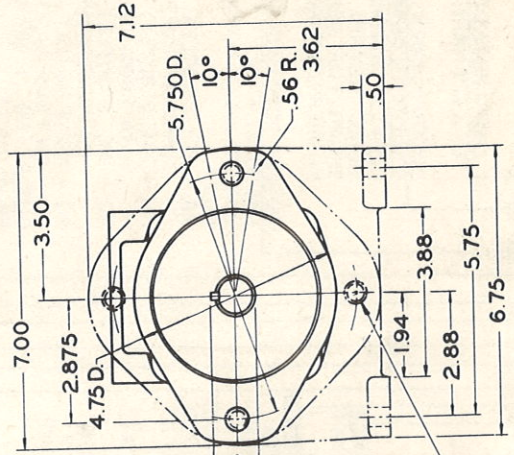
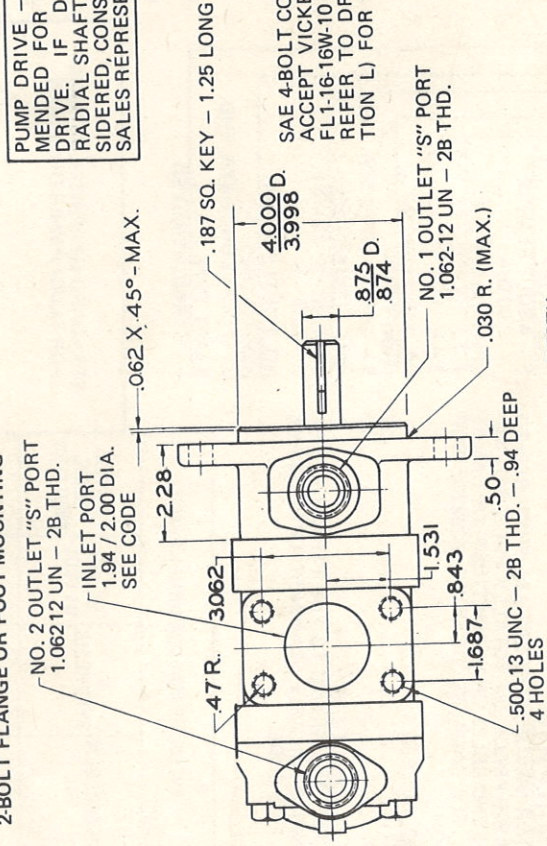
FIXED DISPLACEMENT - VANE TYPE  
FOR USE WITH OIL OR FIRE RESISTANT FLUIDS  
2-BOLT FLANGE OR FOOT MOUNTING

**AIR BLEED**  
AT TIME OF FIRST STARTING, IF THE PUMP DOES NOT IMMEDIATELY PRIME, AIR SHOULD BE BLED FROM PUMP DELIVERY LINE. THIS MAY BE ACCOMPLISHED BY LOOSENING A CONNECTION IN THE DELIVERY LINE CLOSE TO THE PUMP UNTIL OIL FLOWS, INDICATING PUMP HAS PRIMED. AN AIRBLEED VALVE IS AVAILABLE FOR THIS PURPOSE. SEE DRAWING 521601.

RATED DELIVERY GPM @ 1200 RPM & 100 PSI	DIMENSION				
	A	B	C	D	E
7, 8 or 9	8.41	7.39	4.49	2.90	3.43
7, 8 or 9	8.66	7.64	4.49	3.15	3.43
11	8.61	7.59	4.69	2.90	3.63
11	8.86	7.84	4.69	3.15	3.63
11	9.05	8.03	4.69	3.35	3.63
12 or 13	8.75	7.73	4.82	2.90	3.76
12 or 13	8.99	7.97	4.82	3.15	3.76
12 or 13	9.19	8.17	4.82	3.35	3.76

PUMP DRIVE - PUMP IS RECOMMENDED FOR DIRECT COAXIAL DRIVE. IF DRIVES IMPOSING RADIAL SHAFT LOADS ARE CONSIDERED, CONSULT THE VICKERS SALES REPRESENTATIVE.

SAE 4-BOLT CONNECTION PADS WILL ACCEPT VICKERS FL-16-16R-10 AND FL-1-16-16W-10 SAE 4-BOLT FLANGES. REFER TO DRAWING I-250700 (SECTION L) FOR SELECTION.



NOTE: PUMP MAY BE ASSEMBLED ON FOOT MOUNTING IN ANY ONE OF FOUR POSITIONS.



# HYDRAULIC PUMPS & CONTROL VALVES

**CONSTRUCTION**  
SERIES V2020 PUMPS ARE OF VICKERS "BALANCED VANE TYPE" CONSTRUCTION.

**FILTRATION**  
FOR MAXIMUM OVER-ALL EFFICIENCY AND SERVICE LIFE, FILTRATION OF 25 MICRON OR LESS IS RECOMMENDED. FOR FIRE RESISTANT FLUIDS THIS FILTRATION IS MANDATORY.

**SHAFT ROTATION**  
PUMPS ARE NORMALLY ASSEMBLED FOR RIGHT HAND OR CLOCKWISE ROTATION AS VIEWED FROM THE SHAFT END.

IF LEFT HAND OR COUNTERCLOCKWISE ROTATION IS REQUIRED, SPECIFY BY ADDING SUFFIX "L" TO THE MODEL NUMBER.  
EXAMPLE: V-2020-1F13S11S-1CC-20-L

INLET AND OUTLET PORTS REMAIN THE SAME REGARDLESS OF DIRECTION OF SHAFT ROTATION. CHANGE OF ASSEMBLY OF INTERNAL PARTS IS NECESSARY WHEN CHANGE OF SHAFT ROTATION IS REQUIRED.

**INPUT DRIVE SPEED**  
MINIMUM RECOMMENDED DRIVE SPEED... 600 RPM  
MAXIMUM SPEED RATINGS ARE TABULATED IN CHART BELOW FOR THREE TYPES OF FLUID. THESE ARE INFLUENCED BY SPECIFIC GRAVITY, VISCOSITY AND SUCTION HEAD. PUMP SUCTION AND SPEED SHOULD BE RELATED SO THAT VACUUM AT PUMP INLET DOES NOT EXCEED 5" OF MERCURY FOR PETROLEUM OIL AND WATER GLYCOL, AND 3" FOR SYNTHETIC FIRE RESISTANT FLUIDS AND WATER-IN-OIL EMULSIONS. MAXIMUM INLET PRESSURE 5 PSI ALL FLUIDS.

**FLUIDS**  
PETROLEUM OILS - USE ANTIWEAR TYPE HYDRAULIC OILS OR SAE 10W OILS MEETING A.P.I. SERVICE CLASSIFICATION "MS". (SEE "OIL RECOMMENDATION SHEET 286-S" FOR DETAILS.) VISCOSITY OF OIL AT

100° F. SHOULD BE 150-225 SUS. MAXIMUM OIL TEMPERATURE OF 150° F. IS RECOMMENDED.

WATER CONTAINING FLUIDS - WATER GLYCOLS AND WATER-IN-OIL EMULSIONS, AS PRODUCED BY RESPONSIBLE SOURCES FOR RATINGS GIVEN HEREIN, ARE RECOMMENDED. SELECT FLUIDS WITH A VISCOSITY AS CLOSE AS POSSIBLE TO THAT OF PETROLEUM OIL DESCRIBED ABOVE. IT IS RECOMMENDED THAT TEMPERATURES FOR WATER BASE FLUIDS BE LIMITED TO A MAXIMUM OF 130° F.

SYNTHETIC FIRE RESISTANT FLUIDS - PHOSPHATE ESTERS, CHLORINATED HYDROCARBONS, AND BLENDS AS PRODUCED BY RESPONSIBLE SOURCES FOR RATINGS GIVEN HEREIN ARE RECOMMENDED. SELECT FLUIDS WITH VISCOSITY AS CLOSE AS POSSIBLE TO THAT FOR PETROLEUM OIL DESCRIBED ABOVE. MAXIMUM SPECIFIC GRAVITY OF 1.3 IS SUGGESTED. THE FLUID MUST BE COMPATIBLE WITH PUMP SEALS OF FLUOROCARBON ELASTOMERS (i.e., VITON, ETC.). TO OBTAIN PUMPS EQUIPPED FOR OPERATION WITH SYNTHETIC FIRE RESISTANT FLUIDS, ADD THE PREFIX "F3" TO THE MODEL NUMBER. EXAMPLE: F3-V2020-1F13S11S-1CC-20

SEE NOTE ON MAXIMUM SPEED.

ELECTRIC MOTOR PUMPS

MANY MOTOR MANUFACTURERS ARE PREPARED TO FURNISH DRIP PROOF OR TOTALLY ENCLOSED MOTORS WITH END BELLS ON WHICH THIS PUMP CAN BE MOUNTED. SEE VICKERS DRAWING I-258202 FOR DESCRIPTION.

WEIGHT LBS. (APPROX.)

FLANGE MTG. .... 35

FOOT MTG. .... 40

ORDERING INSTRUCTIONS

SELECT PUMPS ACCORDING TO THE TYPICAL MODEL CODE SHOWN. AVAILABLE STANDARD OPTIONS ARE LISTED IN THIS CODE.

V 2020 - 2 3 F 13 S 11 S - 1 CC - 20 - L

VANE  
PUMP  
SERIES  
DESIGNATION  
MOUNTING  
1 - 2-BOLT FLANGE  
2 - FOOT BRACKET  
FOOT BRACKET

MOUNTING POSITION  
WITH RESPECT TO  
INLET PORT WHEN  
VIEWED FROM  
SHAFT END, NO CODE  
NUMBER REQUIRED  
FOR INLET PORT AT  
12 O'CLOCK  
3 = INLET PORT AT  
30° CLOCK  
6 = INLET PORT AT  
60° CLOCK  
9 = INLET PORT AT  
90° CLOCK

INLET PORT  
F - 4-BOLT FLANGE  
2.00 DIA.  
GPM - SHAFT END  
7 - 7 9 - 9 12 - 12  
8 - 8 11 - 11 13 - 13

NO. 1 OUTLET PORT  
(SHAFT END)  
S - 1.062-12 UN-2B STR. THD.  
GPM - COVER END  
6 - 6 8 - 8 11 - 11  
7 - 7 9 - 9

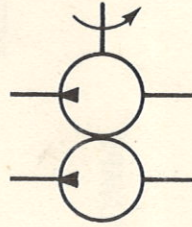
NO. 2 OUTLET PORT  
(COVER END)  
S - 1.062-12 UN-2B STR. THD.  
SHAFT TYPE  
1 - STRAIGHT KEYED

SHAFT ROTATION  
L - LEFT HAND

DESIGN NUMBER  
SUBJECT TO CHANGE  
INSTALLATION DIMEN-  
SIONS REMAIN AS  
SHOWN FOR DESIGN  
NUMBERS 20 THRU 29.

OUTLET POSITIONS (FAC-  
ING COVER END)  
OUTLET NO. 1 OPPOSITE  
INLET  
AA = NO. 2 OUTLET  
OPPOSITE INLET  
AB = NO. 2 OUTLET 90°  
CCW FROM INLET  
AC = NO. 2 OUTLET  
INLINE WITH INLET  
AD = NO. 2 OUTLET 90°  
CW FROM INLET  
OUTLET NO. 1 90° CCW  
FROM INLET  
BA = NO. 2 OUTLET  
OPPOSITE INLET  
BB = NO. 2 OUTLET 90°  
CCW FROM INLET  
BC = NO. 2 OUTLET  
INLINE WITH INLET  
BD = NO. 2 OUTLET 90°  
CW FROM INLET  
OUTLET NO. 1 INLINE WITH  
INLET  
CA = NO. 2 OUTLET  
OPPOSITE INLET  
CB = NO. 2 OUTLET 90°  
CCW FROM INLET  
CC = NO. 2 OUTLET  
INLINE WITH INLET  
CD = NO. 2 OUTLET 90°  
CW FROM INLET  
OUTLET NO. 1 90° CW  
FROM INLET  
DA = NO. 2 OUTLET  
OPPOSITE INLET  
DB = NO. 2 OUTLET 90°  
CCW FROM INLET  
DC = NO. 2 OUTLET  
INLINE WITH INLET  
DD = NO. 2 OUTLET 90°  
CW FROM INLET

STANDARD GRAPHICAL SYMBOL  
FOR FLUID POWER DIAGRAMS



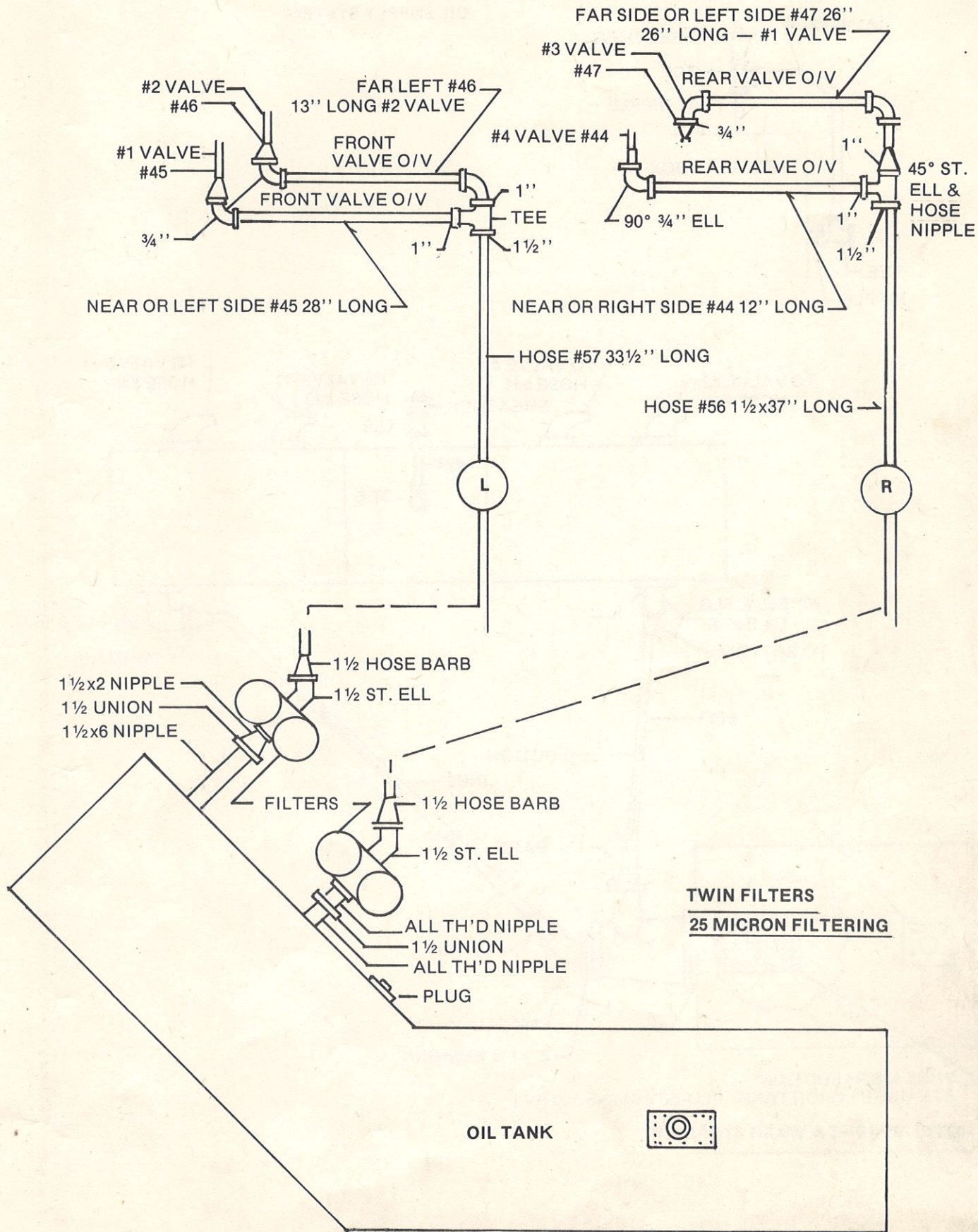
RING SIZES	TYPICAL OPERATING CHARACTERISTICS AT 1200 RPM. DATA BASED ON PERFORMANCE AT OIL TEMPERATURE OF 120° F. VISCOSITY 150 SSU AT 100° F.						MAXIMUM SPEED (RPM) WHEN USED WITH FLUID TYPES				PRESSURE (PSI) CONTINUOUS DUTY					
	1000 PSI		2000 PSI		PETROLEUM OIL, WATER-GLYCOL AND WATER-IN-OIL EMULSION	SYNTHETIC FLUID	SYNTHETIC FLUID	PETROLEUM OIL	SYNTHETIC	WATER GLYCOL	WATER-IN-OIL EMULSION	1800	2000	2250	1800	1575
	INPUT GPM	INPUT HP	INPUT GPM	INPUT HP												
6	6.0	1.25	5.6	4.2	5.2	8.4	1800	1800	2250	2000	1800	1800	2000	2250	1800	1575
7	7.0	1.25	6.5	5.0	6.2	9.2	1800	1800	2250	2000	1800	1800	2000	2250	1800	1575
8	8.2	1.25	7.6	5.6	7.2	10.9	1800	1800	2250	2000	1800	1800	2000	2250	1800	1575
9	9.2	1.30	8.6	6.2	8.2	12.1	1500	1500	2250	2000	1800	1800	2000	2250	1800	1575
11	11.5	1.30	11.0	7.6	10.5	14.6	1500	1500	2000	1800	1575	1575	2000	2000	1575	1350
12	12.0	1.30	11.4	8.2	10.8	15.6	1500	1500	2000	1800	1575	1575	2000	2000	1575	1350
13	13.5	1.30	13.0	8.8	12.5	16.7	1500	1500	2000	1800	1575	1575	2000	2000	1575	1350

SEE CHART ON FRONT PAGE FOR SHAFT AND COVER END COMBINATIONS, NUMBER 6 RING NOT USED IN SHAFT END, NUMBER 12 AND 13 NOT USED IN COVER END.



# OIL SUPPLY, RETURN & FILTERING

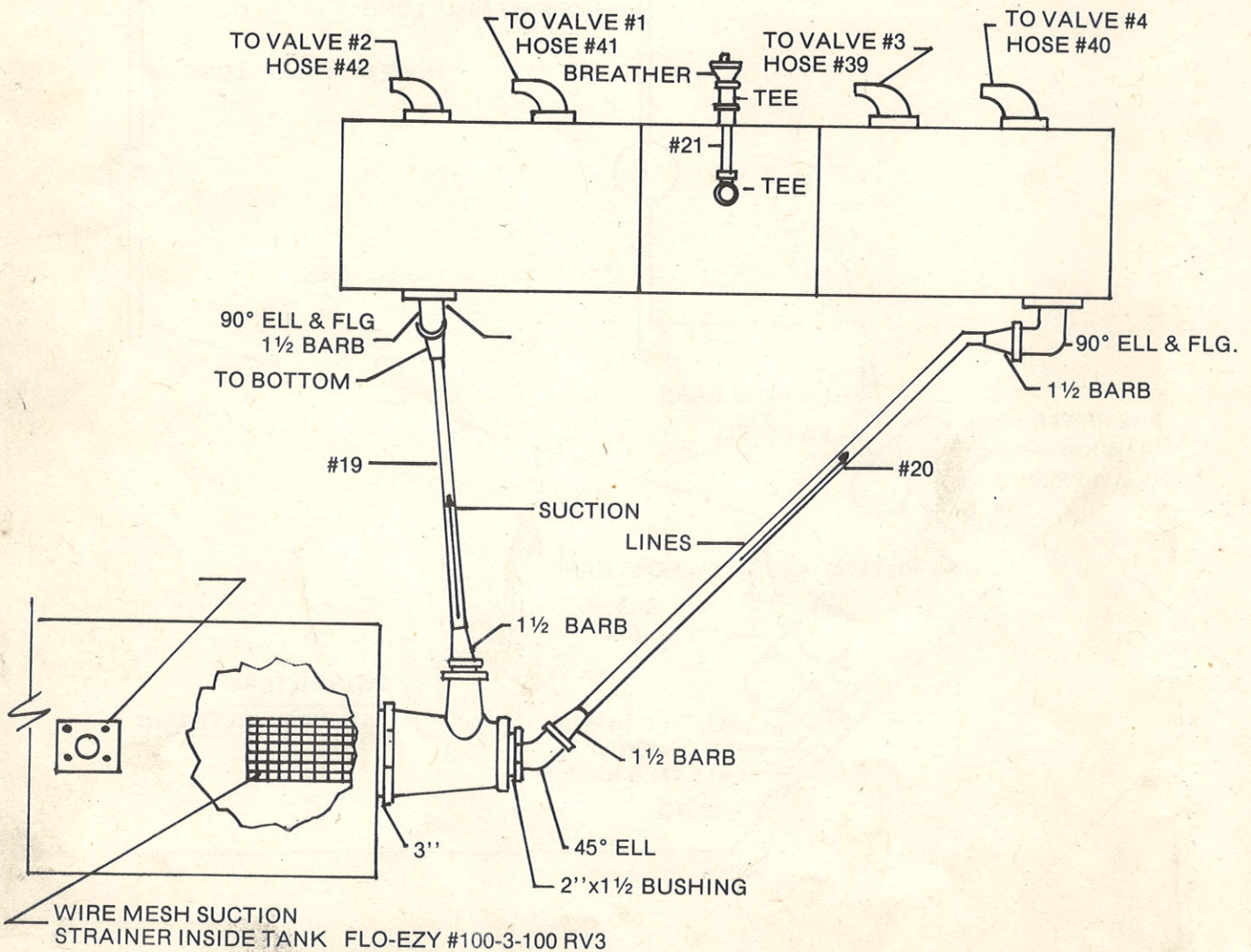
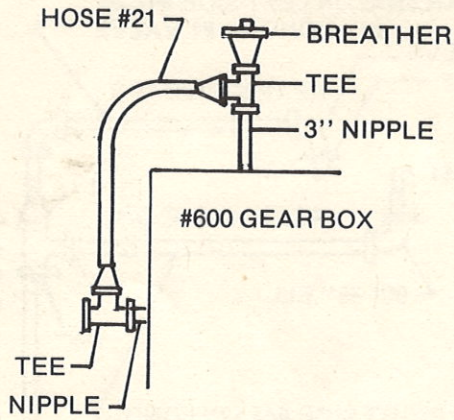
## OIL RETURN & FILTERING SYSTEM





# OIL SUPPLY, RETURN & FILTERING

OIL SUPPLY SYSTEM



**NOTE: REMOVE & WASH STRAINER**

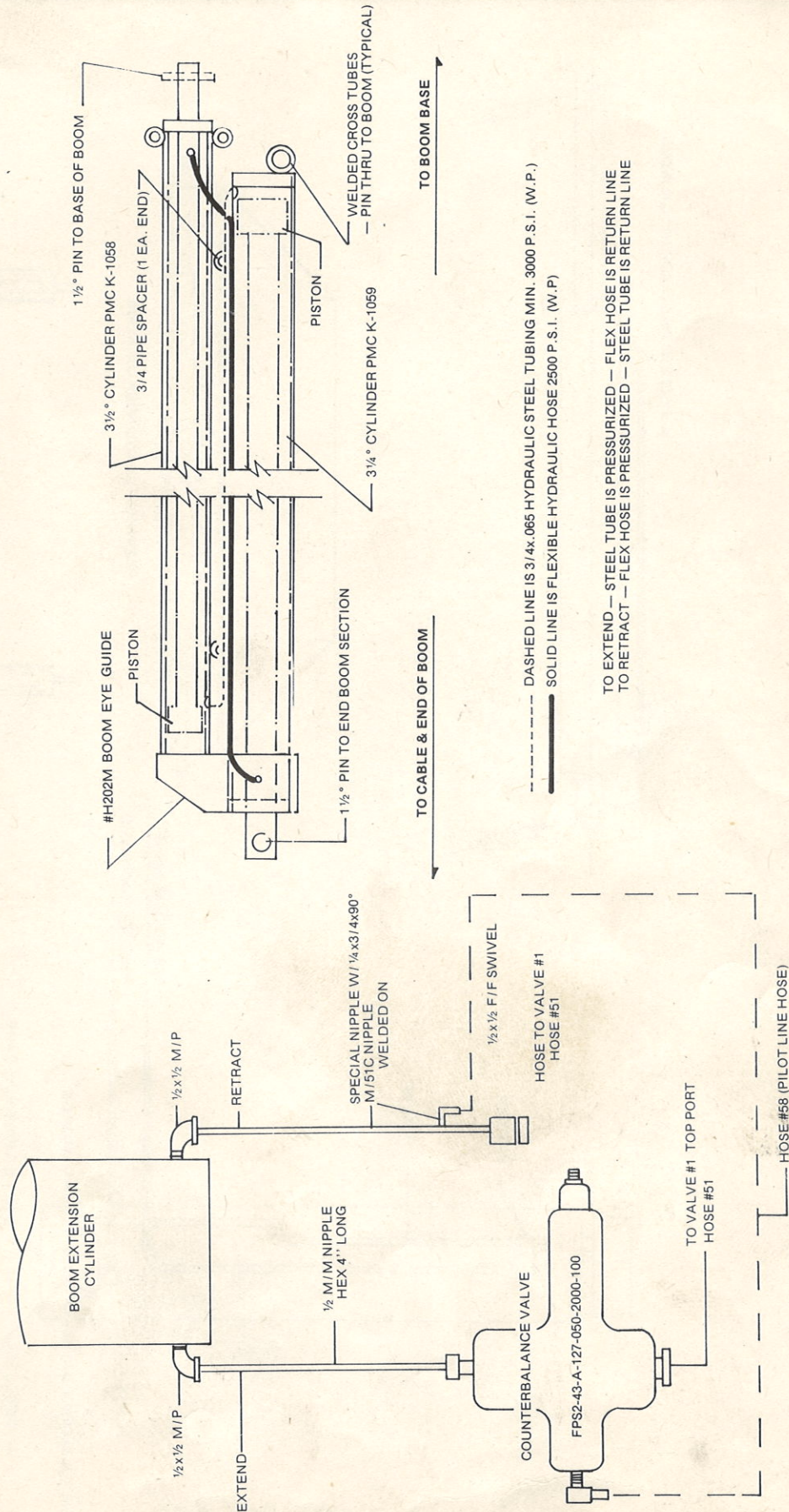


# CYLINDERS

OR's 2-439 N674-7  
 Backup 8-439 N300-9  
 Gland 2500-4500-325 U25 7,50-37B  
 Ring seal 959-31

BOOM EXTENSION CYLINDERS PMC-1058 & 1059  
 PRINCE MFG. CO. 2500 PSI RATED

BOOM EXTENSION & RETRACTION HOSES & C.B. CONNECTION

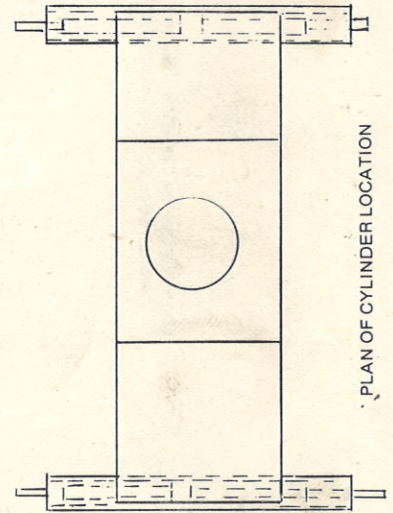
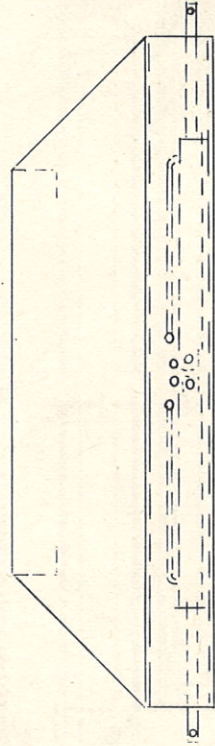
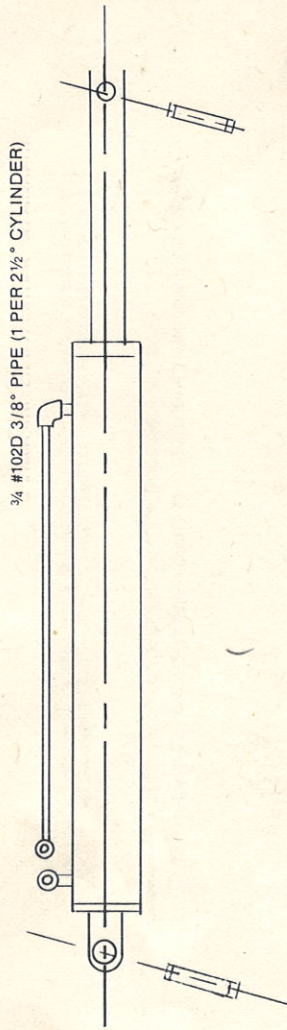
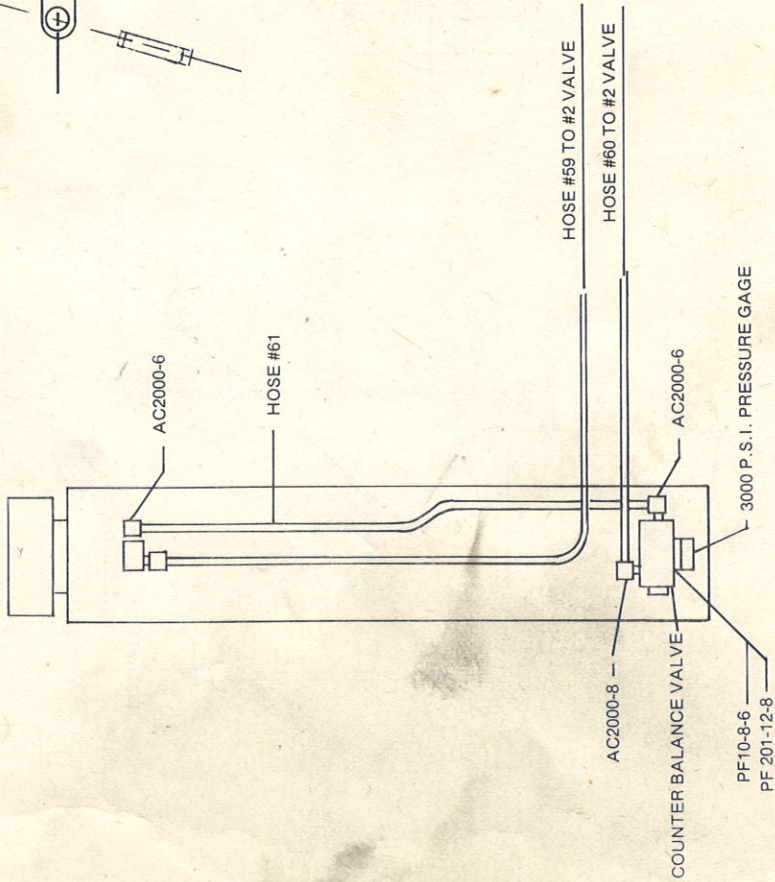




# CYLINDERS

7"  $\phi$  BOOM LIFT CYLINDER — PMC J-1062  
PRINCE MFG. CO. 2500 PSI RATED

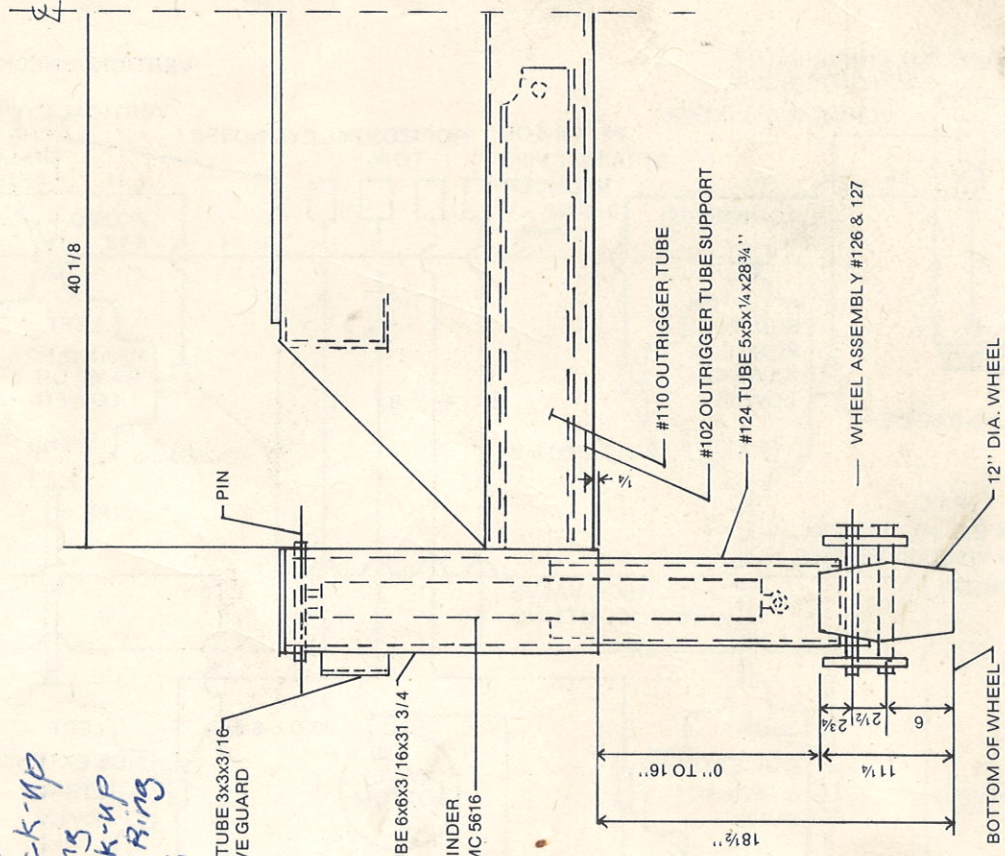
2 1/2"  $\phi$  OUTRIGGER EXTENSION CYLINDER PMC 5400  
PRINCE MFG. CO. 2500 PSI RATED





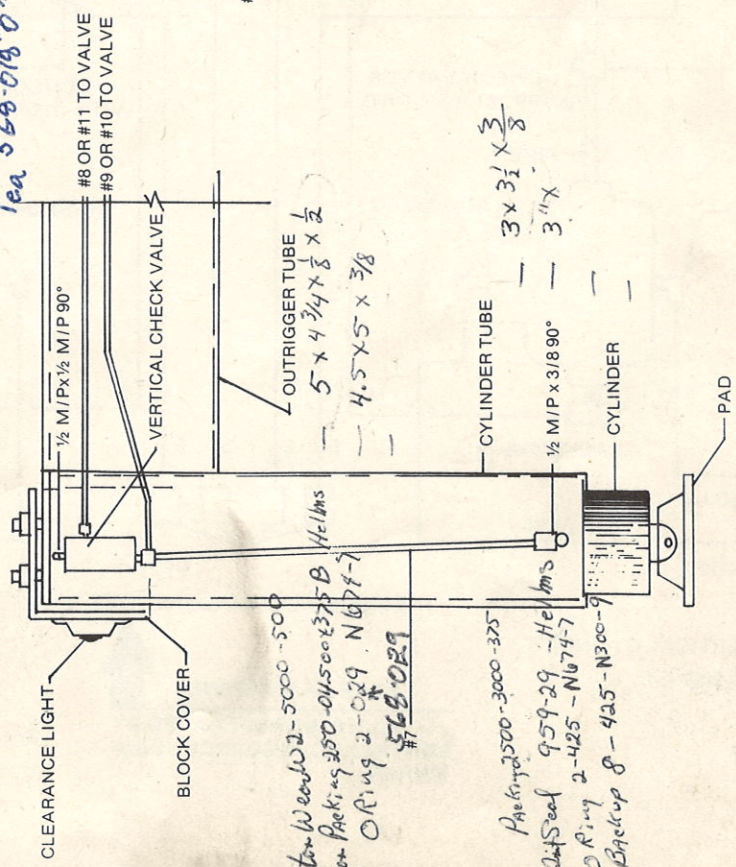
# CYLINDERS

REAR ROLLING OUTRIGGER CYLINDER PMC5616  
PRINCE MFG. CO. 2500 PSI RATED



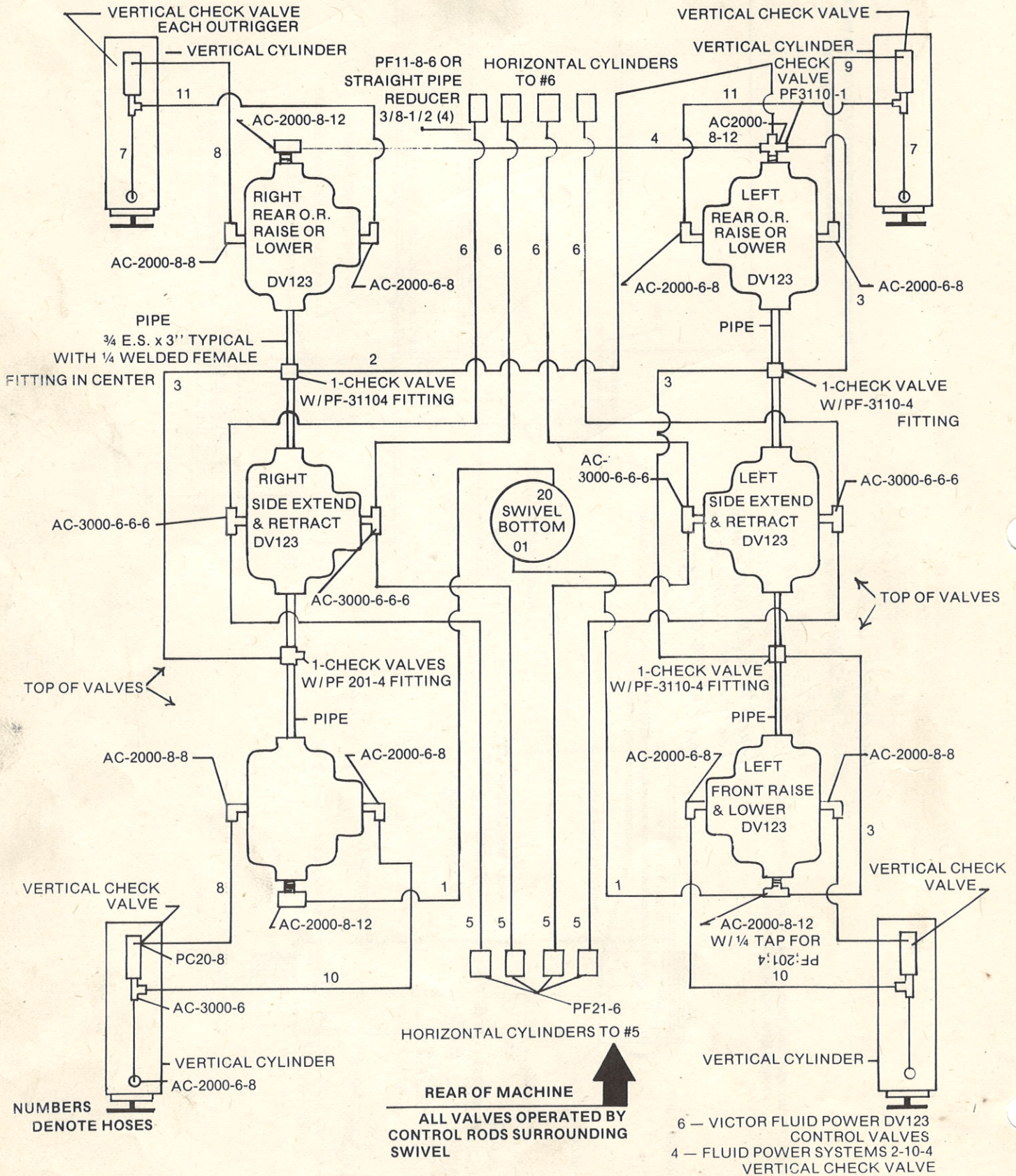
*Horiz O/R Cyl*  
*1 ea AN-15 Wiper*  
*2 ea 568-330 O Ring*  
*3 ea 575-330 Back-up*  
*1 ea 568-220 O Ring*  
*1 ea 575-220 Back-up*  
*1 ea 2500 Piston Ring*  
*1 ea 560-018 O Ring*

TYPICAL FRONT OUTRIGGER CYLINDER — P.M.C. K-589  
PRINCE MFG. CO. 2500 PSI RATED





# OUTRIGGER HYDRAULIC SYSTEM





# SWIVEL & O-RING REPLACEMENT

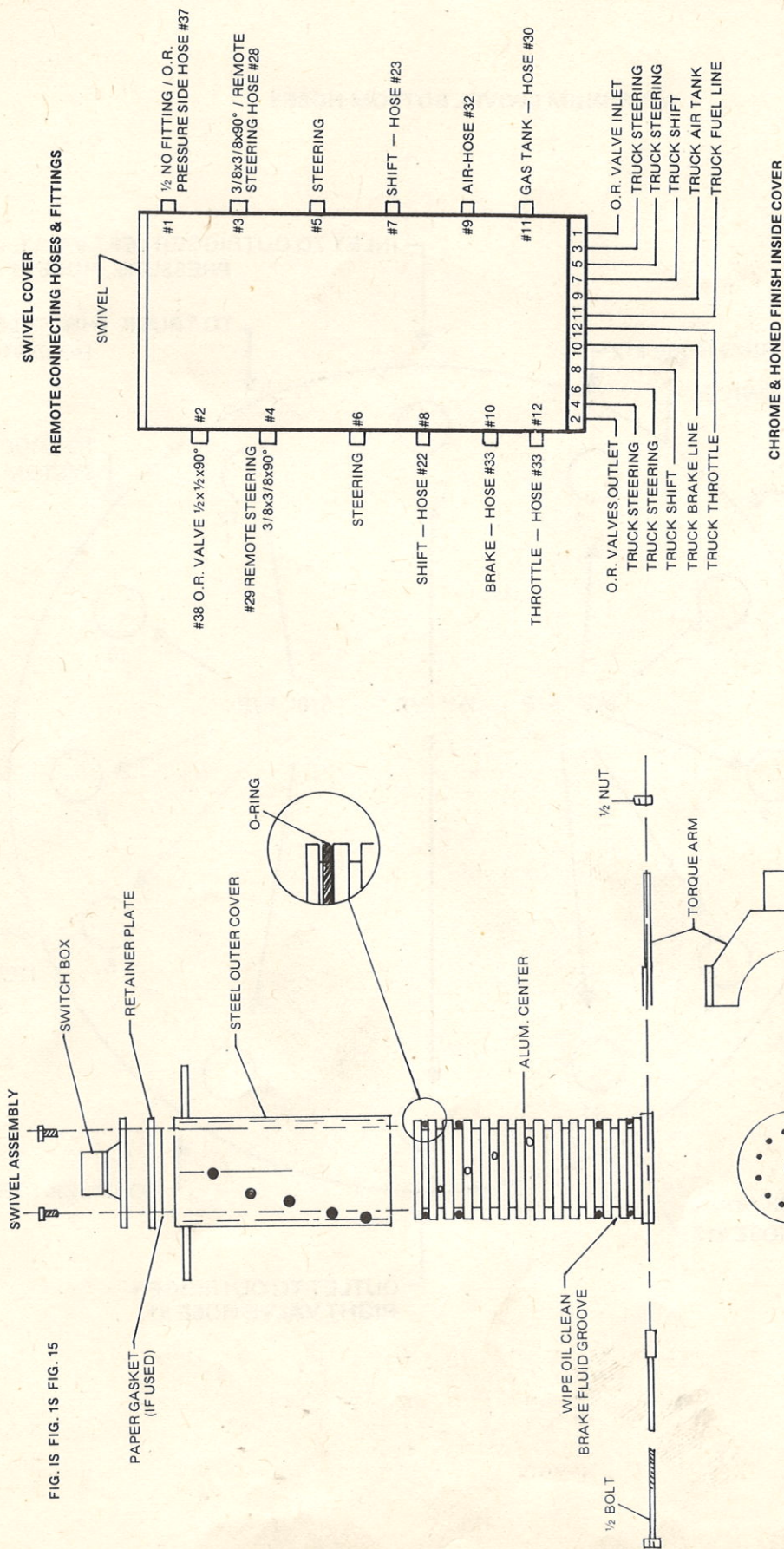
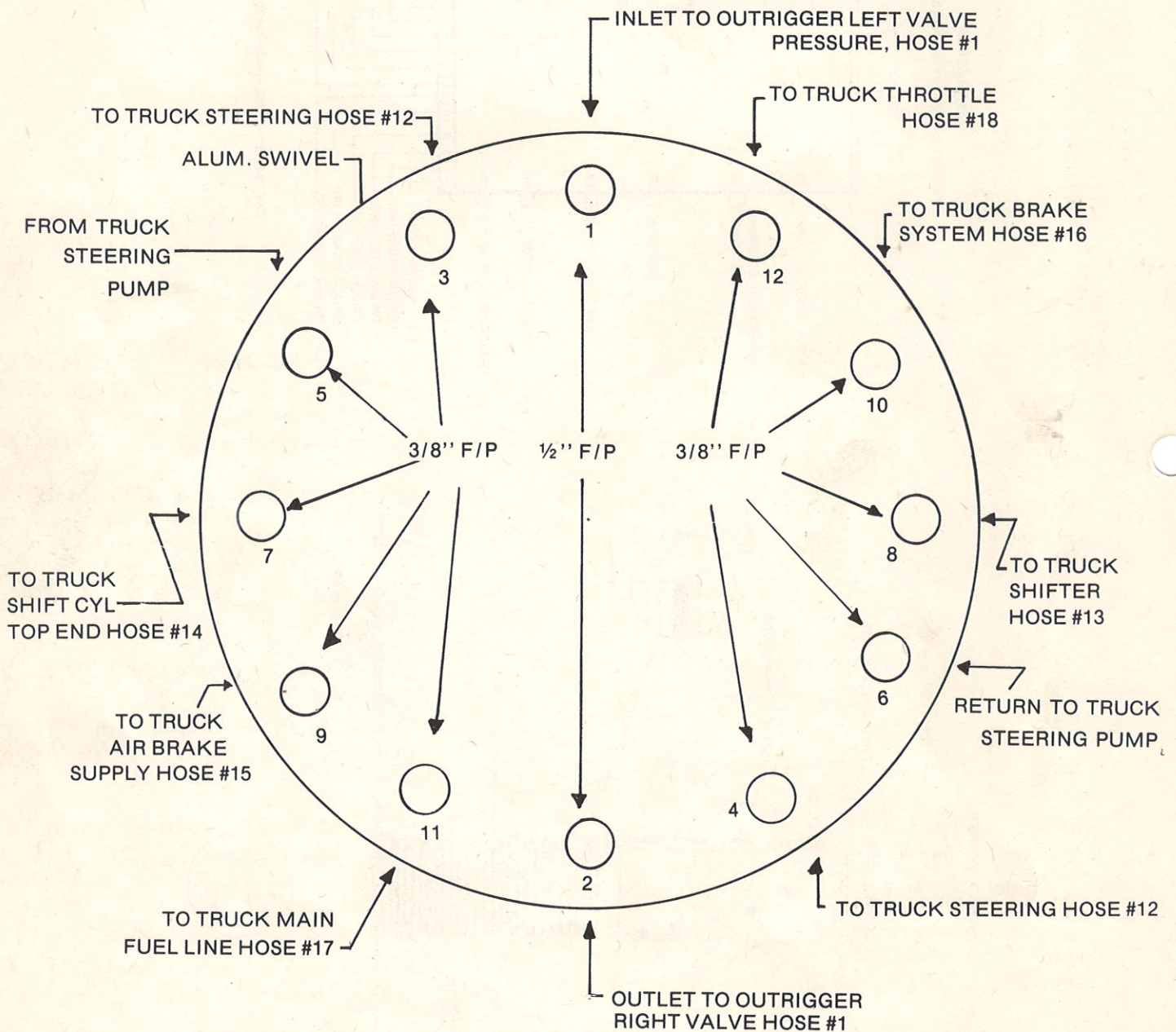


FIG. 15 FIG. 15 FIG. 15



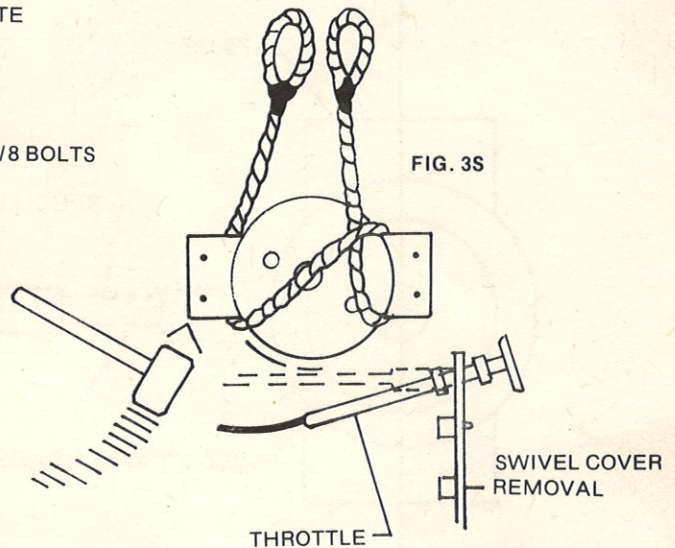
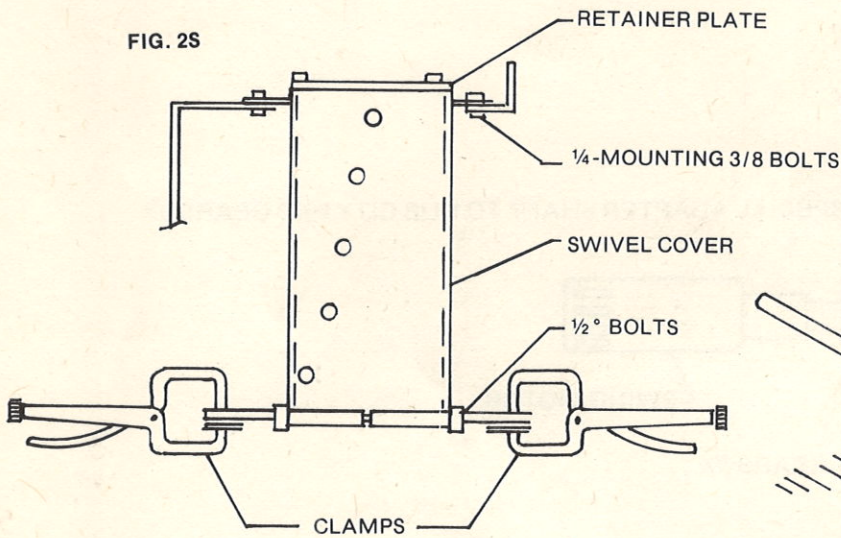
# SWIVEL & O-RING REPLACEMENT

## ALUMINUM SWIVEL BOTTOM HOSES





# SWIVEL & O'RING REPLACEMENT



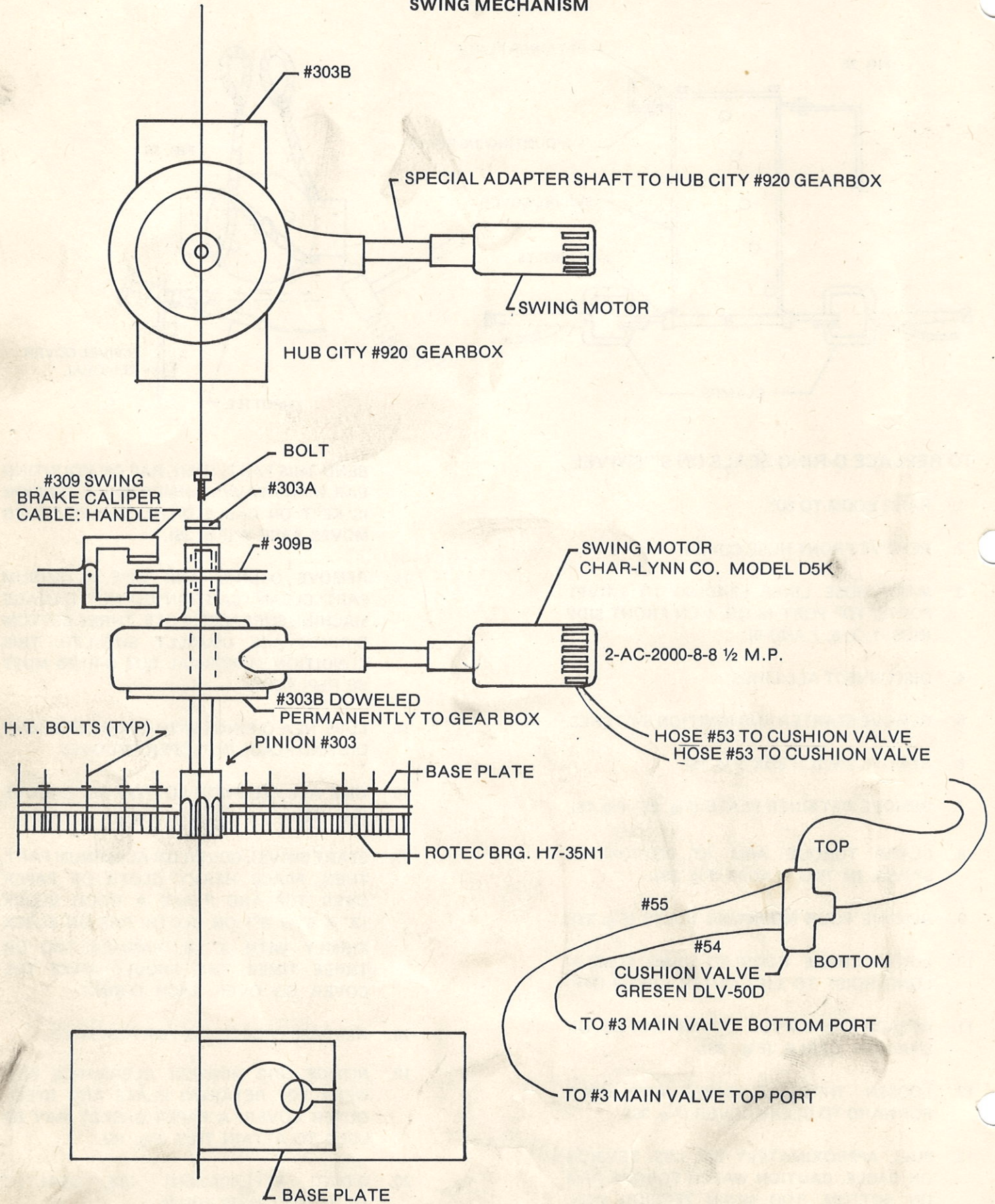
## TO REPLACE O-RING SEALS ON 5" SWIVEL

1. RAISE BOOM TO 80°.
2. REMOVE FRONT HOSE COVER.
3. MARK HOSE LINES LEADING TO SWIVEL PORTS. TOP PORT IS NO. 1 ON FRONT SIDE (NOS. 1, 3, 5, 7 AND 9).
4. DISCONNECT ALL LINES.
5. REMOVE STARTER AND IGNITION SWITCHES.
6. REMOVE SWITCH BOX (Fig. 1S).
7. REMOVE RETAINER PLATE (Fig. 2S - Fig. 1S).
8. CLAMP TORQUE ARM AT BOTTOM OF SWIVEL IN TWO PLACES (Fig. 2S).
9. REMOVE FOUR MOUNTING BOLTS (Fig. 2S).
10. LOWER CRANE HOOD TO HANG COME-A-LONG HOIST TO LIFT OUTER COVER OFF.
11. ATTACH TO SWIVEL COVER BY 3/8 OR SMALLER CABLE (Fig. 3S).
12. LOOSEN THROTTLE CABLE AND HOLD FORWARD TO CLEAR COVER (Fig. 3S).
13. PULL APPROXIMATELY 300 LBS. TENSION ON CABLE, **CAUTION** WATCH TORQUE ARM ON BOTTOM, TOO MUCH TENSION WILL
14. BEND THIS PART. THEN, RAP ON MOUNTING EAR WITH HEAVY HAMMER WHILE TENSION IS KEPT ON CABLE UNTIL SWIVEL COVER MOVES EASILY (Fig. 3S).
15. REMOVE O-RINGS AND WIPE ALUMINUM PART CLEAN, **CAUTION** DO NOT DAMAGE MACHINE SURFACES. NOTE, THREE BOTTOM O-RINGS ARE USUALLY SWELLED; THIS CONDITION IS NORMAL BUT O-RING MUST BE REPLACED.
16. LUBE NEW O-RINGS WITH 20 OR 30 WEIGHT OIL AND PLACE IN PROPER GROOVES.
17. WIPE ALL OIL FROM BOTTOM OIL GROOVE (Fig. 1S).
18. START SWIVEL COVER ON ALUMINUM PART. THEN, PLACE HEAVY CLOTH OR PAPER OVER TOP AND PLACE A WOOD BLOCK (3" x 8" x 8") ON CLOTH; RAP ON BLOCK FIRMLY WITH 8 LB. HAMMER TWO OR THREE TIMES. THIS SHOULD MAKE THE COVER GO OVER EACH O-RING.
19. REVERSE PROCEDURE FOR ASSEMBLY.
20. NOTICE, .010 MINIMUM CLEARANCE BETWEEN TOP RETAINER PLATE AND STEEL OUTER COVER. A PAPER GASKET MAY BE USED TO ATTAIN THIS (Fig. 1S).
21. O-RING REPLACEMENT USE SEALTEC #2-350-N552-90 OR EQUAL.



# SWING MECHANISM & REMOVAL

## SWING MECHANISM

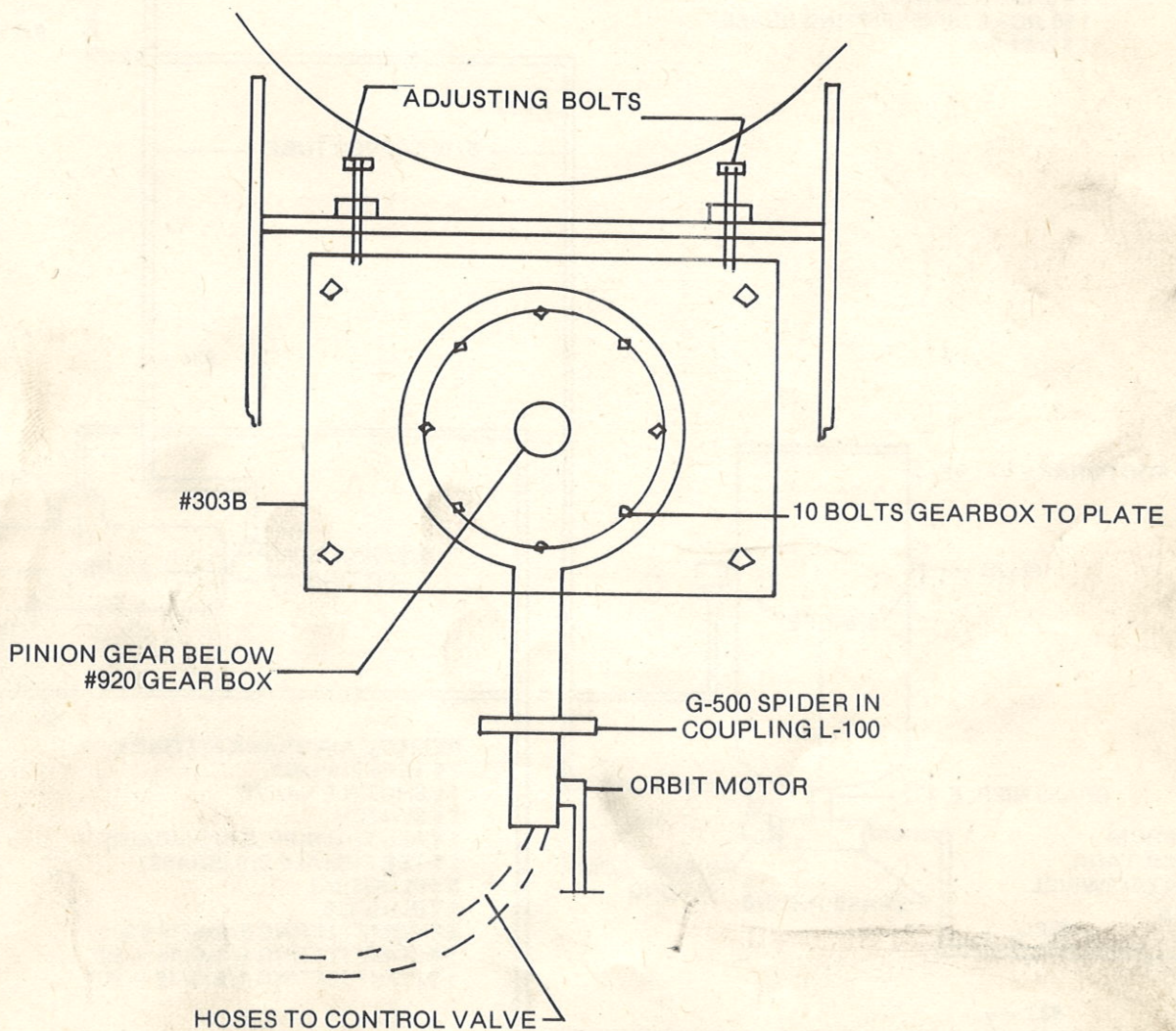




# SWING MECHANISM & REMOVAL PROCEDURE

## TO REMOVE SWING GEAR BOX

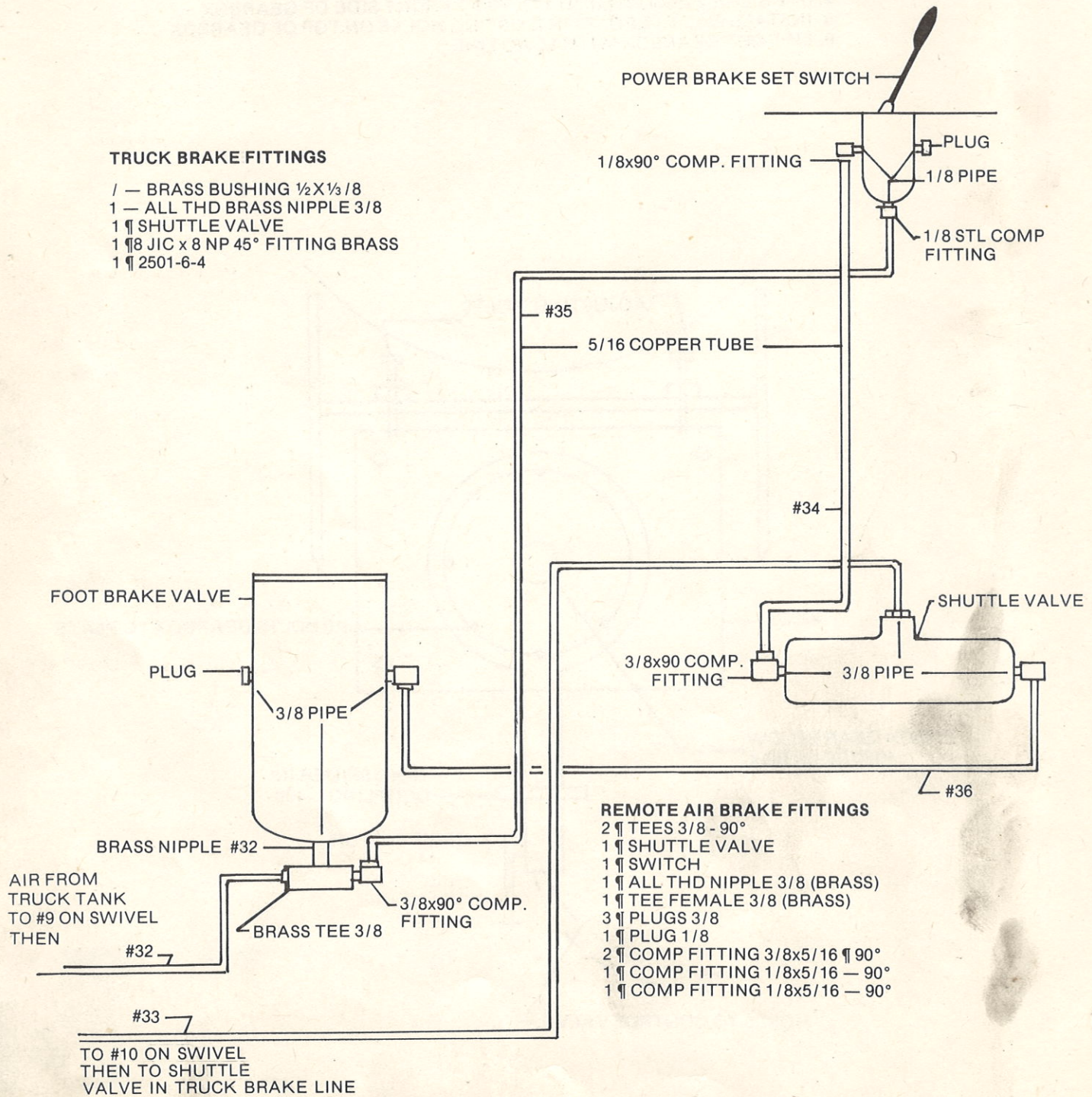
1. SET BOOM AT 75° TO UTILIZE LOAD LINE TO LIFT OUT GEARBOX
2. REMOVE BRAKE CALIPER, DISC, & SWING MOTOR
3. REMOVE 4 MOUNTING BOLTS (1/2" GRADE 3)
4. BACK OFF 2 ADJUSTMENT BOLTS AT FRONT SIDE OF GEARBOX
5. INSTALL 2 1/2" EYEBOLTS IN EXISTING HOLES ON TOP OF GEARBOX
6. LIFT OUT GEARBOX WITH LOAD LINE





# REMOTE SYSTEMS/AIRBRAKE

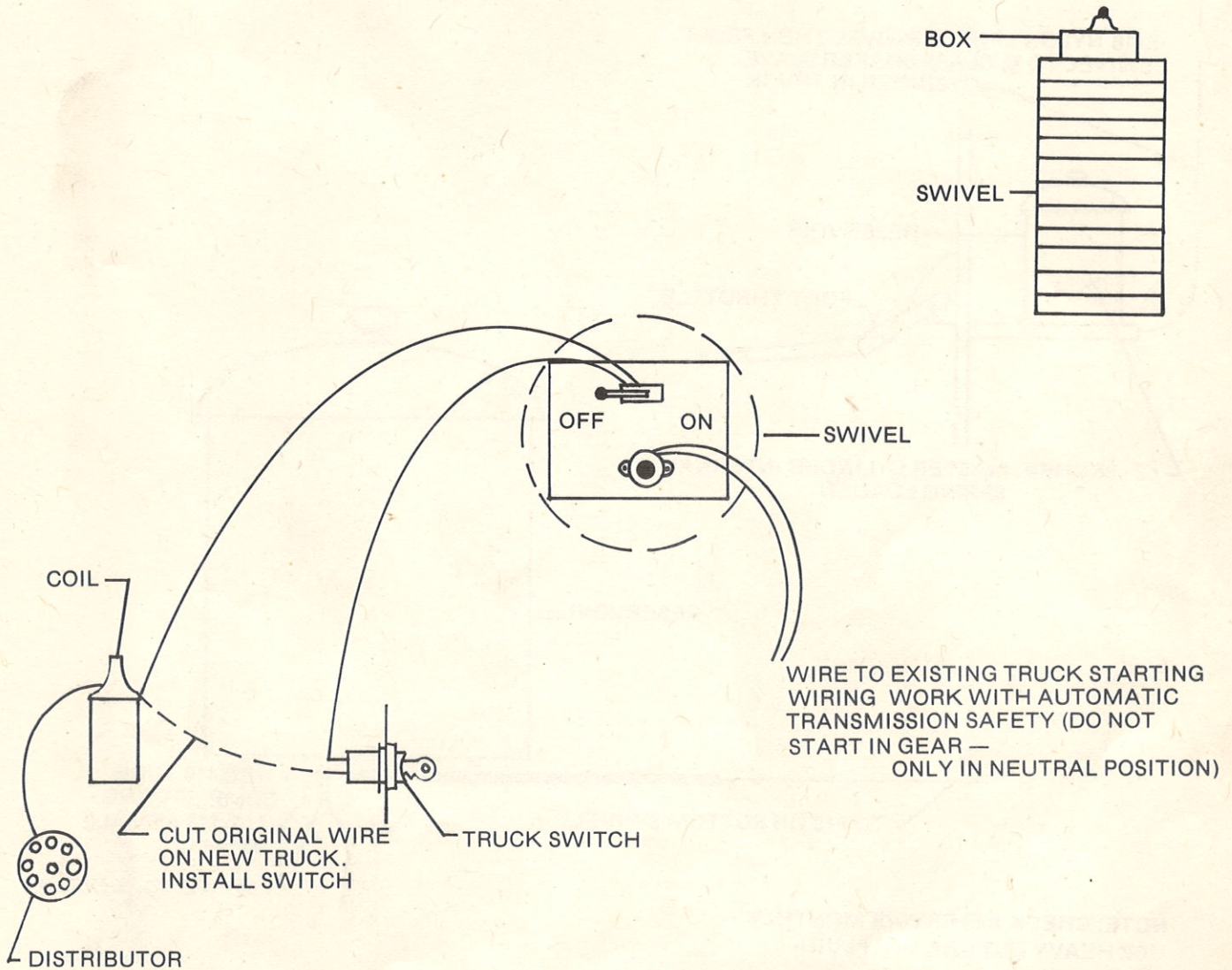
## REMOTE CONTROL BRAKE SYSTEM





# REMOTE SYSTEMS/IGNITION

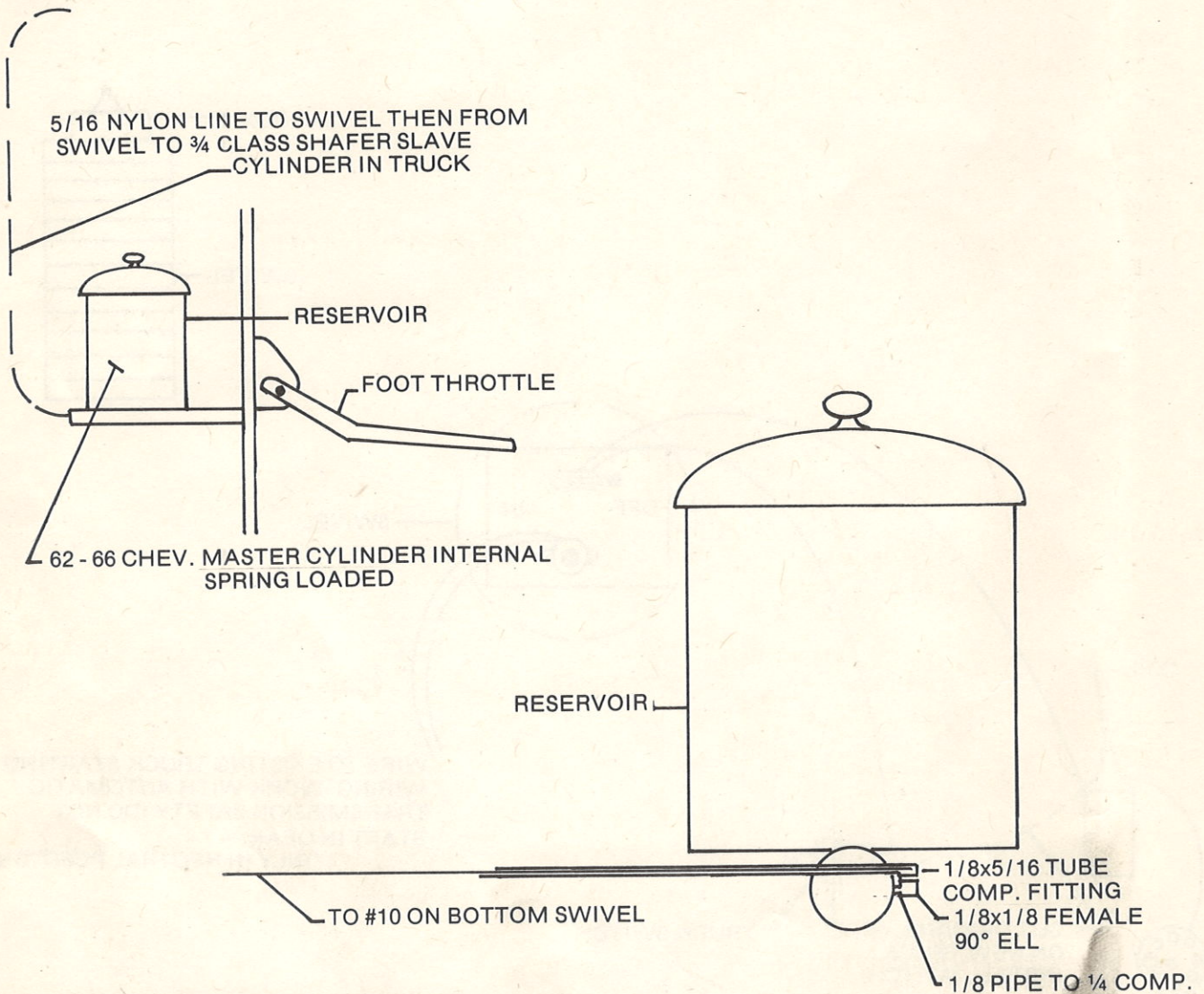
## REMOTE IGNITION





# REMOTE SYSTEMS/THROTTLE

## REMOTE THROTTLE CYLINDER



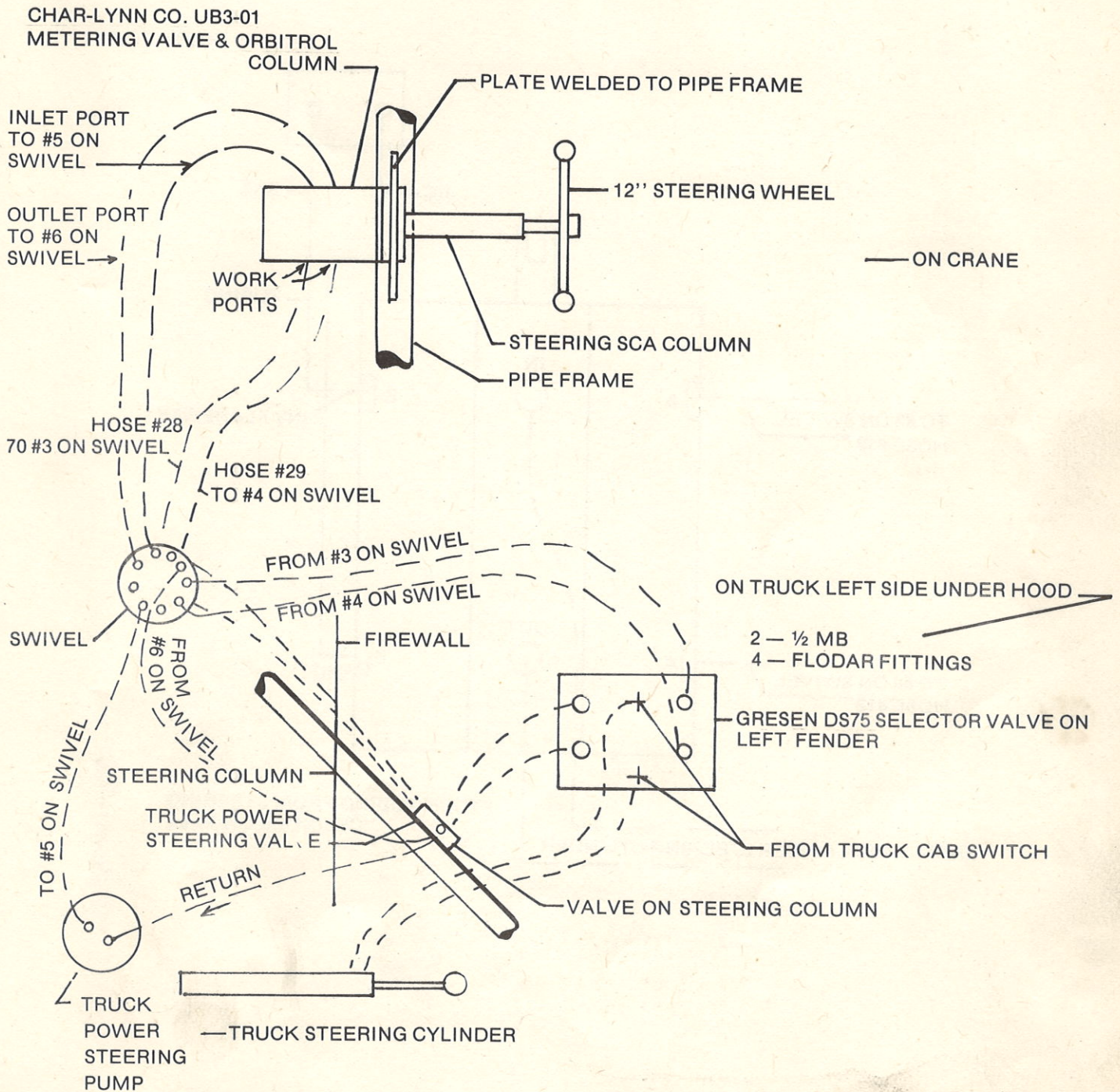
**NOTE: CHECK RESERVOIR MONTHLY —  
USE HEAVY DUTY BRAKE FLUID**

**ALL FITTING BRASS**  
1 — 1/8 PIPE TO 3/4 COMP TUBE  
1 — 90° F/F ELL 1/8  
1 — 90° 1/8x5/16 COMPRESSION FITTING



# REMOTE SYSTEMS/STEERING

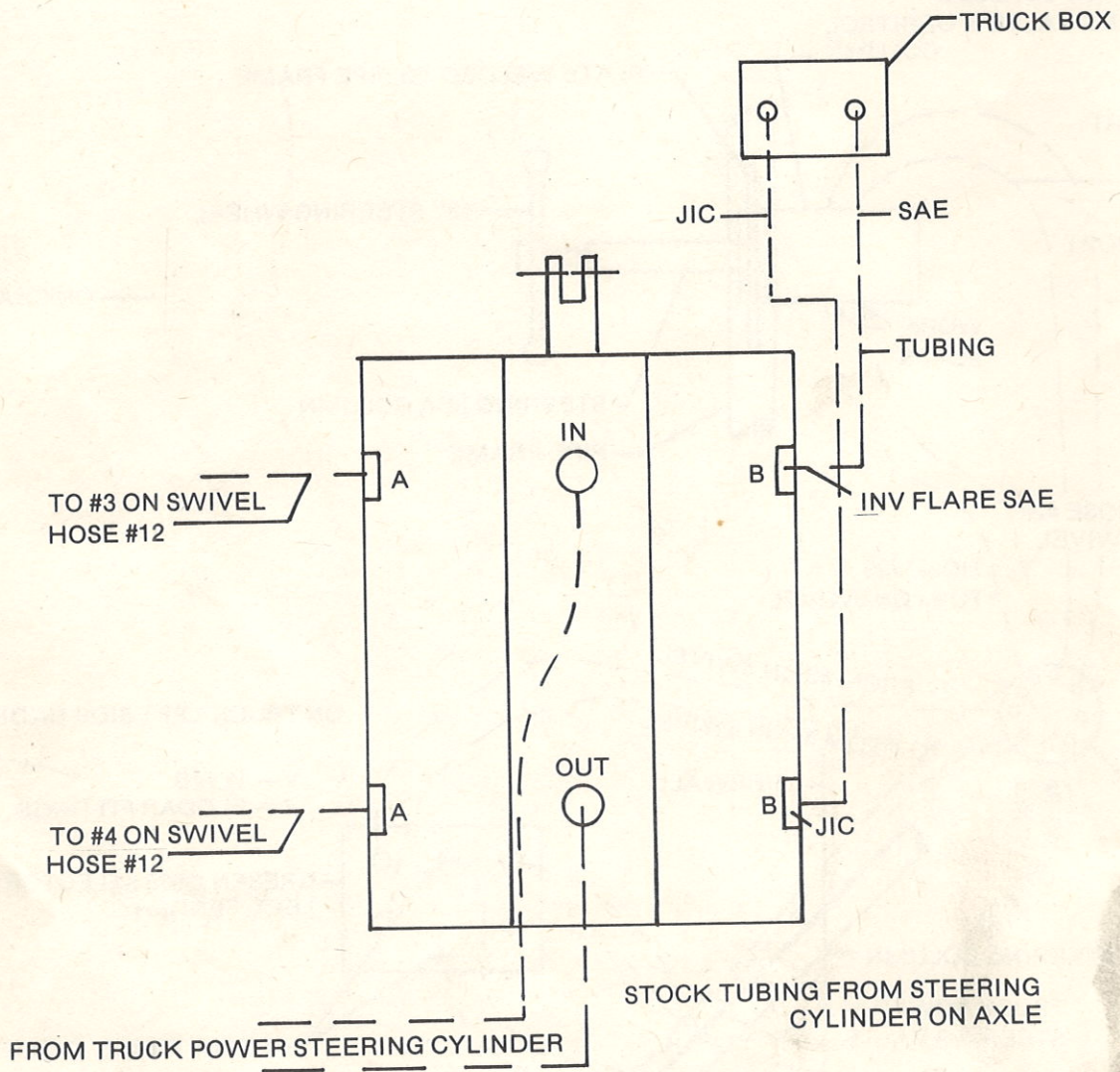
## REMOTE STEERING CRANES SERIAL #111 OR GREATER





# REMOTE SYSTEMS/ STEERING

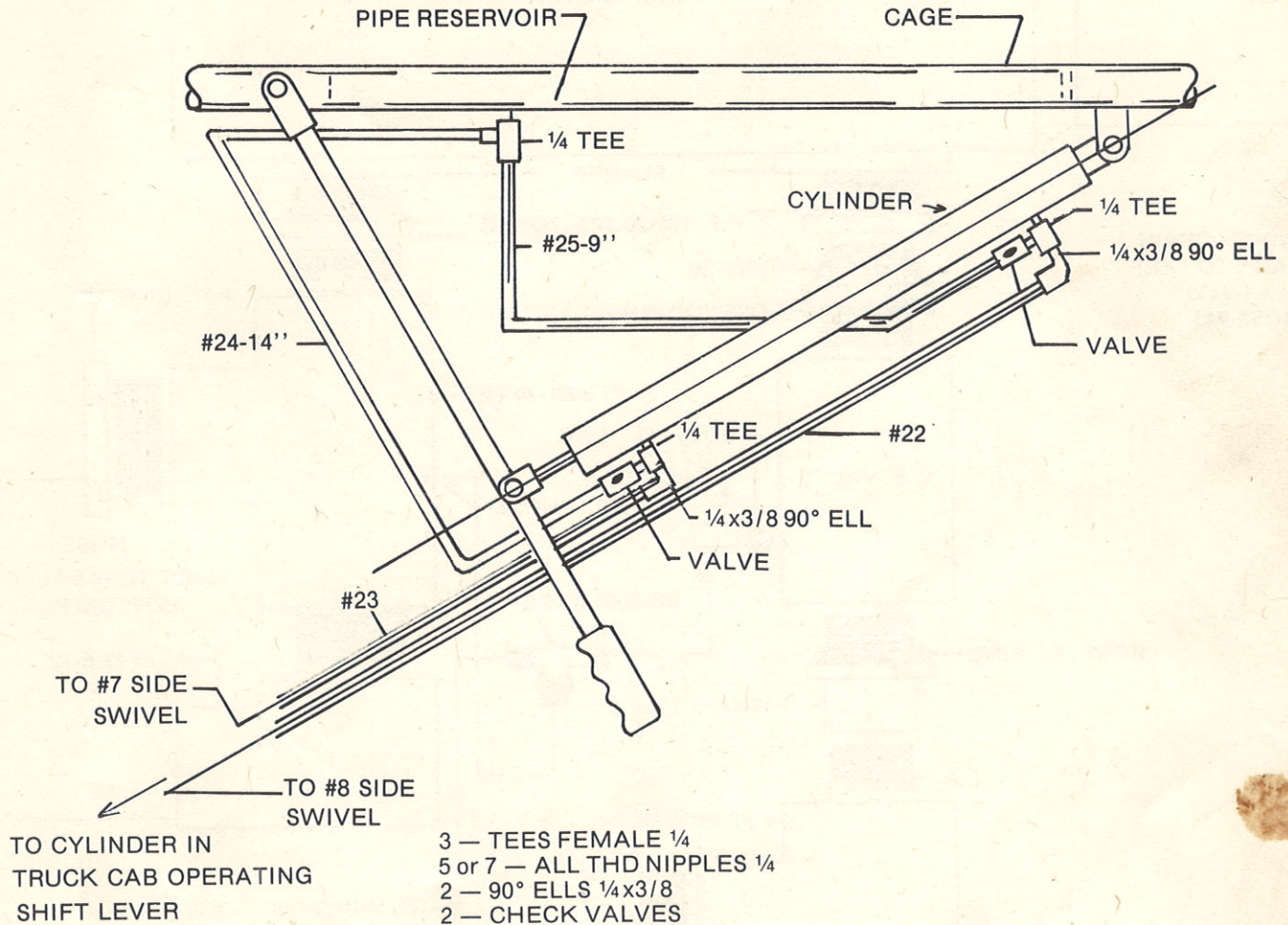
REMOTE POWER STEERING VALVE DS75





# REMOTE SYSTEMS/SHIFTING

## REMOTE CONTROL SHIFTER



## REMOTE SHIFT

PIPE FRAME RESERVOIR USED TO KEEP AIR & OIL UP IN SYSTEM. WHEN USING REMOTE SHIFT THE RESERVOIR IS NOT USED — CLOSE THE 2 NEEDLE VALVES.

1. TO PRESSURIZE SYSTEM TO MAKE SOLID SHIFT ACTION — MOVE SHIFT ARM FORWARD ALL THE WAY THEN BACK 3" WITH BOTH NEEDLE VALVES OPEN.

2. SHUT NEEDLE VALVE ON ROD END OF PISTON — PUT PRESSURE ON THAT END BY PULLING AGAINST RESISTANCE. HOLD THEN TIGHTEN NEEDLE VALVE.

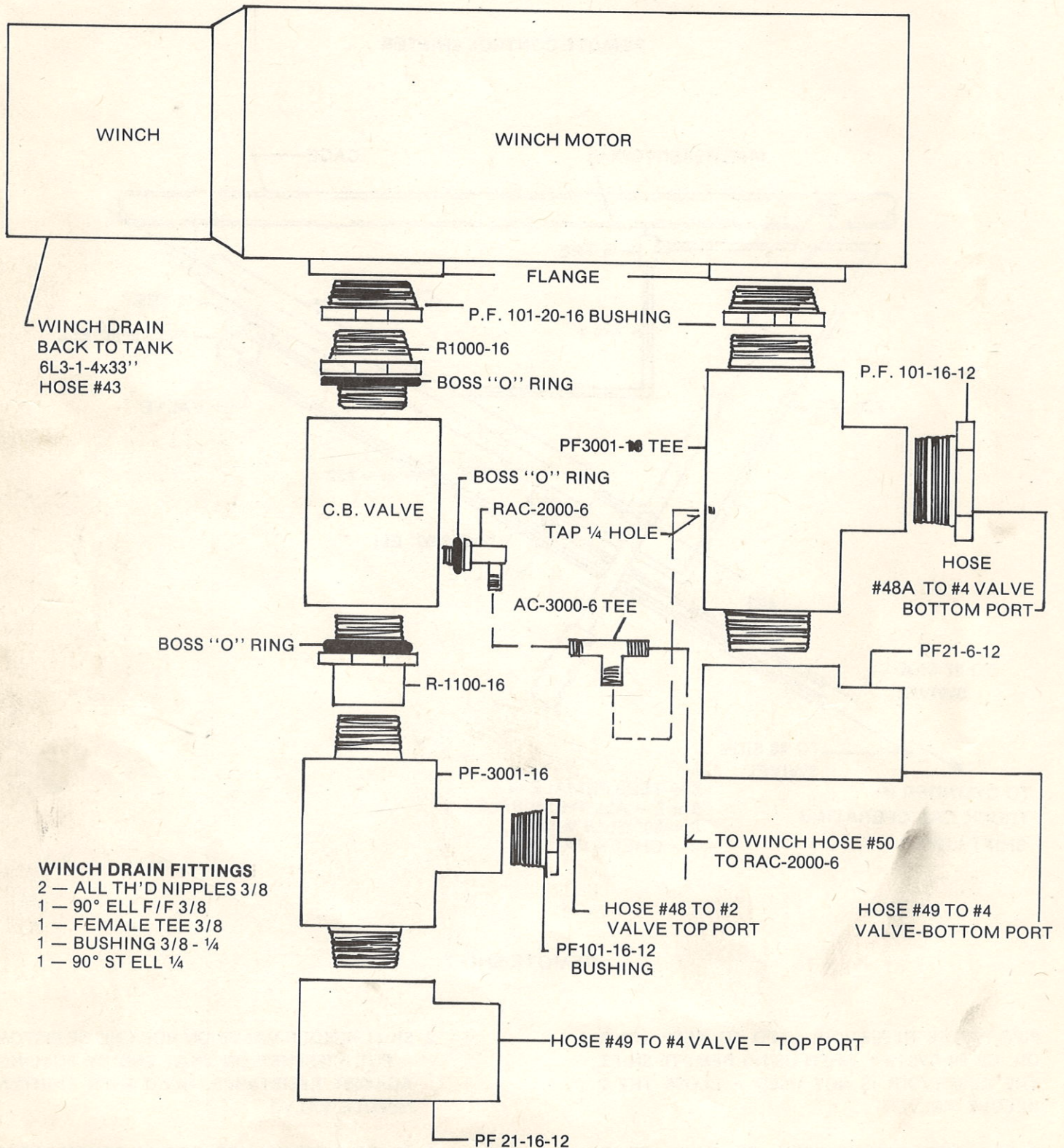
3. BE SURE VALVE ON FLOOR OF TRUCK CAB IS CLOSED WHEN PRESSURIZING.

4. USE 50% DIESEL OIL & 50% HYD OIL IN SYSTEM.



# WINCH & LOAD LINE

## WINCH VALVES AND FITTINGS





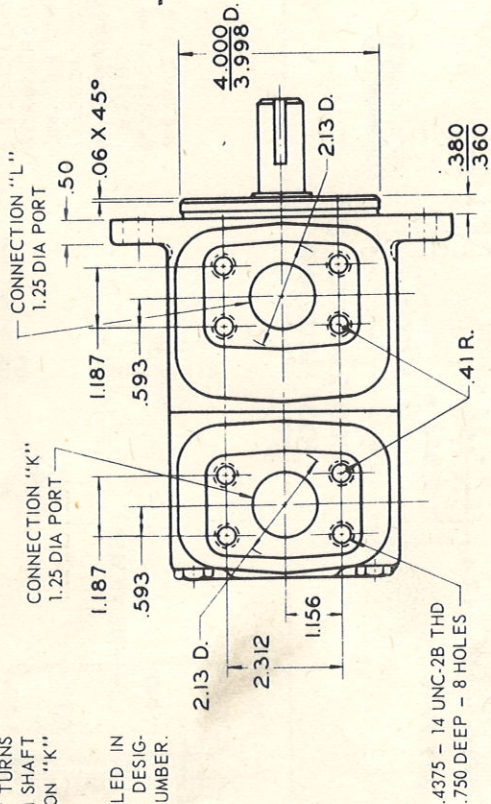
# WINCH & LOAD LINE

**VICKERS** HIGH PERFORMANCE HYDRAULIC MOTORS  
 SERIES 25M (-20 DESIGN)  
 FIXED DISPLACEMENT VANE TYPE

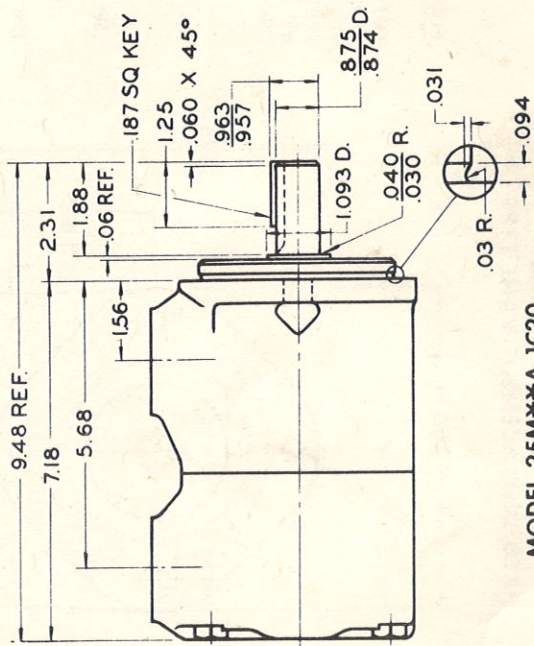
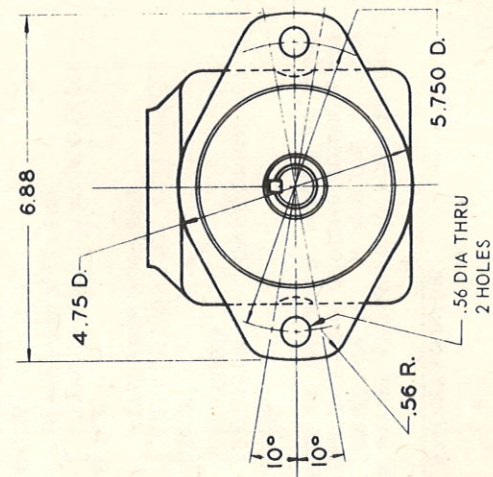
FLUID SUPPLY TO CONNECTION "L" TURNS SHAFT CLOCKWISE AS VIEWED FROM SHAFT END. FLUID SUPPLY TO CONNECTION "K" TURNS SHAFT COUNTERCLOCKWISE.

CONNECTION "K," SHOWN ASSEMBLED IN LINE WITH CONNECTION "L," IS DESIGNATED BY LETTER "C" IN MODEL NUMBER.

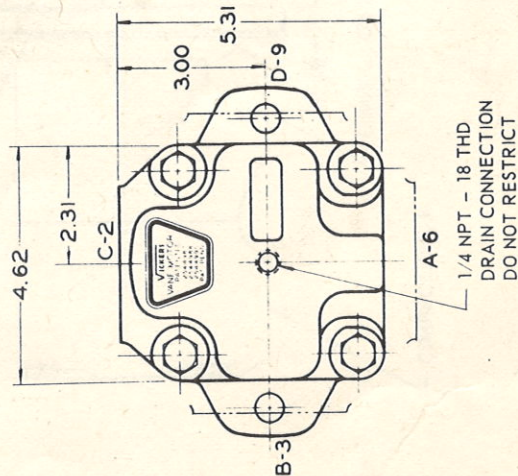
MODEL NUMBER	TORQUE LB. IN. PER 100 PSI	DISPLACEMENT CU. IN. REV.
25M42A-1C20	42	2.68
25M55A-1C20	55	3.52
25M65A-1C20	65	4.19



CLOCKWISE ROTATION

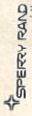


MODEL 25M\*\*A-1C20  
 STANDARD 2-BOLT MOUNTING  
 #1 STRAIGHT KEYS SHAF

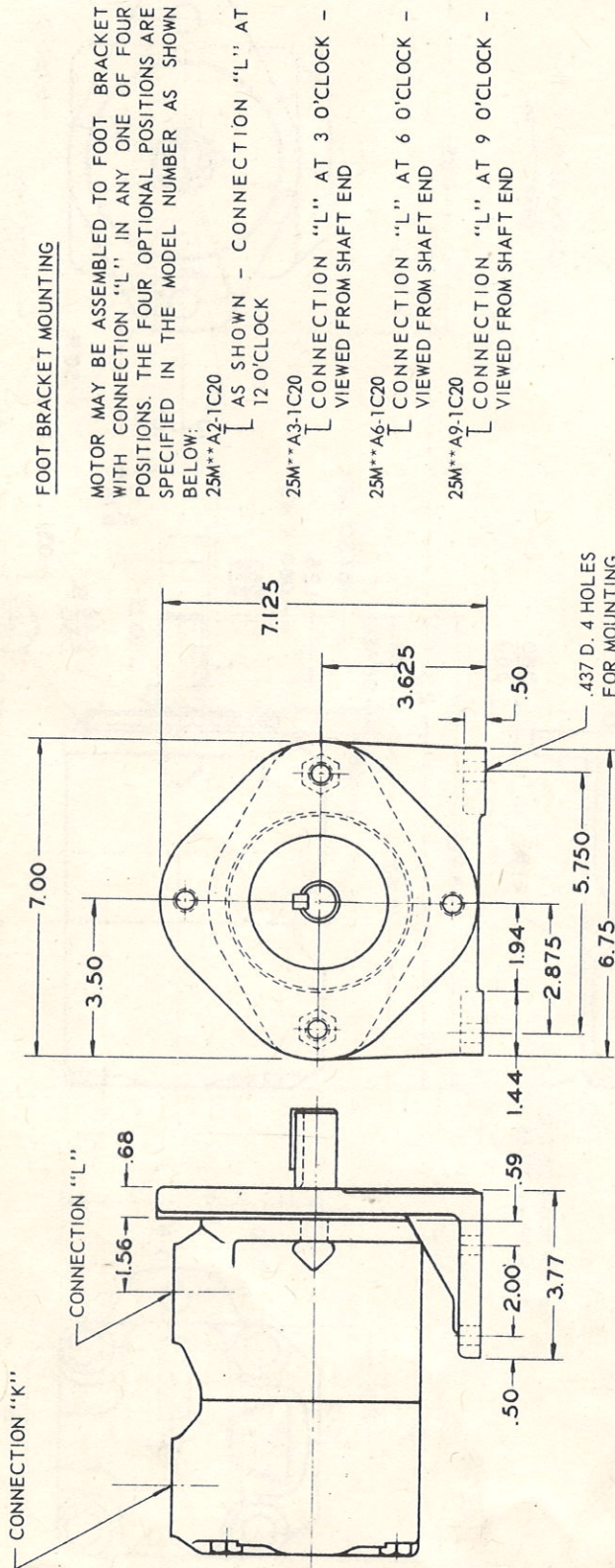




# WINCH & LOAD LINE



## VICKERS® HIGH PERFORMANCE HYDRAULIC MOTORS SERIES 25M (-20 DESIGN) FIXED DISPLACEMENT VANE TYPE

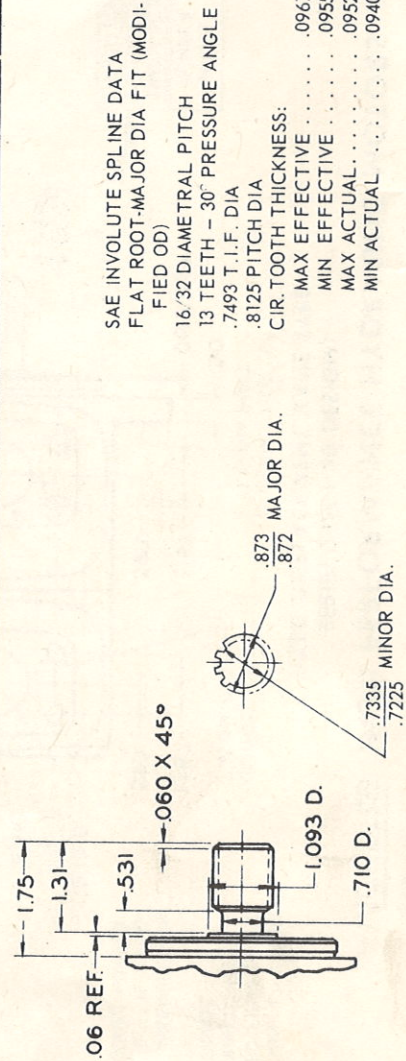


MODEL 25M\*\*A2-1C20  
- FOOT MOUNTING

### FOOT BRACKET MOUNTING

MOTOR MAY BE ASSEMBLED TO FOOT BRACKET WITH CONNECTION "L" IN ANY ONE OF FOUR POSITIONS. THE FOUR OPTIONAL POSITIONS ARE SPECIFIED IN THE MODEL NUMBER AS SHOWN BELOW:

- 25M\*\*A2-1C20  
└ AS SHOWN - CONNECTION "L" AT 12 O'CLOCK
- 25M\*\*A3-1C20  
└ CONNECTION "L" AT 3 O'CLOCK - VIEWED FROM SHAFT END
- 25M\*\*A6-1C20  
└ CONNECTION "L" AT 6 O'CLOCK - VIEWED FROM SHAFT END
- 25M\*\*A9-1C20  
└ CONNECTION "L" AT 9 O'CLOCK - VIEWED FROM SHAFT END



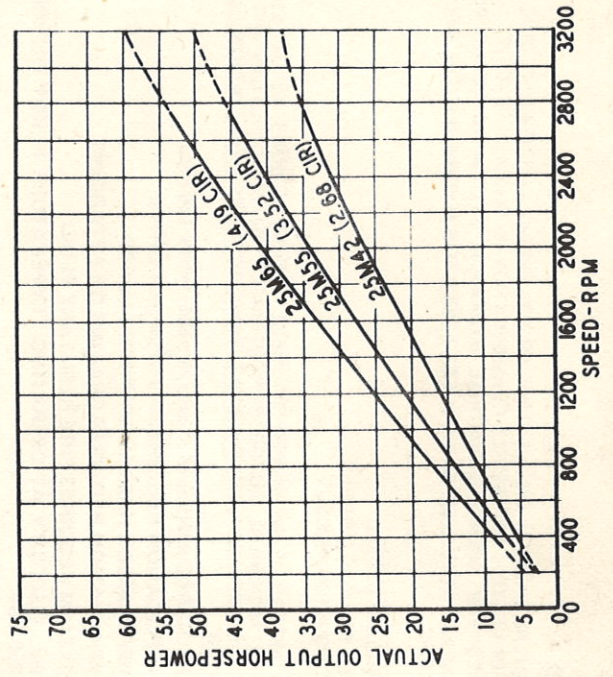
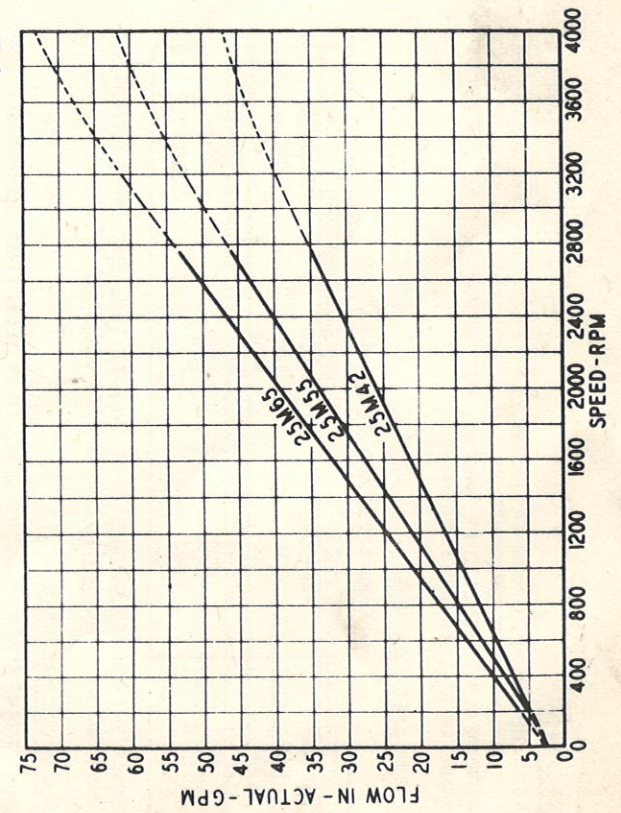
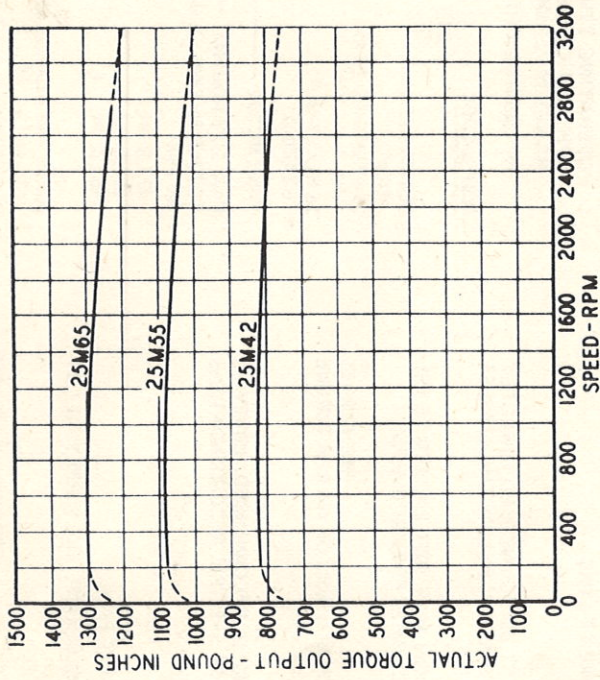
SAE INVOLUTE SPLINE DATA  
FLAT ROOT-MAJOR DIA FIT (MODIFIED OD)  
16/32 DIAMETRAL PITCH  
13 TEETH - 30° PRESSURE ANGLE  
.7493 T.I.F. DIA  
.8125 PITCH DIA  
CIR. TOOTH THICKNESS:  
MAX EFFECTIVE . . . . . .0967  
MIN EFFECTIVE . . . . . .0955  
MAX ACTUAL . . . . . .0952  
MIN ACTUAL . . . . . .0940

MODEL 25M\*\*A\*-11\*\*20  
# 11 SPLINED SHAFT



**TYPICAL PERFORMANCE CURVES**  
 OIL TEMPERATURE - 120 F. OIL VISCOSITY - 150 SSU AT 100° F. OPERATING PRESSURE - 2000 PSI  
 (DASHED PORTION OF CURVES REPRESENTS INTERMITTENT OPERATION)

**SERIES 25M VANE MOTORS (-20 DESIGN)**





# WINCH & LOAD LINE

## GENERAL DATA:

SERIES 25M MOTORS ARE OF VICKERS BALANCED TYPE CONSTRUCTION. OPERATION MAY BE INTERMITTENT OR CONTINUOUS IN EITHER DIRECTION OF ROTATION. WHEN PROPERLY PROTECTED BY VALVING, MOTORS MAY BE USED FOR CYCLE REVERSING OR STALLED WITHOUT DAMAGE.

## OPERATING SPECIFICATIONS:

### MAXIMUM SPEED AND PRESSURE RATINGS

CONTINUOUS OPERATION		INTERMITTENT OPERATION	
SPEED RPM	PRESSURE PSI	SPEED RPM	PRESSURE PSI
3600	500	4000	500
3300	1000	3800	1000
2800	2000	3200	2000
2600 & LOWER	2250	3000 & LOWER	2500

INTERMITTENT SERVICE EQUALS 10% OF OVERALL TIME. EACH APPLICATION OF PRESSURE AND OR SPEED NOT TO EXCEED OVER 6 SECONDS.

### \* MINIMUM OPERATING SPEED

MINIMUM SPEED IS NORMALLY 100 RPM. LOWER SPEEDS ARE PERMISSIBLE DEPENDING UPON TORQUE REQUIREMENTS AND NATURE OF LOAD.

### CASE DRAIN CONNECTION

A FULL SIZE UNRESTRICTED DRAIN LINE MUST BE CONNECTED DIRECTLY FROM THE CASE DRAIN CONNECTION TO A LOCATION BELOW THE LOWEST FLUID LEVEL IN THE SYSTEM RESERVOIR.

PRESSURE SURGES AT THE DRAIN CONNECTION MAY NOT EXCEED 25 PSI. NOMINAL PRESSURE NOT TO EXCEED 10 PSI. MINIMUM PRESSURE 0 PSI.

RUNNING TORQUE ..... SEE CURVES  
STARTING TORQUE ..... 65% (MINIMUM) OF 400 RPM TORQUE

### \* TYPE OF DRIVE

DIRECT DRIVE THROUGH A FLEXIBLE COUPLING IS RECOMMENDED. HOWEVER, BELT, CHAIN, OR GEAR DRIVES CAN BE USED. FOR SPECIFIC RECOMMENDATIONS CONTACT YOUR VICKERS SALES REPRESENTATIVE.

### DRIVE ROTATION

ROTATION CAN BE TO MAXIMUM RPM IN EITHER DIRECTION.

OIL SUPPLY TO CONNECTION "L" TURNS SHAFT CLOCKWISE. OIL SUPPLY TO CONNECTION "K" TURNS SHAFT COUNTERCLOCKWISE.

FILTRATION (MANDATORY) ..... 25 MICRONS OR LESS

### \* FLUID

CLEAN PETROLEUM OIL MEETING OR EXCEEDING LUBRICATING QUALITIES OF SAE 10W MEETING API SERVICE CLASSIFICATION MS (MAXIMUM SEVERITY) IS RECOMMENDED FOR NORMAL INDUSTRIAL HYDRAULIC SYSTEM TEMPERATURES (120°F OPTIMUM). REFER TO DATA SHEET I-286-S FOR HYDRAULIC OIL RECOMMENDATIONS.

### WEIGHT (APPROX.)

2-BOLT FLANGE MODELS ..... 40 LBS  
FOOT MOUNTING MODELS ..... 53 LBS

\* THIS MOTOR IS DESIGNED TO MEET SPECIFICATIONS AS OUTLINED. TO INSURE MAXIMUM MOTOR PERFORMANCE IN CONJUNCTION WITH YOUR SPECIFIC APPLICATION, CONSULT YOUR VICKERS APPLICATION ENGINEER IF YOUR:

REQUIRED MINIMUM SPEED IS LESS THAN 100 RPM

APPLICATION REQUIRES AN INDIRECT DRIVE

APPLICATION HAS OVERRUNNING LOADS

APPLICATION REQUIRES BRAKING OR RETARDING

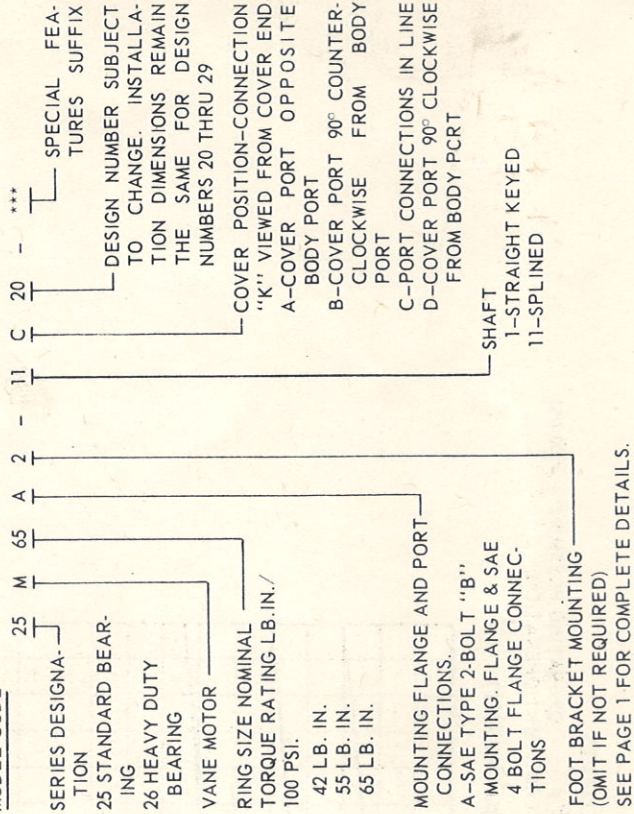
SYSTEM REQUIRES FIRE RESISTANT FLUID

OIL VISCOSITY AT OPERATING TEMPERATURE IS NOT WITHIN 100 TO 250 SSU

OPERATING TEMPERATURE IS NOT WITHIN 100 TO 150°F. WITH PROPER APPLICATION AND FLUID CONSIDERATION, A GREATER TEMPERATURE RANGE IS PERMISSIBLE

NEEDS REQUIRE APPLICATION ASSISTANCE

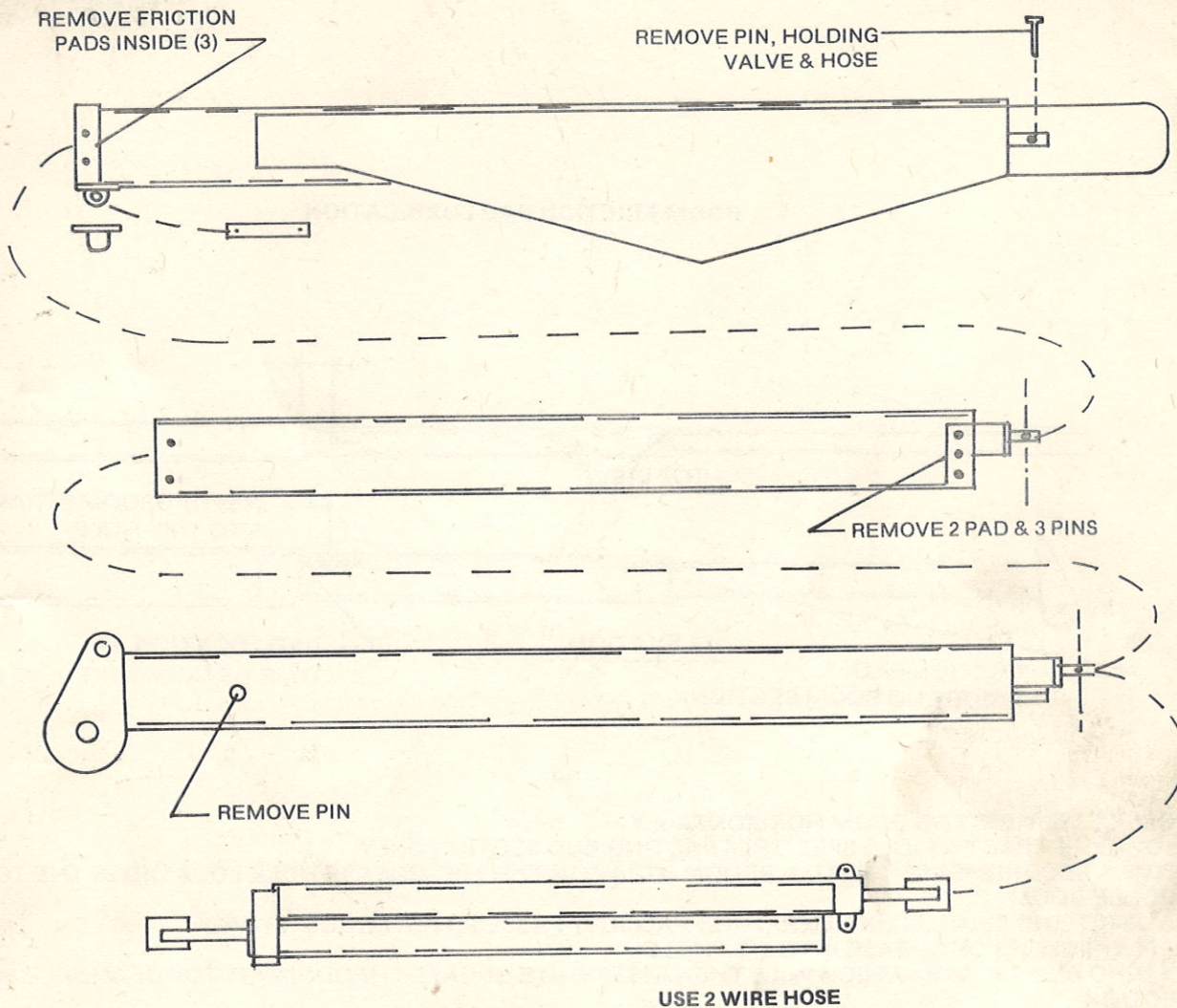
### MODEL CODE



SEE PAGE 1 FOR COMPLETE DETAILS.



# BOOM DISASSEMBLY



## DISASSEMBLY OF BOOM

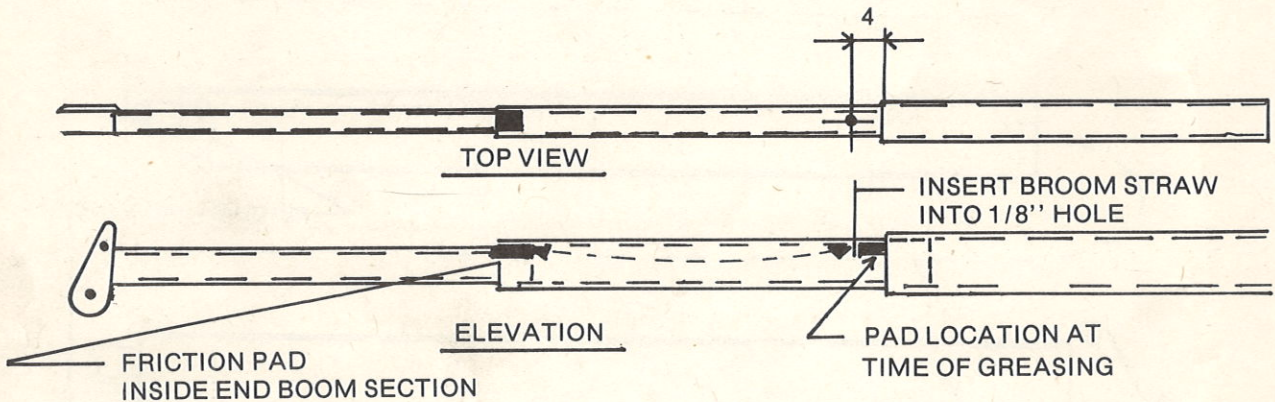
### REMOVAL OF EXTENSION CYLINDERS

1. RETRACT BOOM COMPLETELY AND PLACE IN HORIZONTAL POSITION UNDER OVER-HEAD CRANE.
2. DISCONNECT ALL HOSES AT BASE OF BOOM. REMOVE COUNTER-BALANCE VALVE.
3. REMOVE VERTICAL PIN HOLDING BASE OF BOOM CYLINDER.
4. REMOVE LOAD LINE DISCONNECTING AT WEDGE SOCKET.
5. REMOVE FLOATING AND 2 SIDE OUTSIDE FRICTION PADS ON BASE BOOM SECTION.
6. MIDDLE AND TOP SECTION OF BOOM CAN NOW BE REMOVED FROM BASE SECTION.
7. REMOVE FRICTION PADS FROM OUTSIDE OF BASE END OF MIDDLE BOOM SECTION. REMOVE TOP BOLT THEN TURN PAD TO RELEASE FROM STUD HOLDING PAD.
8. REMOVE 3 PINS HOLDING CYLINDER BASE CROSS TUBES TO MIDDLE SECTION.
9. REMOVE INSIDE PADS FROM TOP END OF MIDDLE SECTION.
10. TOP END BOOM SECTION CAN NOW BE REMOVED FROM MIDDLE SECTION.
11. REMOVE SNAP RING AND PIN HOLDING TOP ROD EYE END TO TOP SECTION OF BOOM.
12. CYLINDERS CAN NOW BE REMOVED.
13. TO REASSEMBLE REVERSE PROCEDURE.

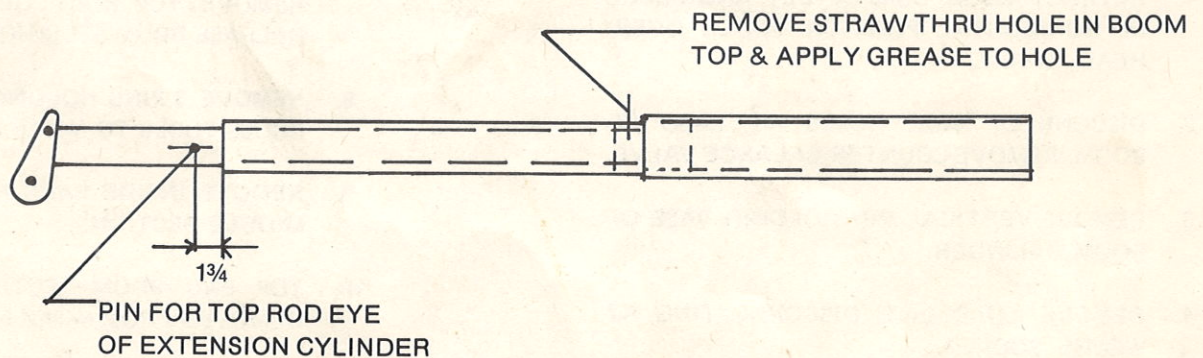


# BOOM FRICTION PAD LUBRICATION

## BOOM FRICTION PAD LUBRICATION

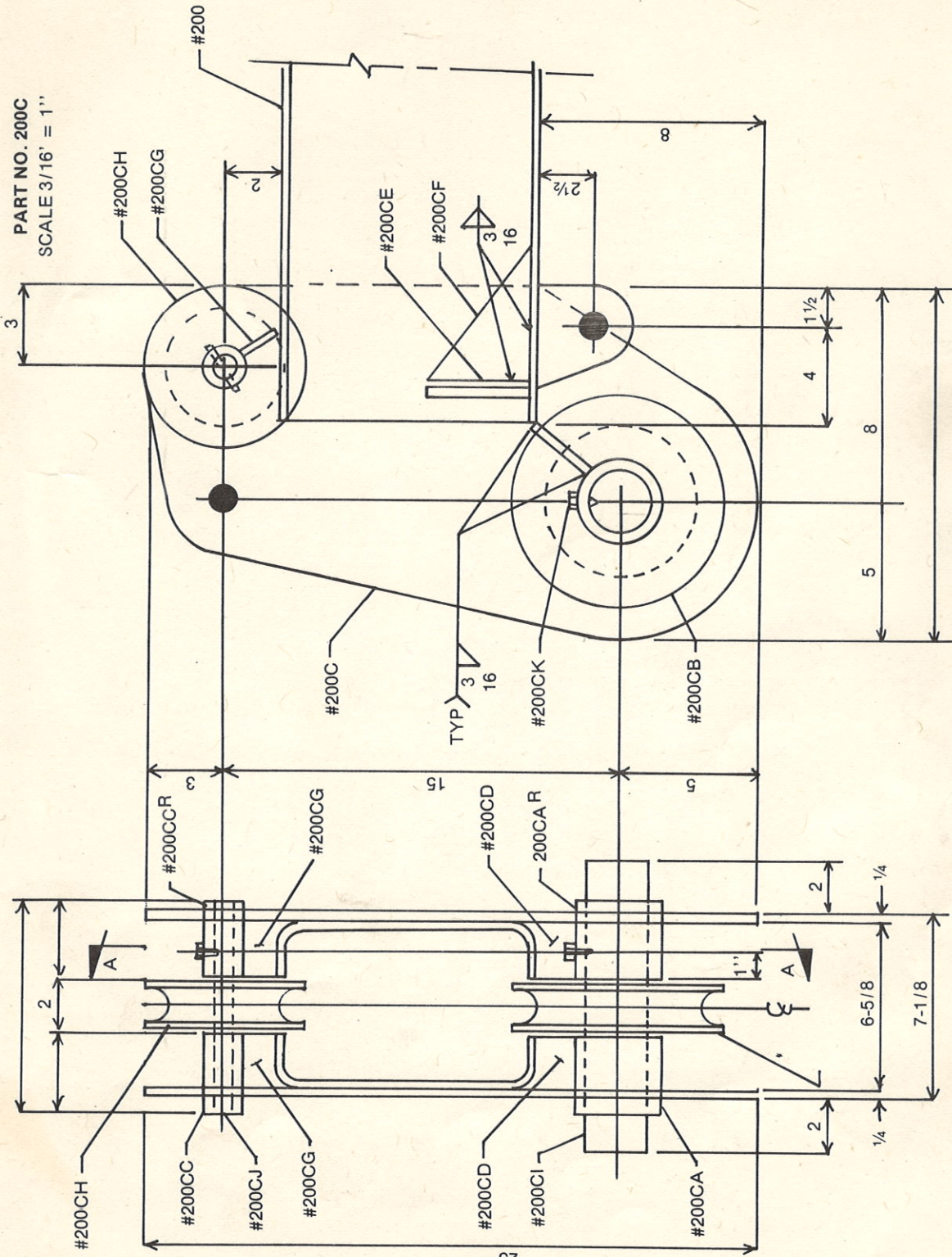


1. COMPLETELY EXTEND BOOM HORIZONTALLY
2. SLOWLY RETRACT AT IDLE SPEED RETRACTING END SECTION ONLY
3. HAVE A SECOND PERSON HOLD A BROOM STRAW IN THE 1/8" GREASE HOLE LOCATED IN THE TOP OF THE MIDDLE BOOM.
4. RETRACT END SECTION UNTIL FRICTION PAD JUST PASSES OVER BROOM STRAW.
5. APPLY 10 SHOTS OF GREASE INTO 1/8" HOLE.
6. EXTEND END SECTION WHICH WILL THEN DISTRIBUTE GREASE THROUGHOUT TOP OF MIDDLE BOOM SECTION.
7. LUBRICATE BOTTOM OF BOOM BY WIPING WITH RAG SOAKED IN HYDRAULIC OIL. APPLY LIGHT FILM OF OIL.





# BOOM HEAD & SHEAVE ASSEMBLY



SECTION A-A  
REMOVE PINS TO REPLACE SHEAVES  
GREASE SHEAVES DAILY

BOOM HEAD PART NO. 200C  
ASSEMBLY DRAWING



