INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Operator's Manual

OPERATING AND SERVICE MANUAL

ICE MODEL 180

DIESEL PILE HAMMER

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.
SPECIALIZING IN PILE DRIVING EQUIPMENT
CORPORATE OFFICES 301 WAREHOUSE DR MATTHEWS, N C 28105
PHONE 704 821-7681 TELEX 572385

MODEL_____

SERIAL NO._____

MACHINE SERIAL NUMBER

The machine serial number is stamped on the serial number plate which is located on front of Hammer under the pump guard. The machine model and serial number should always be furnished when ordering parts and corresponding regarding your machine. The serial number is the only means the distributor or factory has of ensuring that the correct parts will be furnished.

In the event that the serial number plate is lost, there is another number stamped on the upper cylinder mounting flange. This number (example: 9054) should then be furnished as this will enable us to determine the hammer serial number.

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

WARRANTY

INTERNATIONAL CONSTRUCTION EQUIPMENT STANDARD WARRANTY

INTERNATIONAL CONSTRUCTION EQUIPMENT (ICE) WARRANTS NEW PRODUCTS SOLD BY IT TO BE FREE FROM DEFECTS IN MATERIAL OR WORKMANSHIP FOR A PERIOD OF 90 DAYS AFTER DATE OF DELIVERY TO THE FIRST USER AND SUBJECT TO THE FOLLOWING CONDITIONS:

ICE'S OBLIGATION AND LIABILITY UNDER THIS WARRANTY IS EXPRESSLY LIMITED TO REPAIRING OR REPLACING AT ICE'S OPTION, ANY PARTS WHICH APPEAR TO ICE UPON INSPECTION TO HAVE BEEN DEFECTIVE IN MATERIAL OR WORKMANSHIP. SUCH PARTS SHALL BE PROVIDED AT NO COST TO THE USER, AT THE BUSINESS ESTABLISHMENT OF ICE OR THE AUTHORIZED ICE DISTRIBUTOR OF THE PRODUCT DURING REGULAR WORKING HOURS. THIS WARRANTY SHALL NOT APPLY TO COMPONENT PARTS OR ACCESSORIES OF PRODUCTS NOT MANUFACTURED BY ICE AND WHICH CARRY THE WARRANTY OF THE MANUFACTURER THEREOF, OR TO NORMAL MAINTENANCE (SUCH AS ENGINE TUNE-UP) OR TO NORMAL MAINTENANCE PARTS (SUCH AS OIL FILTERS). REPLACEMENT OR REPAIR PARTS INSTALLED IN THE PRODUCT COVERED BY THIS WARRANTY ARE WARRANTED ONLY FOR THE REMAINDER OF THIS WARRANTY AS IF SUCH PARTS WERE ORIGINAL COMPONENTS OF SAID PRODUCT. ICE COMPANY MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OF FITNESS FOR ANY PARTICULAR PURPOSE. ICE'S OBLIGATION UNDER THIS WARRANTY SHALL NOT INCLUDE ANY TRANSPORTATION CHARGES, COSTS OF INSTALLATION, DUTY, TAXES OR ANY OTHER CHARGES WHATSOEVER, OR ANY LIABILITY FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGE OR DELAY. IF REQUESTED BY ICE, PRODUCTS OR PARTS FOR WHICH A WARRANTY CLAIM IS MADE ARE TO BE RETURNED TRANSPORTATION PREPAID TO ICE. ANY IMPROPER USE, INCLUDING OPERATION AFTER DISCOVERY OF DEFECTIVE OR WORN PARTS, OPERATION BEYOND RATED CAPACITY, SUBSTITUTION OF PARTS NOT APPROVED BY ICE OR ANY ALTERATION OR REPAIR BY OTHERS IN SUCH MANNER AS IN ICE'S JUDGEMENT AFFECTS THE PRODUCT MATERIALLY AND ADVERSELY, SHALL VOID THIS WARRANTY.

NO EMPLOYEE OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY UNLESS SUCH CHANGE IS MADE IN WRITING AND SIGNED BY AN OFFICER OF ICE.

NOTE: ICE CORPORATION DOES NOT GUARANTEE ITS PRODUCTS AGAINST BREAKAGE DUE TO ABUSIVE USE. GENERALLY, DRIVING AT 10 BLOWS PER INCH PENETRATION IS CONSIDERED PRACTICAL REFUSAL FOR ANY SIZE HAMMER.

PREFACE

THIS MANUAL WAS PREPARED TO ACQUAINT THE OWNER, OPERATOR AND SERVICEMAN WITH THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE DIESEL PILE HAMMER. WE SUGGEST THAT THIS MANUAL BE CAREFULLY STUDIED BEFORE OPERATING OR UNDERTAKING ANY MAINTENANCE WORK ON THE HAMMER.

THIS MANUAL IS ORGANIZED INTO SECTIONS WHICH COVER PARTS, OPERATORS AND SERVICE. THE APPROPRIATE SECTION CAN READILY BE FOUND BY CONSULTING THE PICTORIAL INDEX LOCATED IN THE FRONT OF THIS BOOK.

THE DIESEL PILE HAMMER, JOINED WITH THE FAMILY OF OTHER ICE MACHINES INCORPORATES THE BEST OF ENGINEERING KNOWLEDGE, YEARS OF TECHNICAL EXPERIENCE AND IS CONSTRUCTED IN ACCORDANCE WITH THE HIGH STANDARDS OF THE COMPANY.

ALL MACHINES AND EQUIPMENT REQUIRE SYSTEMATIC, PERIODIC INSPECTION AND MAINTENANCE IF THEY ARE TO PERFORM SATISFACTORILY OVER A LONG PERIOD OF TIME. THE DIESEL PILE HAMMER IS PRIMARILY AN IMPACTING MACHINE AND IF NOT GIVEN THE BEST OF CARE, OR IF IMPROPERLY USED AND MAINTAINED, IS SELF DESTRUCTIVE. THEREFORE, THE HAMMER SHOULD RECIEVE AT LEAST THE SAME CARE AND MAINTENANCE AS OTHER HIGH QUALITY CONSTRUCTION EQUIPMENT.

WE DO NOT ATTEMPT TO COVER IN THIS MANUAL THE VARIOUS TYPES OF LEADS, SPECIAL DRIVING HEADS, PILING OR OTHER SPECIAL EQUIPMENT USED IN PILE DRIVING WORK. ANY INQUIRIES PERTAINING TO THIS EQUIPMENT OR, QUESTIONS CONCERNING THE OPERATION OR MAINTENANCE OF THE HAMMER SHOULD BE DIRECTED TO YOUR NEAREST ICE DISTRIBUTORS OR FACTORY.

FOR INSTRUCTIONS ON ORDERING PARTS, REFER TO BACK OF THIS PAGE.

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

PARTS LIST

INSTRUCTIONS FOR ORDERING PARTS

QUICK REFERENCE SYSTEM: Parts in this Manual can be readily found by consulting the Quick Reference System page to locate the appropriate Section. When the Section and applicable Figure are located, the Reference Number will assist you in obtaining the Part Number from the Parts List. Never order parts by reference number only. Whenever in doubt as to whether you can correctly order the Part desired, furnish casting number, sketch, photograph, or send in the old part.

ORIGINAL EQUIPMENT: Where effective serial numbers are given, these apply only to equipment and attachments originally furnished with the machine. Where additional equipment has been changed or added, these numbers do not necessarily apply.

OPTIONAL EQUIPMENT: In attempting to maintain this Manual so it will apply to possible future convertible options, all the parts shown may not apply to a particular machine, therefore, parts or assemblies marked optional should be double checked before ordering.

L.H. AND R.H. PARTS LOCATION: The illustrations in this Manual, unless specified otherwise, are shown facing the front of the hammer.

CIRCLED NUMBERS: Circled 0 or bracketed ( ) reference numbers indicate that the part is a unit assembly and made up of component parts which may be ordered separately if required. Indented items following the unit assembly are part of that assembly and may be ordered separately if required.

HARDWARE: Special hardware is shown by item number only. Standard hardware is shown by item number and size. All bolts, capscrews and nuts are hex head unless otherwise indicated. Hardware listed without reference number indicates these are used with the immediately preceeding reference numbered part.

ABBREVIATIONS: Following is a listing of common abbreviated terms used in this book.

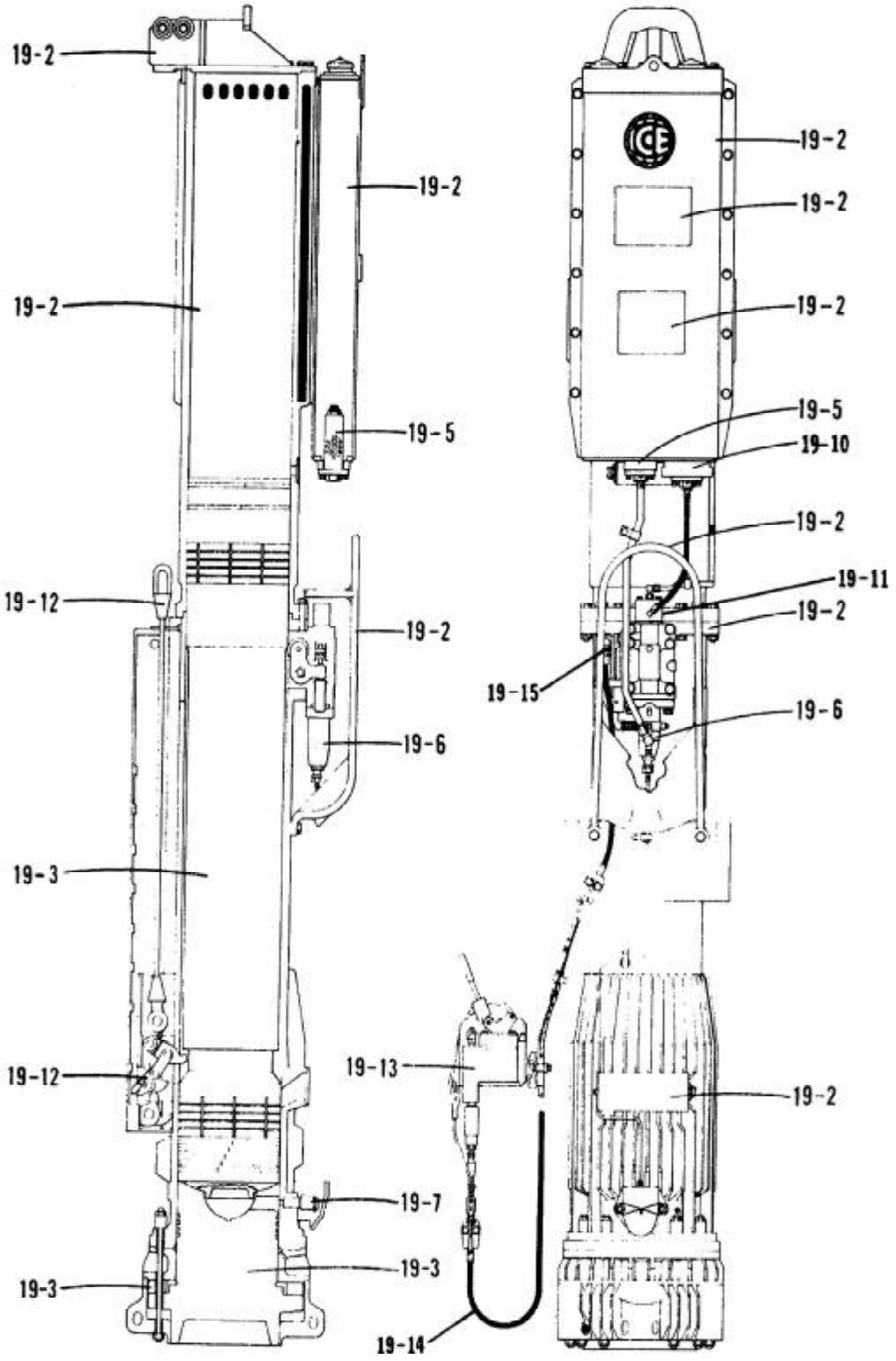
		N. S., not shown
A. R., as required	Dia., diameter	N. F., national fine
Assy., assembly	Diff., differential	Opt., optional
Adj., adjusting	Deg. (or) °, degree	Rd. Hd. Scr., round head screw
Brg., bearing	Fig., figure	Ref., reference
Brkt., bracket	Ftg. (s) fitting (s)	Req'd., required
Conn., connector	Ign., ignition	R.H., right hand
Ctrl., control	L.H., left hand	Sh.Mscr., sheet metal screw
Pt., point	M. Scr., machine screw	S.T.Scr., self tapping screw
Cyl., cylinder	N.C. National coarse	Std., standard

ORDERING: WHENEVER ORDERING PARTS, BE SURE TO INCLUDE THE MODEL AND SERIAL NUMBER OF YOUR MACHINE. Always place orders with your local distributor. This procedure will save you both time and money since orders sent to the factory will be referred to the distributor. In areas not covered by a distributor, orders will be shipped C.O.D. or SDBL unless other arrangements have been made with the factory. Confirm all telephone or telegraph orders immediately to avoid duplicating shipment.

SHIPMENT: State to whom shipment is to be made and method of shipment desired, whether Parcel Post, Express, Freight or Truck, otherwise our own judgement will be used. Claims for shortages or error should be made immediately upon receipt of parts. No responsibility will be assumed for delay, damage or loss to merchandise while in transit. Broken, damaged or lost material should be refused or a full description made of damage, or loss, to the carrier agent on the freight or express bill.

RETURN OF PARTS: If for any reason you desire to return parts to the factory, or to any distributor from whom these parts were obtained, you must first secure permission to return the parts. Shipping instructions will be given you along with this permission. A 10% handling charge must be assessed against the returned shipment unless an error is made by the factory, or by the distributor when filling your order.

Parts Pictorial Index



INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

Parts Pictorial Index

REF.	PART NO.	QTY.	DESCRIPTION
	19-1		"Y" Hitch
	19-2		Cylinder Head
	19-2		Fuel and Lube Tank
	19-2		Upper Cylinder
	19-2		Guard
	19-2		Lower Cylinder
	19-2		Name, Instruction Warning Plates
	19-3		Ram
	19-3		Anvil
	19-3		Recoil Dampener
	19-5		Fuel Filter
	19-6		Fuel Pump
	19-7		Fuel Injector, Fuel and Lube Lines
	19-8		Starting Fluid Injector
	19-10		Oil Filter
	19-11		Oil Pump
	19-12		Starting Device
	19-13		Transmitter and Double Relief Valve
	19-14		Hydraulic Hose and Cables
	19-15		Hydraulic Receiver
	19-16		Driving Head and Adaptor
	19-17		Guide Angles, Pads and Spuds Guides
	19-18		Equivalent Output Energy Rating Instrument
	19-19		Recommended Spare Parts List

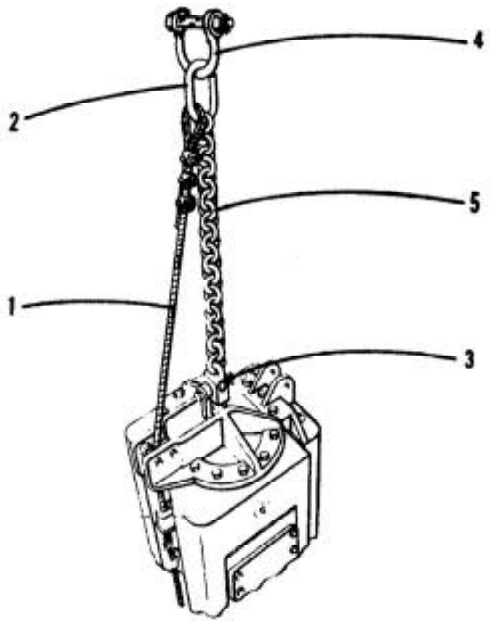
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

R1174

19–1–1.0

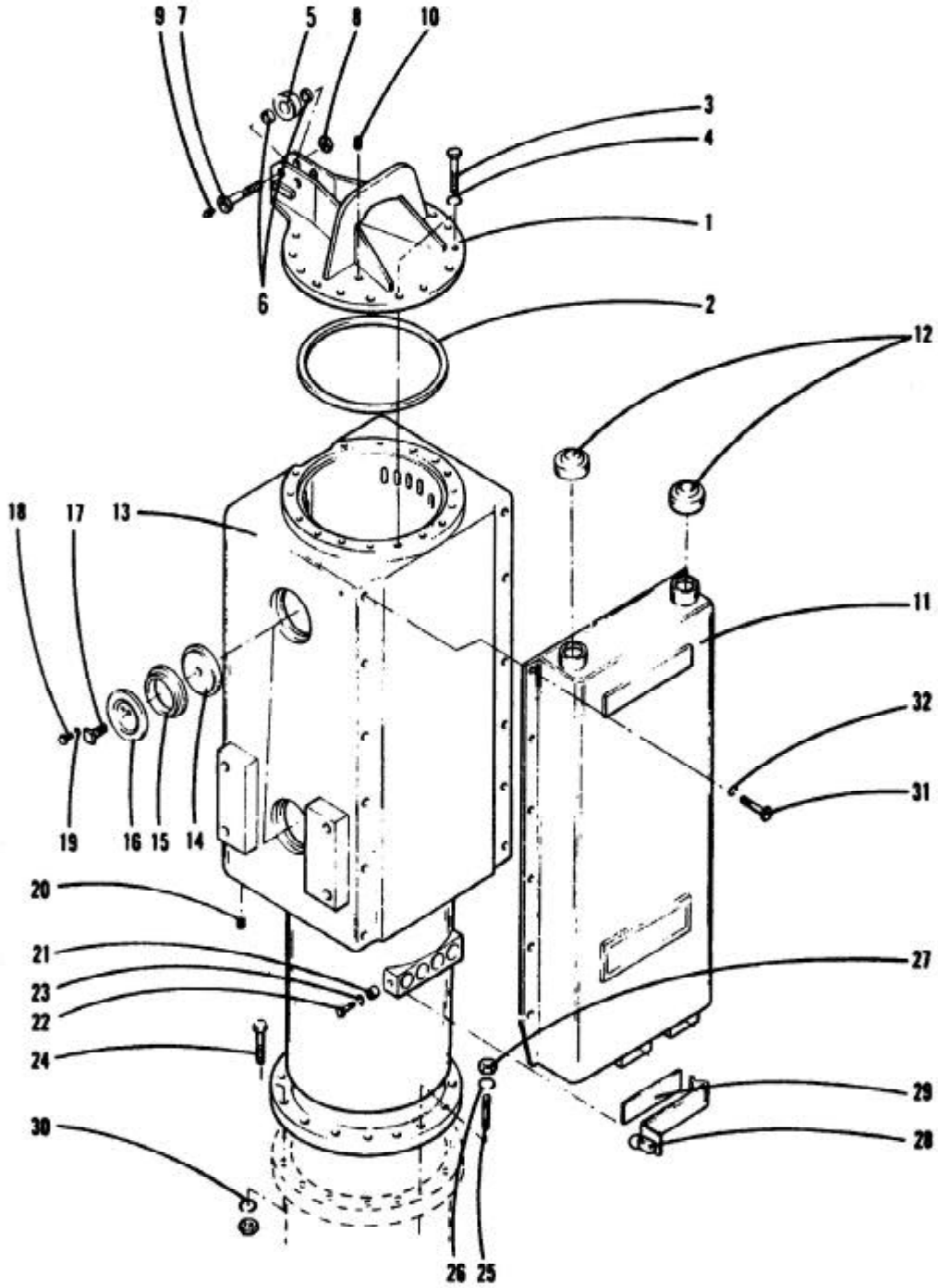
"Y" Hitch



G15Y10

REF.	PART NO.	QTY.	DESCRIPTION
	15Y10	1	"Y" Hitch Assembly
1	15Y13	1	Wire Rope, 1/2"
2	15Y14	1	"Missing Link"
3	7Z404	1	Safety Shackle
4	15Y6	1	Safety Shackle
5	15Y11	1	Chain and Anchor

Cylinder Head, Upper Cylinder, Fuel and Lube Tank



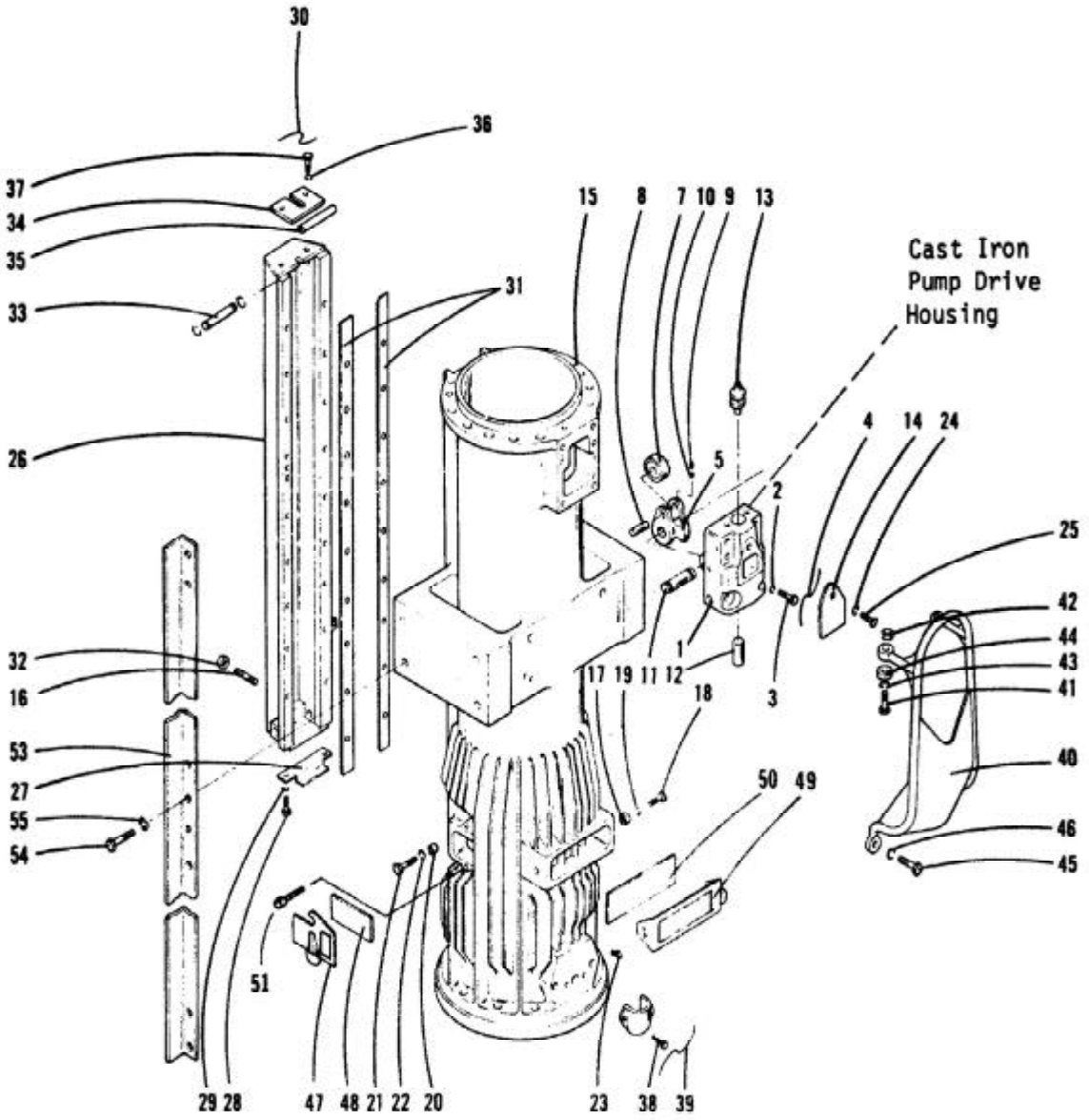
G16A8,15B13,15H24,15N7,15N33

CYLINDER HEAD, UPPER CYLINDER, FUEL AND LUBE TANK

REF.	PART NO.	QTY.	DESCRIPTION
1	15B29	1	Cylinder Head
2	7Z136	1	Gasket
3	1X2618	16	Capscrew
4	1X31	16	Lockwasher
5	7Z137	2	Roller, W/Bushing
6	7Z139	4	Bushing
7	15B36	2	Capscrew
8	1X109	2	Locknut
9	1X812	2	Grease Fitting, 1/8"
10	1X830	1	Pipe Plug
11	15H75	1	Fuel And Lube Tank
12	5Z393	2	Cap
13*	15A19	1	Upper Cylinder
14	15A15	4	Plate, Pressure
15	7Z19	4	Seal Ring
16	15A16	4	Plate, Clamping
17	1X2515	4	Bolt
18	1X2234	4	Capscrew
19	1X1571	4	Lockwasher
20	1X2249	2	Pipe Plug
21	15A17	2	Spacer
22	1X4154	2	Capscrew
23	1X27	2	Lockwasher
24	1X2749	12	Capscrew, Upper To Lower Cylinder
25	7Z9	2	Stud, Upper To Lower Cylinder
26	1X31	2	Lockwasher
27	1X171	2	Nut
28	15N33	1	Equalizer Port Cover
	15N34	1	Port Cover
	13N33	1	Latch
	15N18	1	Emblem
29	15N24	1	Gasket
30	1X31	12	Lockwasher
31	1X2618	12	Capscrew, Fuel Tank To Upper Cylinder
32	1X31	12	Lockwasher

Check W/Factory For Details

Fuel Pump Drive System And Lower Cylinder Name Plates

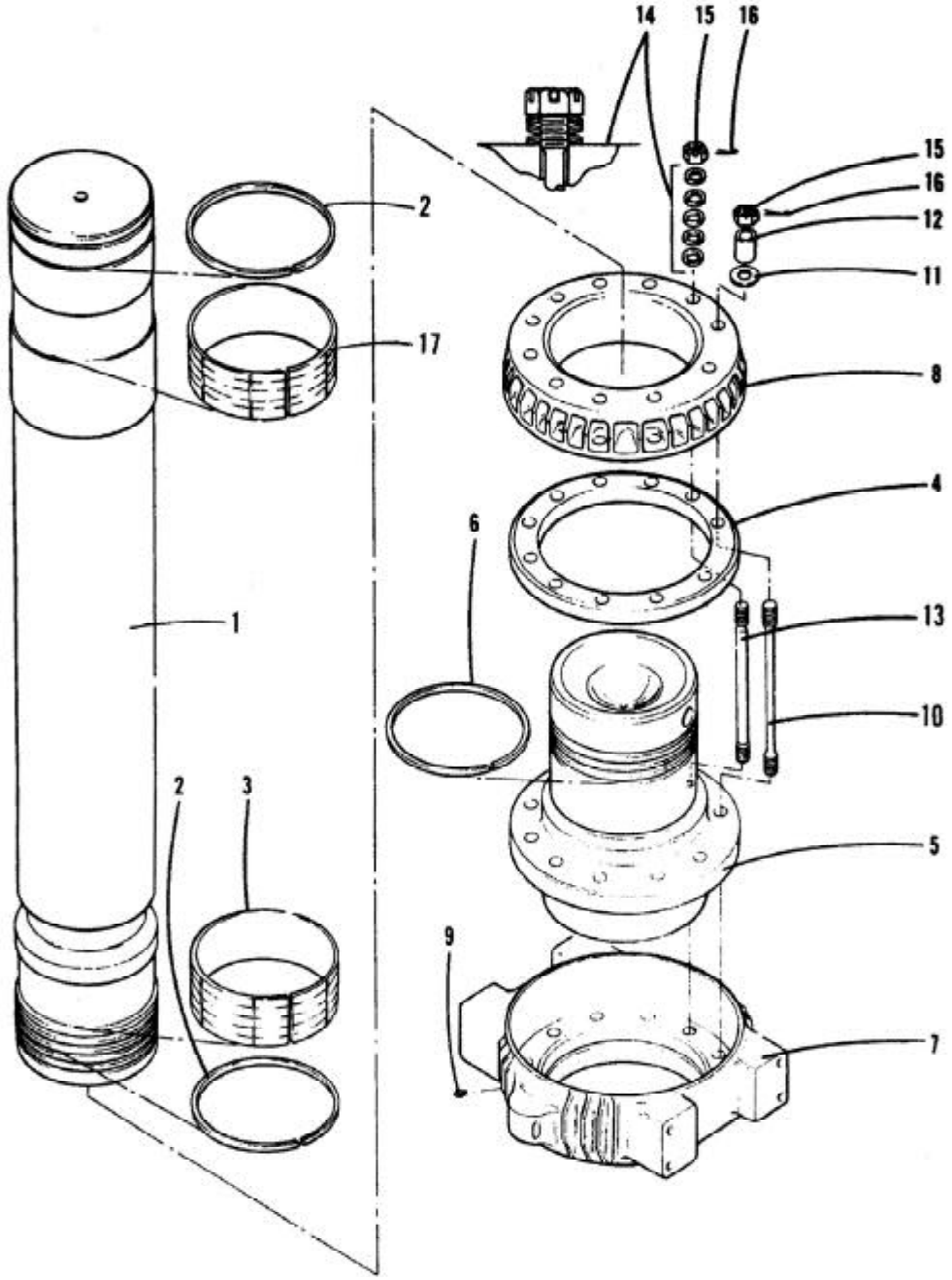


G15H22,15A8,15D6 ,15N7

FUEL PUMP DRIVE SYSTEM AND LOWER CYLINDER NAME PLATES

REF.	PART NO.	QTY.	DESCRIPTION
1	15H102	1	Housing (Cast Iron)
2	7Z346	6	Washer, Spring
3	7Z345	6	Capscrew
4		2	Locking Wire
5	15H100	1	Lever
7	7Z129	1	Cam Roller
8	15H97	1	Mounting Pin
9	1X1790	1	Lockscrew, 1/4"
10	1X481	1	Set Screw 1/4" x 1/4"
11	15H98	1	Shaft
11A	1X2460	1	Rollpin
12	15H2	1	Tappet
13	7Z154	1	Tappet
14	15H91	1	Cover
15*	15A7	1	Cylinder, Lower
16	7Z11	18	Stud
17	15A17	2	Spacer
18	1X4154	2	Capscrew
19	1X27	2	Lockwasher
20	15A20	4	Spacer
21	1X3951	4	Capscrew
22	1X6	4	Washer
23	1X812	6	Grease Fitting, 1/8"
24	1X28	1	Lockwasher, 3/8"
25	1X527	1	Capscrew, 3/8" x 5/8"
26	15D9	1	Cover
27	7Z430	1	Dirt Guard
28	15D14	2	Capscrew
29	1X4	2	Washer
30		2	Locking Wire
31	7Z102	2	Wear Strip
32	1X1647	18	Locknut
33	7Z130	1	Pin
34	7Z456	1	Cover Plate Assembly
35	7Z456	1	Cover Plate Assembly
36	1X30	2	Lockwasher, 1/2"
37	5Z526	2	Capscrew
38	5Z724	2	Capscrew
39		1	Locking Wire
40	15N12	1	Guard, Pump
41	7Z290	2	Capscrew
42	1X171	2	Nut
43	1X31	2	Lockwasher
44	7Z449	2	Spacer, A.R.
45	1X2251	2	Capscrew
46	1X109	2	Locknut
47	15N32	2	Intake Cover Assembly
	15N30	2	Cover
	13N33	2	Latch
	15N18	2	Emblem
48	15N31	2	Gasket
49	15N35	1	Exhaust Cover Assembly
	15N21		Cover
	13N33	1	Latch
	15N19	1	Emblem
50	7Z297	1	Gasket
			See Parts Code Page 19-17
51	5Z724	2	Capscrew
			Consult Factory For Details
			Name And Instruction Plates
	13P23	1	Operating Instructions (On Fuel & Lube Tank)
	15P25	1	Lube & Fuel Instructions (On Fuel & Lube Tank)
	13P46	1	Name & Patent Plate (On O.D. Of Cylinder)
	1X1516	4	Drive Screw

Ram, Anvil And Dampener



G15B6,14

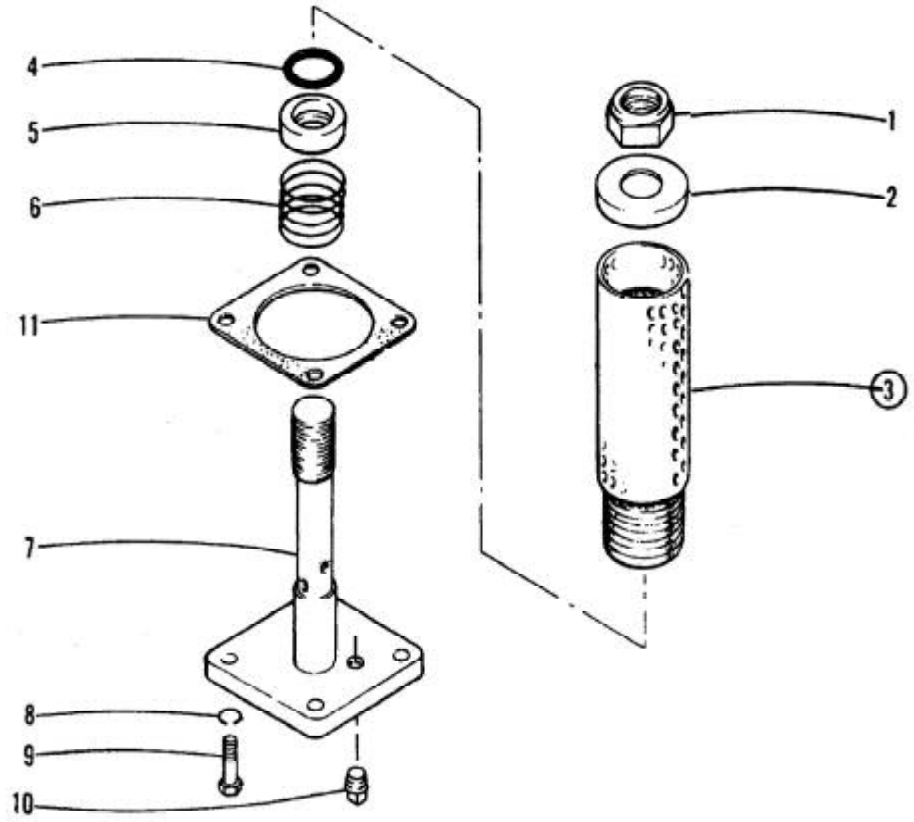
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

Ram, Anvil And Dampener

REF.	PART NO.	QTY.	DESCRIPTION
1	15B9	1	Ram
2	7Z267	7	Piston Ring
3	7Z360	1	Wear Ring
4	15B13	1	Recoil Dampener
5	15B14	1	Anvil
6	7Z267	4	Piston Ring
7	15B15	1	Anvil Guide
8	15B16	1	Cooling Ring
9	1X812	2	Grease Fitting, 1/8"
10	15B17	10	Stud
11	5Z455	10	Washer, Spring
12	7Z314	10	Spacer
13	15B18	1	Stud, Alignment
14	5Z455	7	Washer, Spring
15	1X2164	22	Nut
16	1X1304	22	Cotter, 5/32" x 1-1/2"
17	15B45	1	Wear Ring

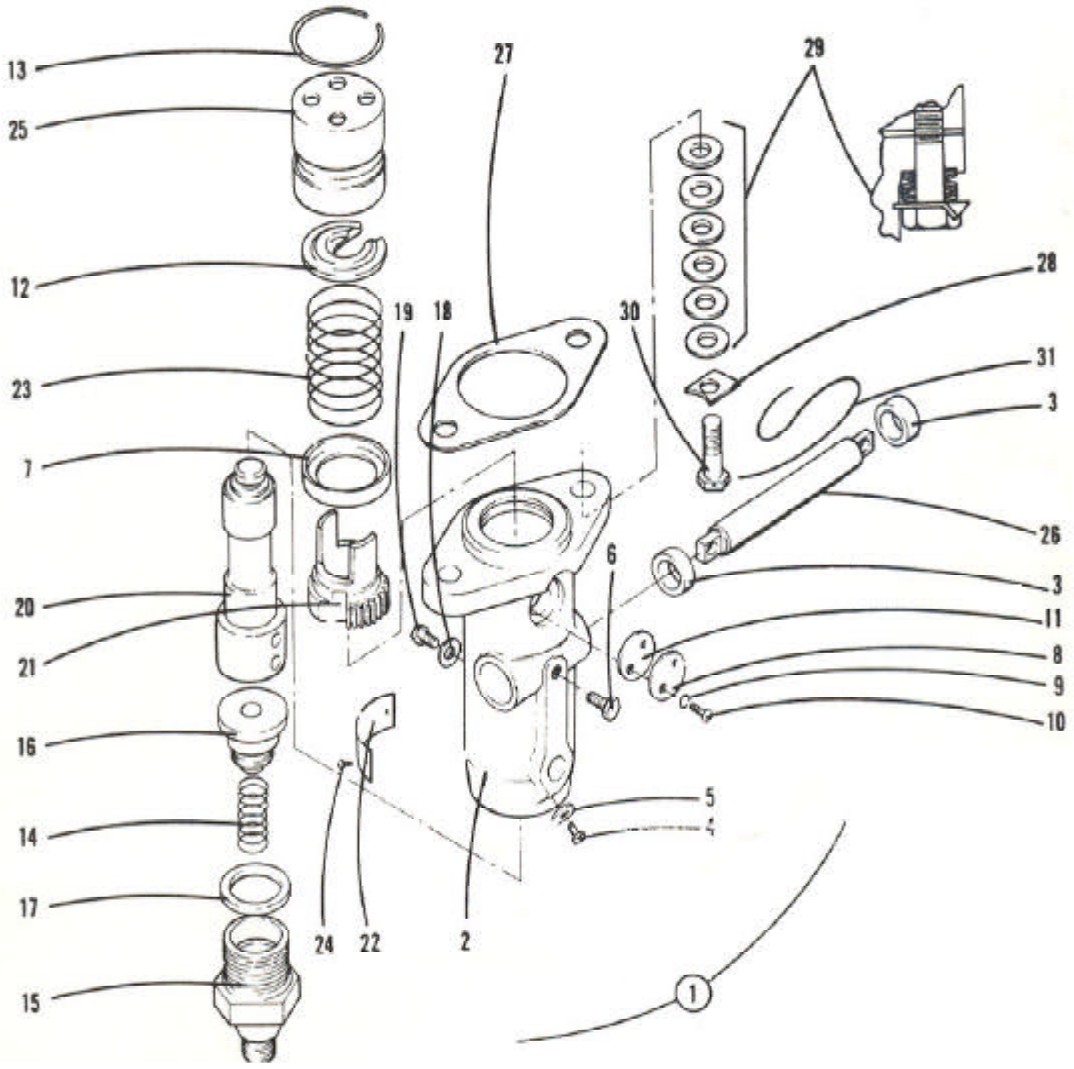
Fuel Filter Assembly



G13H20 S-2083-A

REF.	PART NO.	QTY	DESCRIPTION
	13H333	1	Fuel Filter Assembly
1	1X3837	1	Locknut
2	5Z930	1	Plate, Top End
3	5Z986	1	Element, Filter Assembly
4	1X8006	1	"O" Ring
5	5Z928	1	Plate, Bottom End
6	5Z91	1	Spring
7	13H335	1	Head, Filter
8	1X28	4	Lockwasher, 3/8"
9	1X2823	4	Capscrew
10	1X826	1	Pipe Plug, 1/8"
11	13H203	1	Gasket

Fuel Pump Assembly



15H29 15H27

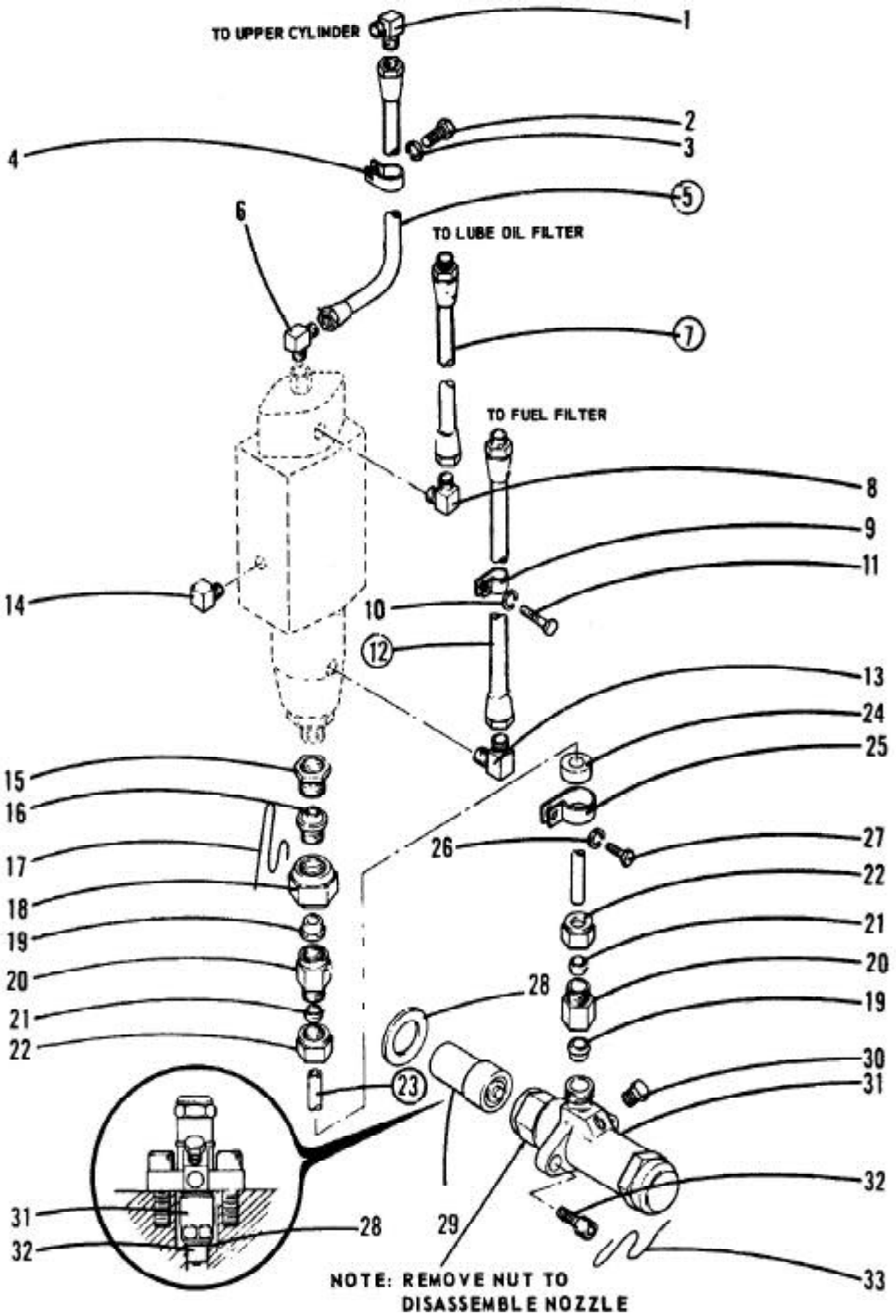
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

Fuel Pump Assembly

REF.	PART NO.	QTY.	DESCRIPTION
1	7Z463	1	Fuel Pump Assembly
2	3Z73	1	Housing W/ Bushing
3	3Z39	2	Bushing
4	3Z75	1	Bleed Screw
5	3Z41	1	Gasket
6	3Z48	1	Screw
7	3Z77	1	Seat
8	3Z31	1	Window Cover
9	3Z29	2	Gasket
10	3Z30	2	Screw
11	3Z36	1	Gasket
12	3Z58	1	Seat
13	3Z76	1	Snap Ring
14	3Z28	1	Spring
15	3Z27	1	Holder
16	3Z54	1	Valve
17	3Z42	1	Gasket
18	3Z40	1	Gasket
19	3Z47	1	Screw
20	3Z37	1	Plunger
21	3Z52	1	Sleeve
22	NP7659	1	Name Plate
23	3Z50	1	Spring
24	SC150-2	2	Rivet, Name Plate
25	3Z74	1	Cup
26	3Z44	1	Control Rack
27	7Z30	4	Shim, 22 GA., A.R.
28	7Z440	2	Lock Plate, 16 GA.
29	5Z240	12	Washer, Spring
30	1X2744	2	Capscrew
31		1	Locking Wire

Injector Assembly, Fuel And Lube Lines



15H23, 15H29

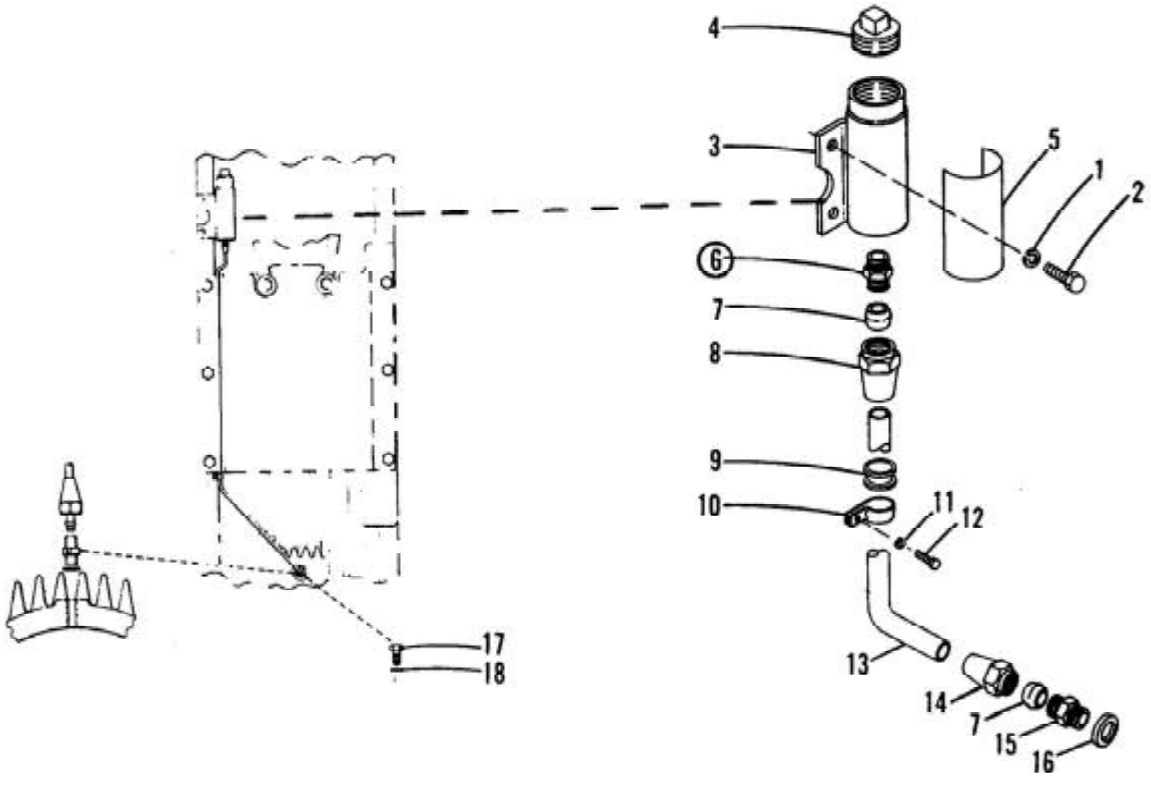
INTERNATIONAL CONSTRUCTION EQUIPMENT INC.

Parts List

Injector Assembly, Fuel And Lube Lines

REF.	PART NO.	QTY.	DESCRIPTION
1	6Z155	1	Elbow
2	1X3860	2	Capscrew
3	1X27	2	Lockwasher
4	5Z621	2	Clamp, Tube
⑤	15H28	1	Hose Assembly W/ Fittings
6	6Z432	1	Elbow
⑦	15H39	1	Hose Assembly W/ Fittings
8	6Z432	1	Elbow
9	5Z623	1	Clamp, Tube
10	1X27	1	Lockwasher
11	1X3860	1	Capscrew
⑫	15H41	1	Hose Assembly W/ Fittings
13	5Z189	1	Elbow
14	1X823	1	Plug, Pipe
	7Z432	1	Line Fitting Assembly
15	5Z509	1	Bushing
16	7Z431	1	Nipple
17		1	Wire, Locking
18	5Z510	1	Coupling
	15H32	1	Tube Assembly
19	5Z200	2	Sleeve
20	5Z197	2	Nut, Diesel
21	5Z198	2	Sleeve
22	5Z199	2	Nut
23	15H31	1	Tube
24	5Z421	2	Grommet
25	5Z208	2	Clamp
26	1X27	2	Lockwasher
27	1X3860	2	Capscrew
	13H373	1	Injector Assembly
28	5Z240	1	Washer, Spring
29	13H374	1	Nozzle
30	5Z204	1	Plug
31	6Z304	1	Holder
32	5Z724	2	Capscrew
33		1	Wire, Locking

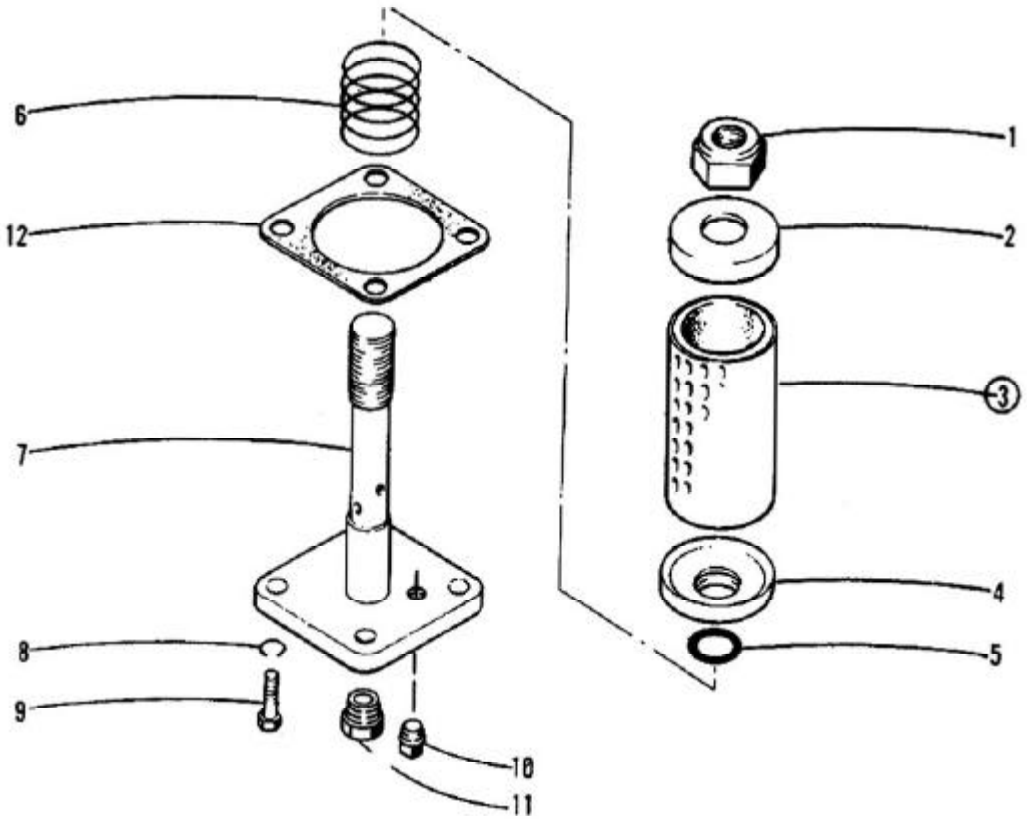
Starting Fluid Injector



15H47,27P8 S-2085-A

REF.	PART NO.	QTY.	DESCRIPTION	REF.	PART NO.	QTY.	DESCRIPTION
	1X30	2	Lockwasher, 1/2"	18	6Z336	1	Gasket, Copper
2	1X3951	2	Capscrew				
3	15H106	1	Starting Fluid Tank				
4	15H72	1	Pipe Plug	10	1X8020	2	Clamp, Tube ┐180 And
5	15H57	1	Emblem	11	1X25	2	Lockwasher 520 DPH
6	6Z341	1	Connector Assembly	12	1X8010	2	Screw, Machine
7	6Z338	2	Sleeves, Compression	13	15H37	1	Tube, Copper ┘
8	6Z339	1	Nut, Compression				
9	5Z421	1	Grommet ┐-440 DPH				
10	5Z208	1	Clamp (For 180				
11	1X27	1	Lockwasher And 520 DPH				
12	1X3860	1	Capscrew - See Be-				
13	13H319	1	Tube, Copper ┘ low)				
	27H183	1	Tube, Copper, (660 DPH - Only)				
14	1X1348	1	Nut, Union				
15	6Z335	1	Valve, Check				
16	6Z336	1	Gasket				
			If Starting Fluid Injector Is Installed, Save The Following Items:				
17	1X3863	1	Capscrew, 7/16" x 3/4"				

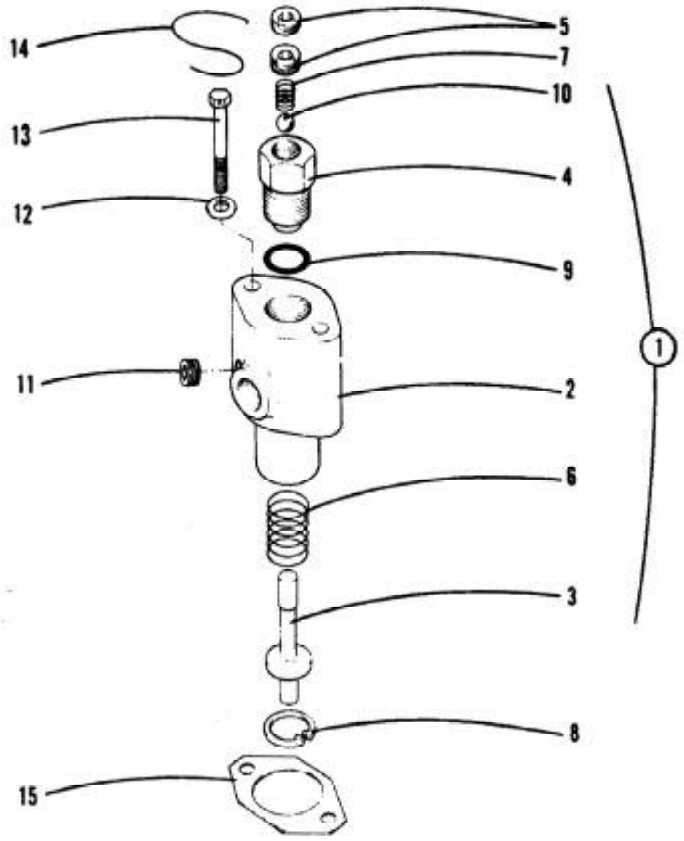
Oil Filter Assembly



G13H20 S-2083-A

REF.	PART NO.	QTY.	DESCRIPTION
	13H334	1	Oil Filter Assembly
1	1X3837	1	Locknut
2	5Z1029	1	Plate, Top End
3	15H55	1	Filter Element Assembly
4	5Z1030	1	Plate, Bottom End
5	1X8006	1	"O" Ring
6	5Z91	1	Spring
7	13H331	1	Head, Filter
8	1X28	4	Lockwasher
9	1X2823	4	Capscrew
10	1X826	1	Pipe Plug, 1/8"
11	1X2168	1	Bushing, Pipe (Not Used on 660 DPH)
12	13H203	1	Gasket

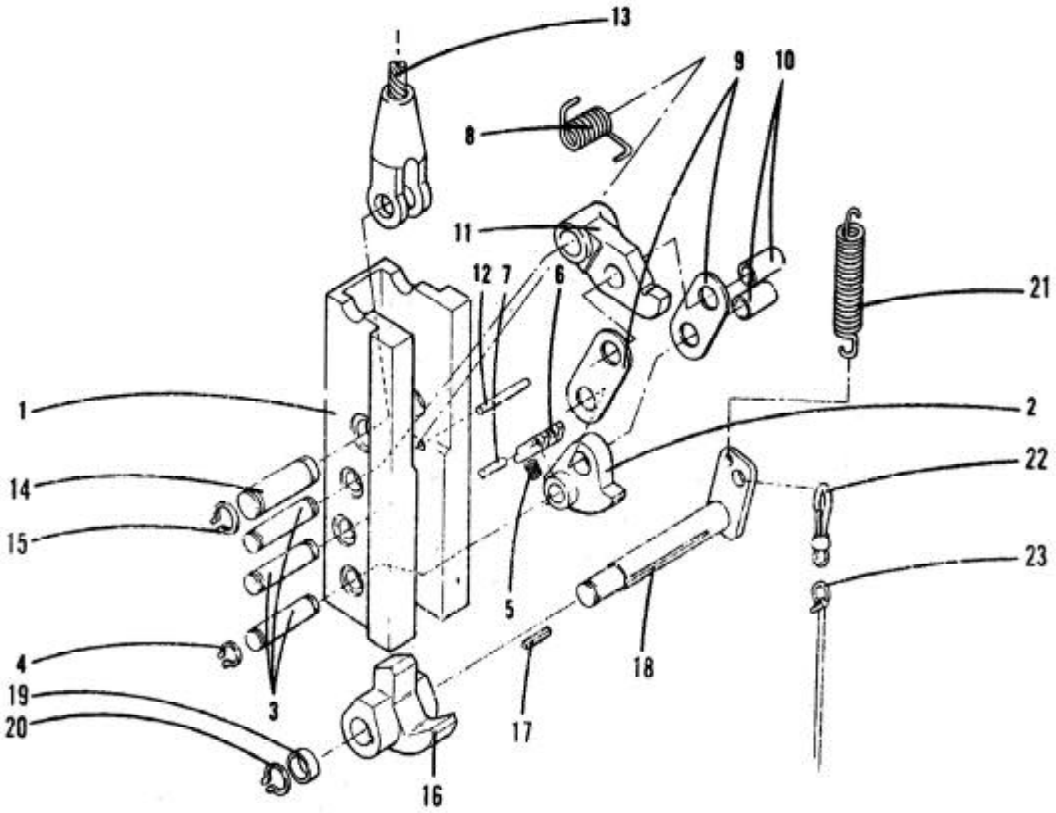
Oil Pump Assembly



G15H23 , 6Z590

REF.	PART NO.	QTY	DESCRIPTION
①	6Z590	1	Lubricating Oil Pump Assembly
2	5Z121	1	Housing
3	5Z122	1	Plunger
4	5Z720	1	Fitting, Discharge
5	1X1792	2	Lockscrew, 3/8"
6	5Z125	1	Spring
7	5Z126	1	Spring
8	1X2050	1	Retaining Ring
9	1X8031	1	"O" Ring
10	5Z129	1	Ball, Steel
11	1X823	1	Pipe Plug, 1/8"
12	5Z318	2	Washer, Spring
13	5Z365	2	Capscrew
14		1	Locking Wire
15	5Z130		Shim, 22 GA., A.R.

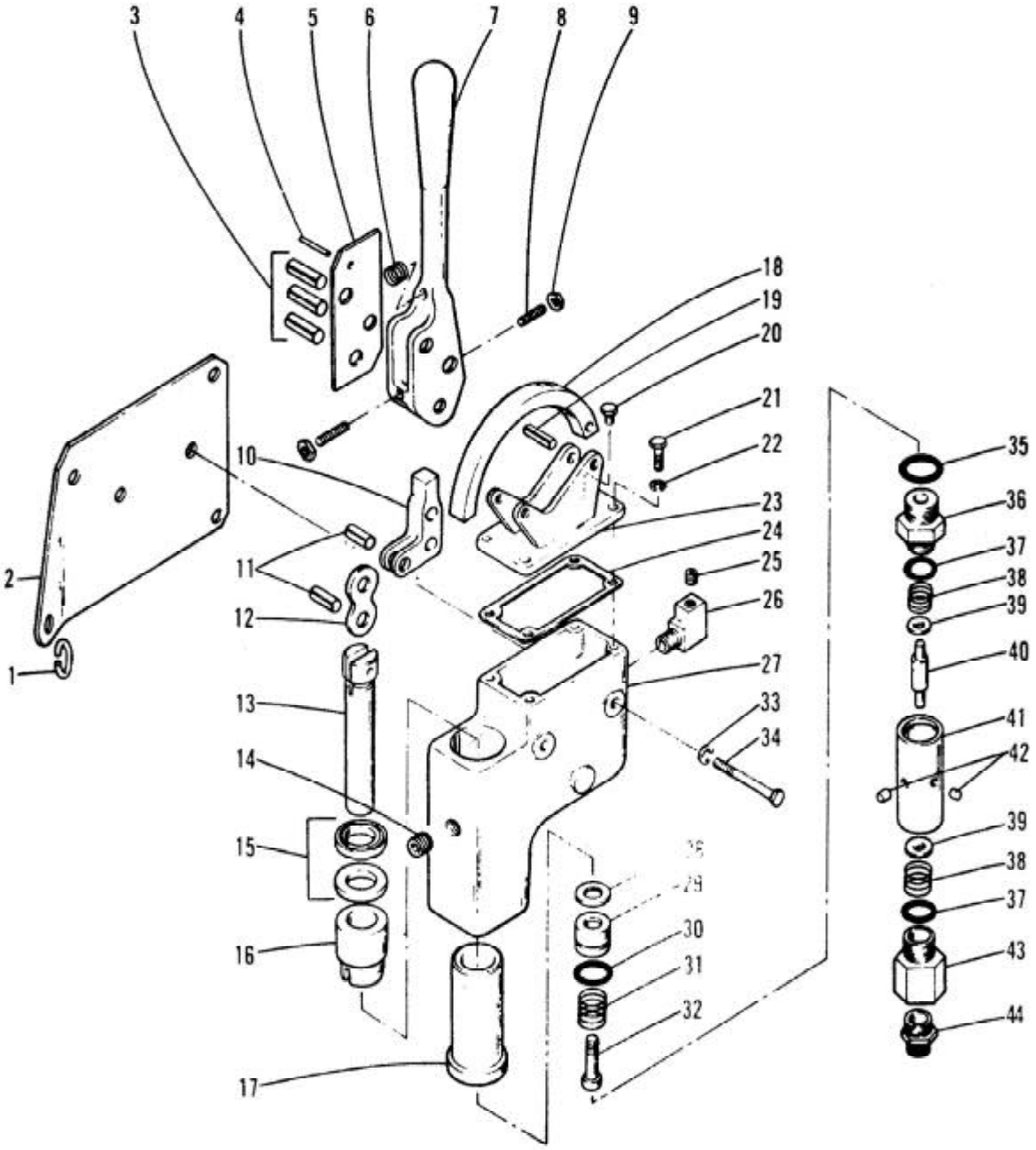
Starting Device



G15D6

REF.	PART NO.	QTY.	DESCRIPTION	REF.	PART NO.	QTY.	DESCRIPTION
1	7Z428	1	Housing	14	7Z85	1	Pin
2	7Z78	1	Lever	15	1X1850	2	Snap Ring
3	27D206	3	Pin	16	7Z260	1	Latch Block
4	1X1860	6	Snap Ring	17	7Z98	1	Key
5	7Z75	1	Spring	18	15D4	1	Block And Lever
6	15D10	1	Lever	19	15D5	1	Spacer
7	7Z77	1	Pin, Dowel	20	1X2492	2	Retaining Ring
8	7Z82	1	Spring	21	5Z61	1	Spring
9	7Z79	2	Link	22	6Z267	1	Snap Shackle
10	7Z80	2	Pin	23	5Z63	1	Rope
11	7Z81	1	Lever				
12	1X2042	1	Rollpin				
13	7Z83	1	Wire Rope Assembly				

** Transmitter And Double Relief Valve



G15J9 - 13J45

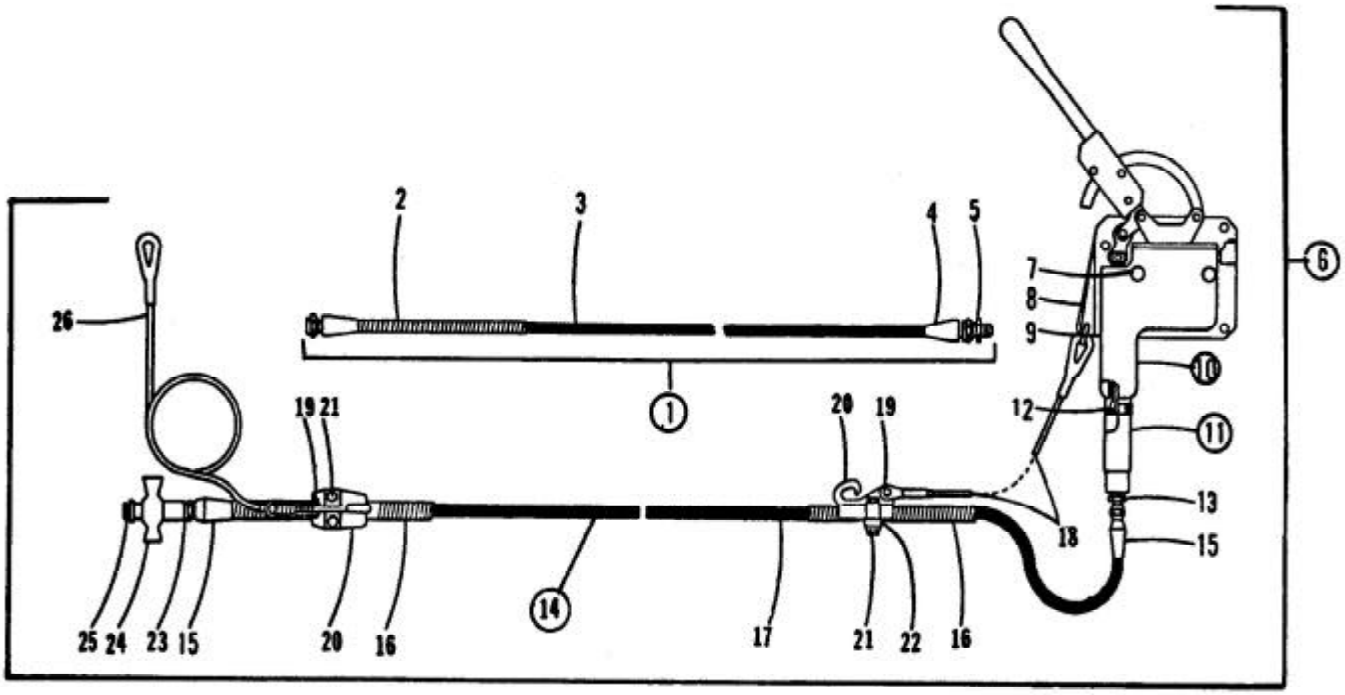
S-2087-B

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

** Transmitter And Double Relief Valve

REF.	PART NO.	QTY.	DESCRIPTION
1	1X8027	1	Link
2**	15J33	1	Plate, Control
**	13J45	1	Transmitter Assembly
3	1X2437	3	Rollpin
4	1X2346	1	Rollpin
5	5Z916	2	Lock, Lever
6	1X8032	1	Spring
7	5Z1040	1	Lever
8	1X2345	2	Screw, Set, 1/4" x 3/4"
9	1X180	2	Nut, Jam
10	5Z1039	1	Lever
11	1X1965	2	Rollpin
12	5Z520	1	Bar, Side
13	13J48	1	Piston
14	1X823	1	Plug, Pipe
15	1X5603	2	Seal
16*		1	Liner
17*		1	Liner
18	5Z1209	1	Quadrant
19	1X2413	2	Rollpin
20	5Z911	1	Cover, Oil
21	1X512	4	Capscrew
22	1X26	4	Lockwasher, 1/4"
23	13J49	1	Plate, Cover
24	5Z550	1	Gasket
25	1X824	1	Plug, Pipe
26	1X8023	1	Elbow
27*		1	Body
28	5Z1376	1	Washer
29	5Z759	1	Piston
30	1X8024	1	"O" Ring
31	1X8032	1	Spring
32	1X2242	1	Bolt
33	1X27	2	Lockwasher, 5/16"
34	1X3898	2	Capscrew
**	13J50	1	Double Relief Valve Assembly
*	13J51	1	Body Assembly
35	1X8022	1	"O" Ring
36	5Z990	1	Cap
37	5Z556	2	"O" Ring
38	5Z555	2	Spring
39	1X1776	2	Washer
40*		1	Piston
41*		1	Body
42*	5Z795	2	Dowel
43	5Z835	1	Cap
44	1X1151	1	Connector
*			Not Sold Separately
**			Part of Hydraulic Control Assembly, 15J36



15J15,22,36

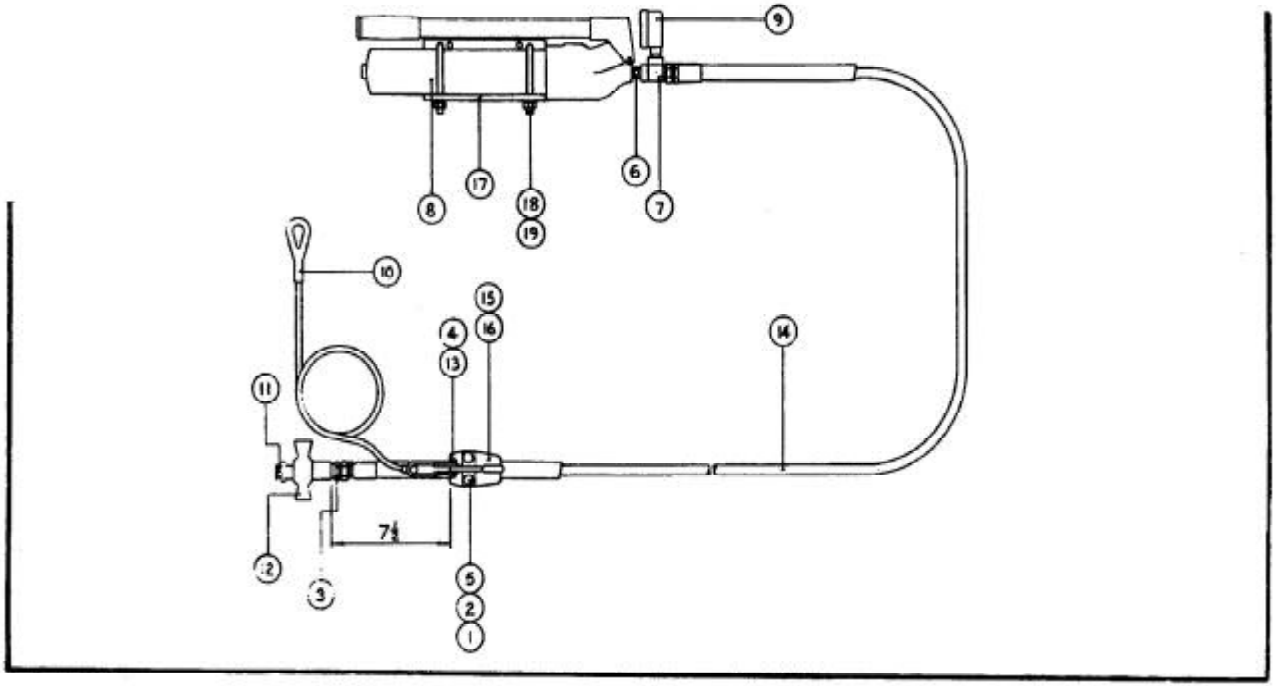
S-2095-B

HYDRAULIC CONTROL SYSTEM

REF.	PART NO.	QTY.	DESCRIPTION	REF	PART NO.	QTY.	DESCRIPTION
1	15J22	1	Hose Ext. Assy., 20'	18	5Z62	1	Rope, Strain & Pull
2	5Z165	1	Sleeve, Coil	19	5Z454	2	Pin, Clevis
3		1	Hose, 20'		1X2219	2	Pin, Groove
4	1X8033	2	Fitting, Female Swivel	20	15J30	2	Bracket, Hanger & Hook
5	1X1156	1	Union	21	1X3757	4	Capscrew
6	15J36	1	Hydraulic Control System		1X28	4	Lockwasher, 3/8"
7	1X3898	2	Capscrew		1X151	4	Nut
	1X27	2	Lockwasher, 5/16"	22	15J31	1	Bar
8	15J33	1	Plate, Mounting	23	1X1150	1	Fitting Connector
9	1X8027	1	Link, Chain	24	5Z298	1	Coupling
10	13J45	1	Transmitter Assy. (See Page 19-13)	25	5Z230	1	Plug, Dust
				26	5Z62	1	Rope & Strain & Pull
11	13J50	1	Double Relief Assy. (See Page 19-13)				
12	1X8022	1	"O" Ring				
13	1X1151	1	Connector				
14	15J15	1	Hose Assy.				
15	1X8033	2	Fitting, Fm. Swivel				
16	5Z165	2	Sleeve, Coil				
17		1	Hose, 60'				

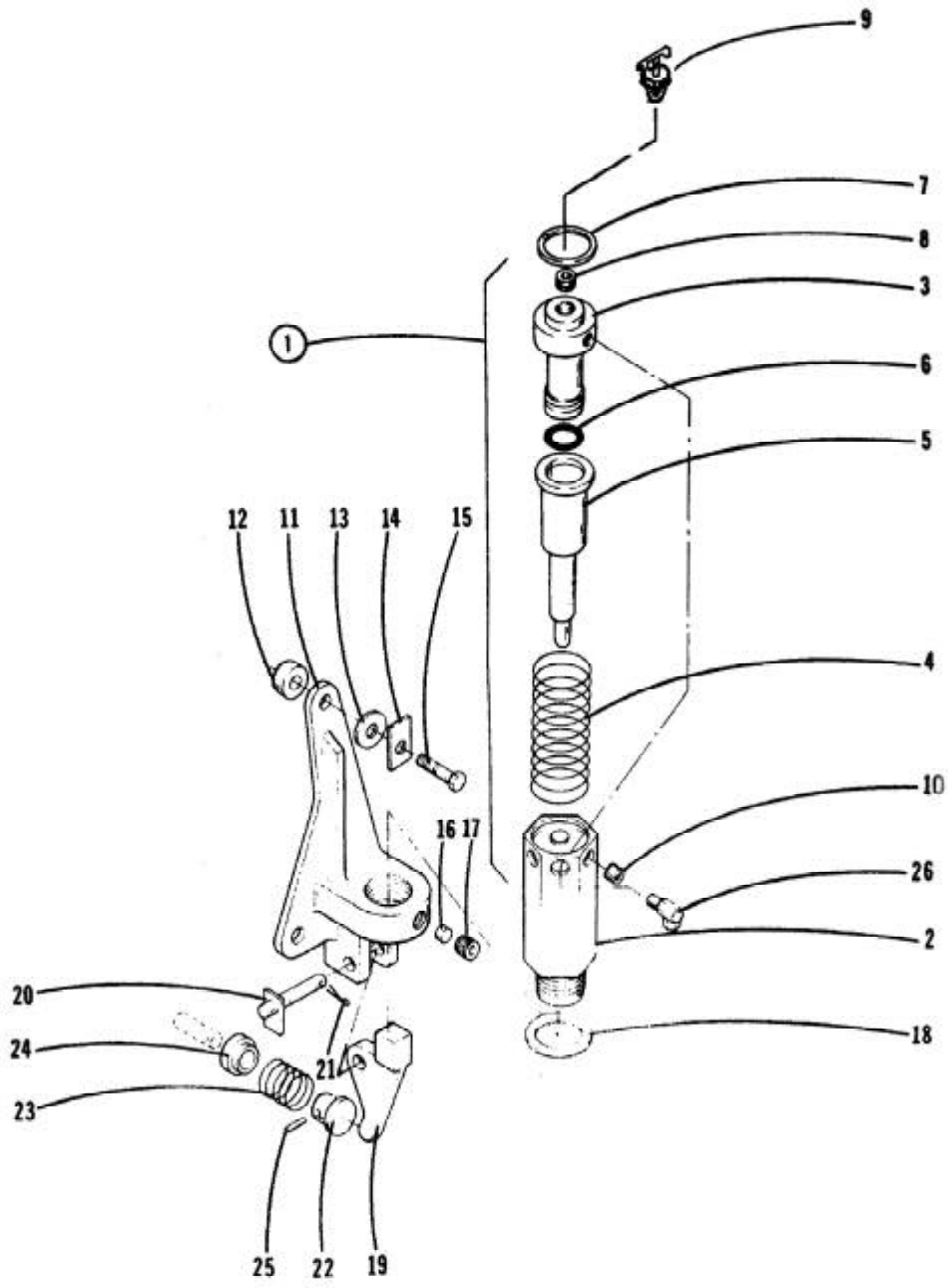
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

19-14-2.1
PARTS LIST



HYDRAULIC CONTROL SYSTEM II							
REF.	PART NO.	QTY.	DESCRIPTION	REF	PART NO.	QTY.	DESCRIPTION
1	1X0028	2	Lockwasher				
2	1X0151	2	Nut				
3	1X1150	1	Male Connector				
4	1X2219	1	Groove Pin				
5	1X3757	2	Capscrew				
6	1X7019	1	1/4 NPT Hex Nipple				
7	1X8151	1	1/4 NPT Female X #6 Tee				
8	1X8152	1	Hand Pump				
9	1X8153	1	Pressure Gauge				
10	5Z0062	1	Strain & Pull Rope				
11	5Z0230	1	Dust Plug				
12	5Z0298	1	Coupling				
13	5Z0454	1	Clevis Pin				
14	15J0015	1	Hose Assy				
15	15J0030	1	Hanger & Hook Brkt.				
16	15J0031	1	Bar				
17	10J0009	1	Bracket				
18	1X8394	2	U-Bolt				
19	1X0026	4	Lockwasher				

Hydraulic Receiver



G15J8

HYDRAULIC RECEIVER

REF.	PART NO.	QTY.	DESCRIPTION
1	13J54	1	Hydraulic Receiver Assembly
2	5Z974	1	Casing
3	5Z975	1	Piston
4	1X8008	1	Spring
5	13J55	1	Rod
6	1X8024	1	"O" Ring Kit
7	1X2369	1	Snap Ring
8	1X814	1	Bushing, Reducing
9	1X7002	1	Drain Cock
10	1X824	1	Pipe Plug
11	15J27	1	Bracket
12	7Z143	2	Bushing
13	5Z240	2	Washer
14	7Z258	2	Lock Plate
15	1X2746	2	Capscrew
16	5Z725	1	Plug
17	1X485	1	Set Screw, 3/8" x 3/8"
18	5Z491	2	Shim, 22 GA., A.R.
19	7Z145	1	Bell Crank
20	7Z385	1	Pin
21	1X1086	1	Cotter, 1/8" x 1"
22	15J2[illegible]	1	Spring Seat
23	7Z15[illegible]	1	Spring
24	15J28	1	Stop Rack
25	1X2048	1	Rollpin
26	5Z1211	1	Adaptor

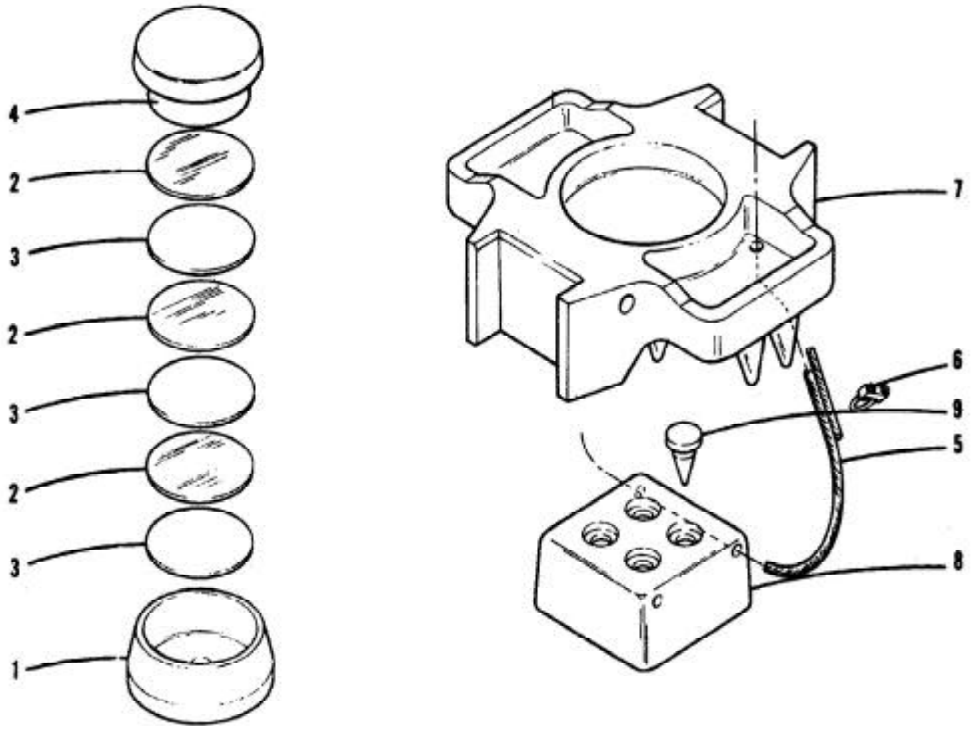
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

R1174

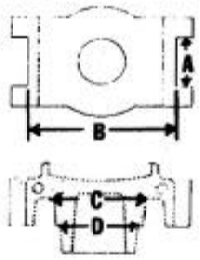
19—16—1.0

Driving Head And Adaptor

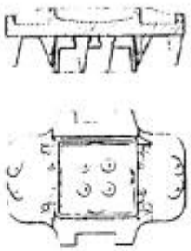


G 15S3028

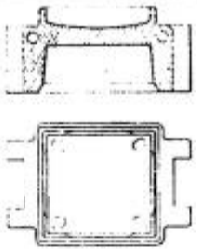
REF.	PART NO.	QTY	DESCRIPTION
1	7Z162	1	Adaptor
2	7Z163	3	Disc, Aluminum
3	7Z164	3	Disc, Plastic
4	7Z165	1	Cap
5	5Z289	1	Wire Rope
6	1X51	3	Clip
7*		1	Driving Head
8*		1	Filler
9*		4	Filler Tip
*			Parts Listed For Reference Only



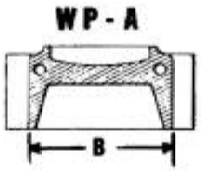
CP-A



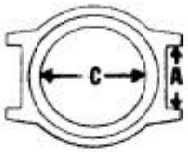
UP-C

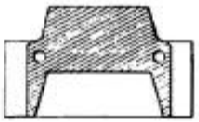


SC-A

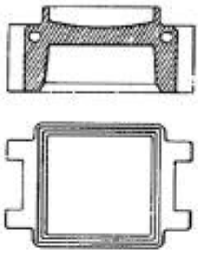


WP-A





WP-B

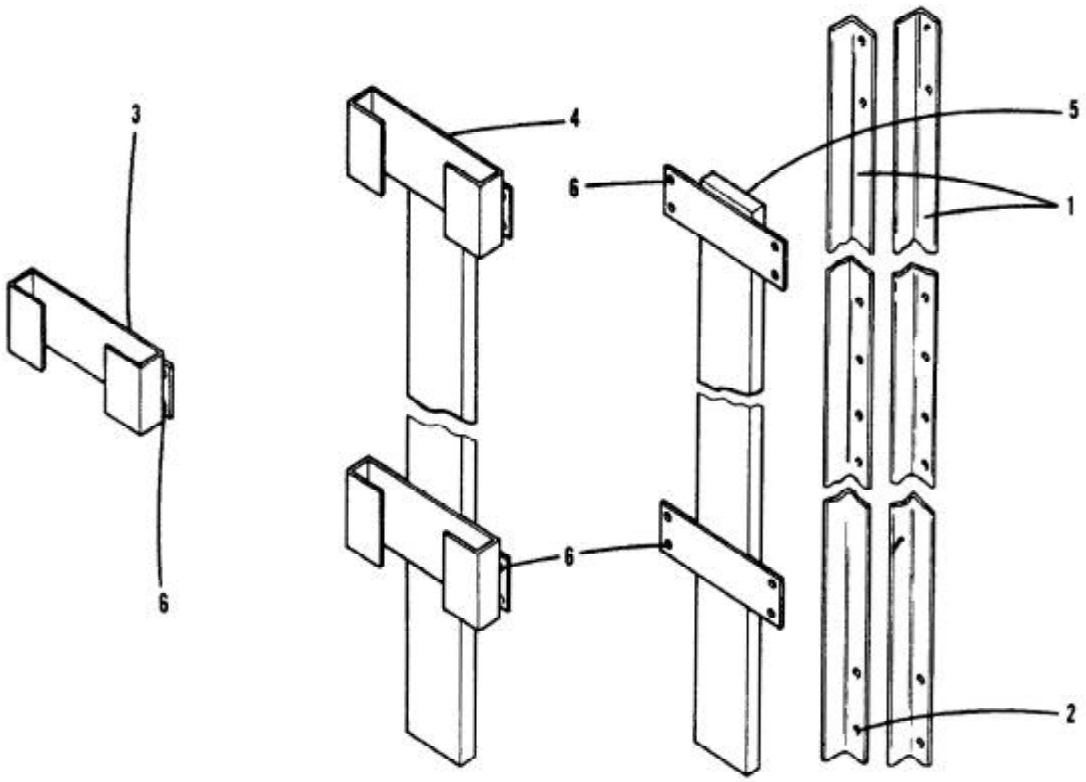


SC-B

DRIVING HEADS AND FILLERS

STYLE	PART NO.	CASTING	LEAD DIMENSIONS		HEAD DIMENSION		PILE TYPE	FILLER	TIP	G
			RAILS	SPACING	TOP	BOTTOM				
CP-A	7Z169	S3375-3	6" **A**	18-1/2" **B**	11-1/4" **C**	9-1/2" **D**	CYLINDRICAL			7Z18
	7Z266	S3375-3	6"	18-1/2"	10-1/4"	NONE	CYLINDRICAL			7Z57
	15S4	S3375-3	8"	18-1/2"	11-1/4"	9-1/2"	CYLINDRICAL			15S4
	15S15	S3375-3	6"	18-1/2"	7-7/8"	NONE	CYLINDRICAL			15S11
UP-C	15S12	S4373-1	6"	18-1/2"	12-3/4" SQUARE		UNIVERSAL			15S9
	15S23	S4373-1	7"	18-1/2"	12-3/4" SQUARE		UNIVERSAL			15S19
	15S24	S4373-1	8"	18-1/2"	12-3/4" SQUARE		UNIVERSAL			15S20
								15S8	15S9	15S8
SC-A	7Z206	S3470-2	6"	18-1/2"	12-1/2"		SQUARE CONCRETE			7Z28
	7Z242	S3470-2	7"	18-1/2"	12-1/2"		SQUARE CONCRETE			7Z44
	7Z241	S3470-2	7-3/8"	18-1/2"	12-1/2"		SQUARE CONCRETE			7Z45
	7Z541	S3470-2	7"	18-1/2"	12-1/2"		SQUARE CONCRETE			7Z134
	15S25	S3470-2	8"	18-1/2"	12-1/2"		SQUARE CONCRETE			15S21
	15S18	S3470-2	6"	18-1/2"	13"		OCTAGONAL CONCRETE			15S14
WP-A	7A329	S3601-1	6" **A**	18-1/2" **B**	13" **C**		WOOD			7Z76
	7Z244	S3537	6"	20"	13"		WOOD			7Z46
	7Z245	S3538	8"	20"	13"		WOOD			7Z47
	7Z362	S3537	8"	20-1/2"	13"		WOOD			7Z95
	7Z363	S3537	7"	19-1/2"	13"		WOOD			7Z90
	7Z437	S3537	7"	20"	13"		WOOD			7Z108
	7Z455	S3601-1	7"	18-1/2"	13"		WOOD			7Z114
	15S3	S3601-1	8"	18-1/2"	13"		WOOD			15S3
	15S21	S3601-1	6-1/4"	18-1/2"	13"		WOOD			15S17
	15S22	S3601-1	7-1/2"	18-1/2"	13"		WOOD			15S18
WP-B	7Z424	S3714-1	6"	18-1/2"	13"		WOOD W/O ADAPTOR			7Z102
SC-B	15S20	S4570	6"	18-1/2"	15" SQUARE		SQUARE CONCRETE			15S16

Guide Angles, Pads And Spud Guides



G15L17,18,19,20,21,22,23,24,26,28 ,30,32 ,34

REF.	PART NO.	QTY.	DESCRIPTION
1	15L94	6	Guide Angle, Short Section
	15L97	4	Guide Angle, Full Length, 18-1/2" x 8" Leads
	15L98	4	Guide Angle, Full Length, 18-1/2" x 7" Leads
	15L99	4	Guide Angle, Full Length, 18-1/2" x 6" Leads
	15L100	4	Guide Angle, Full Length, 18-1/2" x 9" Leads
	15L101	6	Plate, Full Length, 20" x 7" Leads
	15L98	4	Guide Angle, Full Length, 20" x 7" Leads
	15L97	4	Angle, Full Length, 20" x 8" Leads
	15L101	4	Bar, Full Length, 20" x 8" Leads
	15L114	2	Plate, Full Length, 20" x 8" Leads
	15L128	6	Plate, Full Length, 21-1/2" x 7" Leads
	15L98	4	Angle, Full Length, 21-1/2" x 7" Leads
	15L132	6	Plate, Full Length, 20-1/2" x 7" Leads
	15L98	4	Angle, Full Length, 20-1/2" x 7" Leads
	15L101	4	Plate, Full Length, 20" x 6" Leads
	15L138	2	Plate, Full Length, 20" x 6" Leads
	15L99	4	Angle, Full Length, 20" x 6" Leads
	15L132	4	Plate, Full Length, 20-3/8" x 6-1/4" Leads
	15L146	2	Plate, Full Length, 20-3/8" x 6-1/4" Leads
	15L147	4	Angle, Full Length, 20-3/8" x 6-1/4" Leads
	15L148	4	Guide Angle, Full Length, 18-1/2" x 7-1/2" Leads
2	7Z198	24	Capscrew

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

Guide Angles, Pads And Spud Guides

REF.	PART NO.	QTY.	DESCRIPTION
	7Z221	24	Capscrew
	15L127	24	Capscrew
	1X32	24	Lockwasher, 3/4"
			Pads
	15L139	2	Top Pad, 18" Wide Hammer to 26-1/2" Leads
	15L143	2	Bottom Pad, 18" Wide Hammer to 26-1/2" Leads
	7Z198	24	Capscrew
	1X32	24	Lockwasher, 3/4"
	1X199	24	Jam Nut, 3/4"
	15L152	2	Top Pad, 18" Wide Hammer to 27" Leads
	15L154	2	Bottom Pad, 18" Wide Hammer to 27" Leads
	1X2497	24	Capscrew
	1X32	24	Lockwasher, 3/4"
	1X99	24	Jam Nut, 3/4"
	15L167	2	Top Pad, 20-7/8" Wide Hammer to 26-1/2" x 6" Leads
	15L170	2	Bottom Pad, 20-7/8" Wide Hammer to 26-1/2" x 6" Leads
	1X1345	48	Capscrew, 3/4" x 1-1/2"
	1X32	48	Lockwasher, 3/4"
	1X172	24	Nut, 3/4"
	15L132	6	Plate, 18" Wide Hammer to 20-1/2" Leads
	15L27	24	Capscrew
	1X32	24	Lockwasher, 3/4"
			Spud Guides
3	15L109	1	Upper Guide, Spud Side, 10" H Pile
	15L119	1	Upper Guide, Spud Side, 12" H Pile
	15L130	1	Upper Guide, Spud Side, 8" H Pile
4	15L102	1	Head Guide, Spud Side, 10" H Pile
	15L122	1	Head Guide, Spud Side, 12" H Pile
	15H131	1	Head Guide, Spud Side, 8" H Pile
5	15L108	1	Head Guide, Opposite Spud Side, 8", 10", & 12" H Pile
6	7Z198	20	Capscrew
	1X32	20	Lockwasher, 3/4"

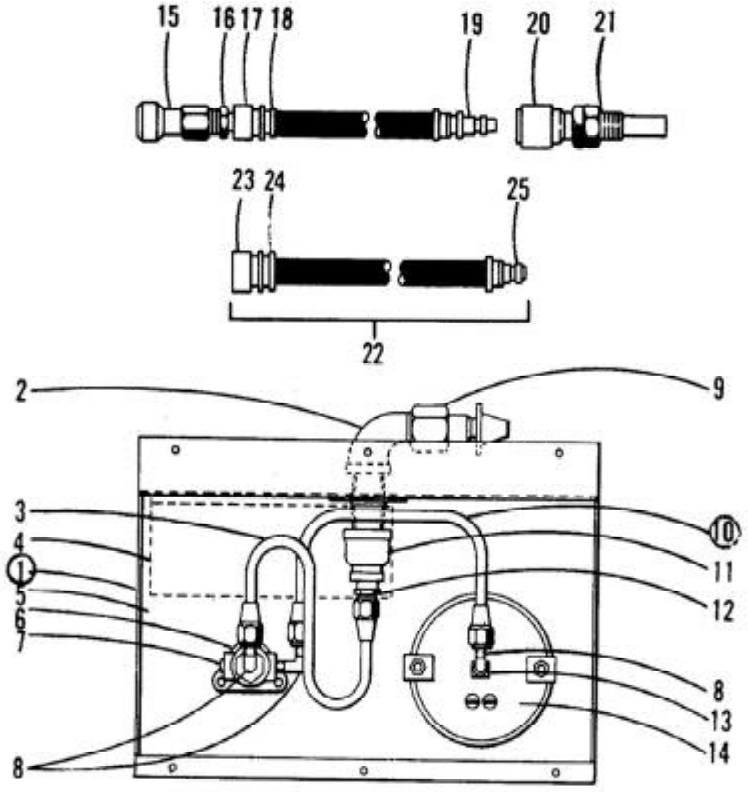
INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Parts List

R1174

19—18—1.0

Equivalent Output Energy Rating Instrument



G13T4,27T

S-2093-A

REF.	PART NO.	QTY.	DESCRIPTION
1	13T16	1	Rating Instrument Box Assembly
2	1X927	1	Elbow
3	5Z1489	1	Tube Assembly W/ Ftgs.
4	5Z1488	1	Emblem
5	5Z1475	1	Box, Instrument
6	5Z729	1	Valve, Push Button Controls
7	1X823	1	Plug, Pipe
8	1X8029	3	Elbow
9	5Z1478	1	Plug
10	5Z1491	1	Tube Assembly, W/ Ftgs.
11	1X857	1	Coupling, Pipe Reducer
12	1X8028	1	Union, Half
13	1X854	1	Coupling, Pipe Reducer
14	5Z960	1	Gage, Air Pressure
	13T7	1	Air Hose Assembly, (50')
15	5Z1484	1	Socket
16	13T9	1	Plug
17	13T8	1	Socket
18	5Z739	2	Clamp, Hose
19	5Z737	1	Plug
20	5Z736	1	Socket
21	5Z961	1	Adaptor
22	13T12	1	Air Hose Assembly, (30')
23	13T8	1	Socket
24	5Z739	2	Clamp, Hose
25	13T11	1	Plug

Parts List

Recommended Spare Parts - 180 DPH

Part No.	Qty.	Code Page	Description	Where Used
13H373	1	19-7	Injector Assembly	
5Z986	1	19-5	Fuel Filter Element	Fuel Filter Assembly
5Z118	1	19-7	Fitting	Hose Assembly (Lube)
6Z590	1	19-11	Lube Pump	
5Z130	3	19-11	Shim, 22 GA.	Lube Pump
5Z197	2	19-7	Diesel Nut	Injector Line
5Z200	3	19-7	Sleeve	Injector Line
5Z379	1 Qt.	Sec. 10	Controloyle	Transmitter
6Z152	3	19-7	Fitting (Swivel)	Hose Assembly
6Z432	3	19-7	Elbow	Lube Fitting
7Z463	1	19-6	Fuel Pump	
7Z30	4	19-6	Shim	Fuel Pump
7Z80	2	19-12	Pin	Starting Device
7Z432	1	19-7	Fitting	Fuel Pump Line Fitting
15H32	1	19-7	Injector Tube Assembly	
6Z335	1	19-8	Check Valve	Starting Fluid Injector
6Z336	1	19-8	Gasket	Starting Fluid Injector

Operator's Manual

Section 2

Pictorial Index And Safety

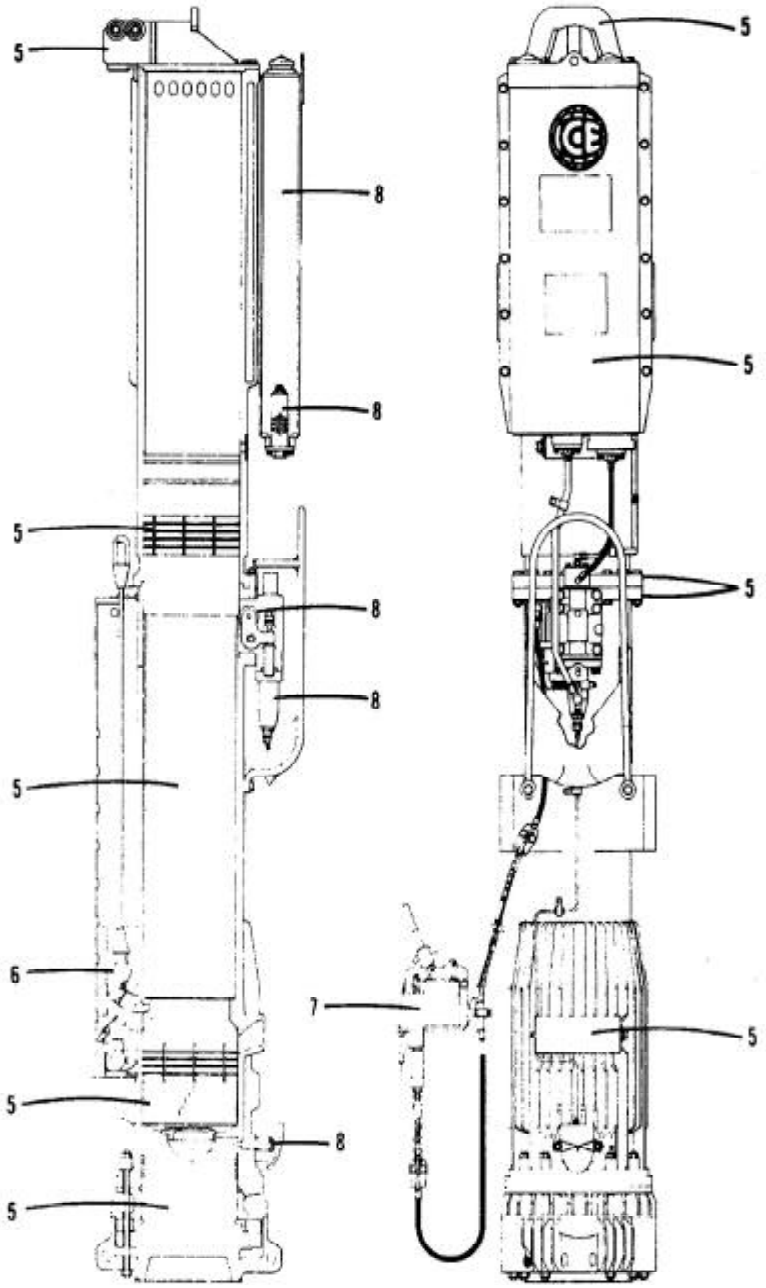


Fig. 2-1
Diesel Pile Hammer (180)

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Operator's Manual

Section 2 - Continued

Pictorial Index And Safety

NOTE: Read and follow the below safety precautions before installing and operating the Diesel Pile Hammer.

CAUTION

DON'T TAKE CHANCES!

(1) Keep hands out of intake-exhaust ports when Hammer is running or when ram is raised, and when checking wear rings, ram's surface, and ports for lubrication.

(2) Rounded or damaged bolt heads or nuts should be replaced so proper torque values may be obtained. Proper torque values are necessary to prevent parts on Hammer, leads, boom and other parts, from loosening up and falling and injuring ground personnel. Refer to fastener torque diagram, section 11.

(3) Wear protective gloves when working around a "hot" Hammer to reduce burn hazard.

(4) Use caution when using starting fluid - very flammable, fumes are toxic and spills on skin or clothing may cause frost bite.

(5) Have a fire extinguisher in immediate area in case of fire.

(6) Hammer and crane operator - take signals from one man unless for emergency stop.

(7) Keep clear of Hammer while in operation in case a part would loosen up and fall from Hammer, hook block, boom or leads. Also keep clear of intake and exhaust port; objects can be blown from ports with sufficient force to cause injury.

(8) Hard hats should be worn by all personnel while working around equipment to guard against personal injury.

(9) Never attempt to lubricate, service, or repair Hammer while it is running or located off and above ground level.

(10) Keep all parts of machine, boom, leads, piles and wire ropes at least 15 feet from electric power lines, transformers or other electrical equipment or such distance as required by applicable safety codes or rules. This is a most DANGEROUS hazard! All personnel on job can be in danger!

(11) Frequently tighten wire rope clips to secure Hammer attachment to lifting line.

(12) See that leads being used are adequate and safe.

(13) Make sure crane being used has sufficient capacity to handle Hammer and related equipment.

(14) Pile driving and extracting involves shock loading and vibration. Do not go under boom, hammer, leads or piling and stay away from area around point where pile enters ground. Fasteners and other parts can loosen and fall.

(15) Inspect all parts frequently to correct any loosening or damage.

(16) Inspect wire rope frequently per instructions in Section 10. Don't operate with a defective rope!

(17) Keep away from fuel nozzle spray when testing nozzle: Pressure can inject fuel under skin where it may form tumorous growths!

Operator's Manual

Section 3
General Description and Operation

General Description

The I C E Diesel Pile Hammer is a two-cycle, compression ignition engine with a free piston. The piston (17), Fig. 8-1, is the "ram" which delivers the work output of the hammer into driving the pile down.

The I C E Hammer is a self contained mechanism which incorporates its own fuel oil and lube oil tanks (16). Another of its distinguishing features is its enclosed top or cylinder head (13) allowing for a faster cycle and a shorter hammer. The hammer consists of the following major components:

The Cylinder in two parts:
Upper.....(1) Lower.....(4)
Ram.....(17)
Anvil.....(10)
Anvil Guide.....(11)
Cylinder Head.....(13)
Starting Device.....(6)
Lube Oil Pump.....(18)
Fuel Injection Equipment:
Fuel Tank.....(16)
Fuel Pump.....(20)
Injectors.....(8)
Hydraulic Control:
Transmitter.....(22)
Receiver.....(19)

The Hammer is started as lifting lever (7) engages the under cut of ram (17); raising hoist line attached to starting device (6) causes the ram to rise in the cylinder (1). Upward travel of the ram compresses the air in the upper cylinder and bounce chamber (15) interconnected through ports (14). The starting device linkage is tripped and disengaged from the ram which in turn gravity falls in the cylinder. As the ram descends in the cylinder, the compressed air in the bounce chambers expands giving added velocity to its downward travel.

The outside diameter of the ram is machined to form a cam surface (3) which operates the fuel pump (20) and lube oil pump (18). As the ram continues downward and covers up exhaust ports (21), this volume of air is trapped and compressed under the ram.

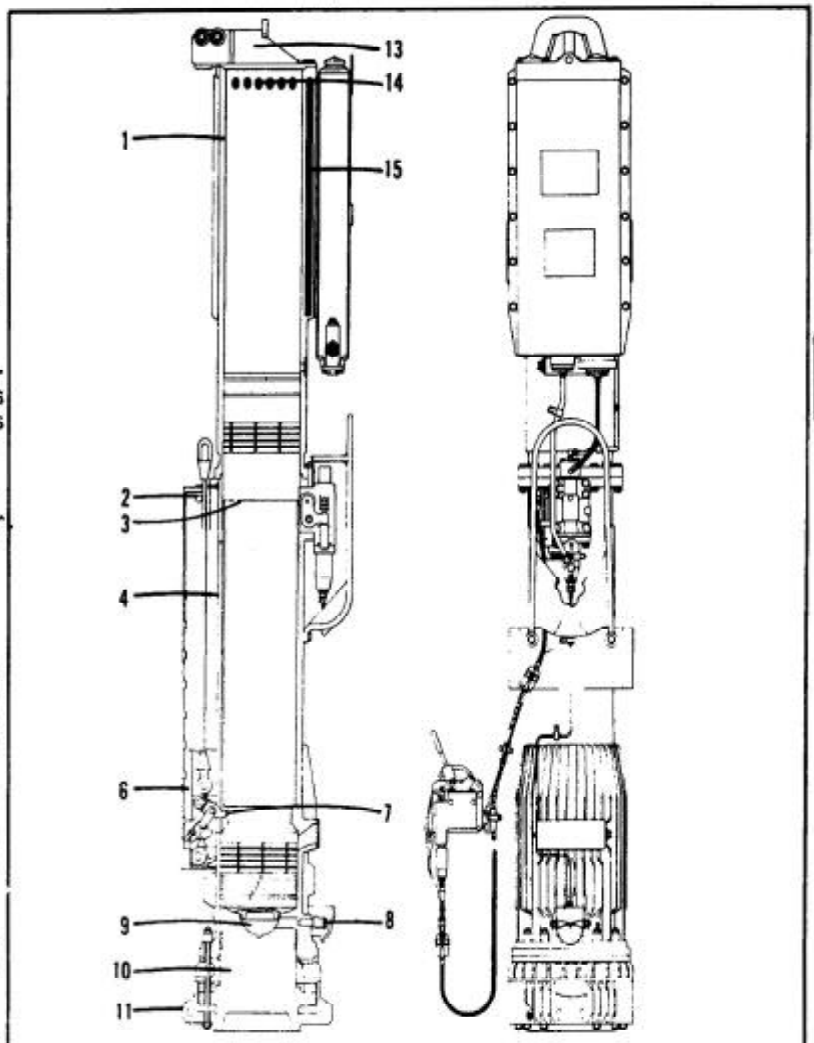


Fig. 3-1
Diesel Pile Hammer

(1) Upper Cylinder
(2) Lifting Pin
(3) Cam Surface
(4) Lower Cylinder
(5) Starting Fluid Injector
(6) Starting Device
(7) Lifting Lever
(8) Injector
(9) Combustion Chamber
(10) Anvil
(11) Anvil Retainer
(12) Lifting Eye
(13) Cylinder Head
(14) Chamber Ports
(15) Bounce Chamber
(16) Fuel Tank
(17) Ram
(18) Lube Oil Pump
(19) Receiver
(20) Fuel Pump
(21) Exhaust Ports
(22) Transmitter
(23) Drain Plug

Then as the ram near's the end of its downstroke, atomized fuel is injected (8). These combustive gases ignite (due to high compression temperatures), explode and expand, driving the ram upward and the pile downward. This last result is possible because of the vertical movement of anvil (10) within guide (11).

As the ram rises, it uncovers the exhaust ports (21) and an instant later the intake ports are opened creating a turbulance which scavenges the air in the combustion chamber. The rising ram again compresses the air in the bounce

chamber and the cycle is repeated. When handling and operating, it should be kept in mind that the Pile Hammer is essentially a Diesel Engine and should be afforded the same care and treatment

Handling

Safe handling practices go hand in hand with protection of component parts on this Hammer. When picking up the Hammer, it must be remembered that the ram is free in the cylinder. For this reason the Hammer should not be picked up with a single hoist line attached to the enter of the Hammer because the ram may slide and unbalance the Hammer and cause it to "flip".

The use of handling brackets (see tools) is recommended with lifting chains attached at a 45° angle to pick up Hammer as shown in Fig. 3-2. Lay Hammer down on blocks on the guide angle pads. Handling the Hammer in this manner will insure against damage to fuel and lube system, fuel and lube tank, bounce chamber tank and other vital Hammer parts.

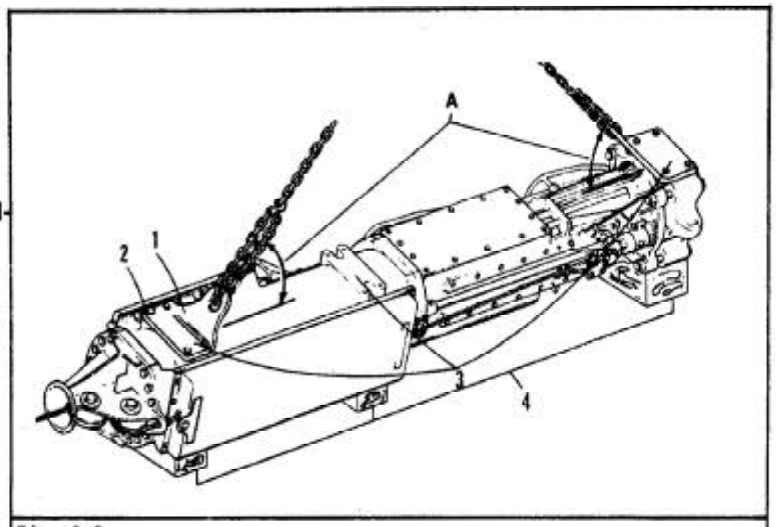


Fig. 3-2
Handling Diesel Pile Hammer (Typical)
(A) Chains At 45° Angle
(1) Handling Brackets
(2) Capscrews & Lockwashers
(3) Guide Angle Mounting Pads (440)
(4) Cribing

Installation

A lifting eye (6 in Fig. 3-3) is provided in the cylinder head for lifting the Hammer into the leads.
Note: The lifting eye should be used only for lifting the Hammer's weight. When it is necessary to make heavy lifts, such as removing stuck mandrels from tube pilings, do not pull thru Hammer.

After the Hammer is in the leads it can be hoisted and started in one of three ways:
(1) If two separate crane hoist lines are available, one should be attached to the starting device (3) and one to the cylinder head (6).
(2) The standard "Y" hitch is connected to the crane hoist line (4). It consists of a short length of chain (5) which is attached to the lifting eye in the cylinder head and a longer length of non-rotating wire rope which is attached to the starting device. The wire rope has enough slack to make the chain bear the weight of the Hammer when lifting it in the leads and will readily collapse to offer no resistance against lowering the starting device to latch it in.
(3) If only one crane hoist line is available, the line can be attached to the starting device (3) for both hoisting and starting of the Hammer. The entire Hammer may be lifted with this starting line by hoisting the starting device to its maximum stroke where it engages the lifting pin located in the top of the starting device cover. This method is not recommended and should be used on a temporary basis.

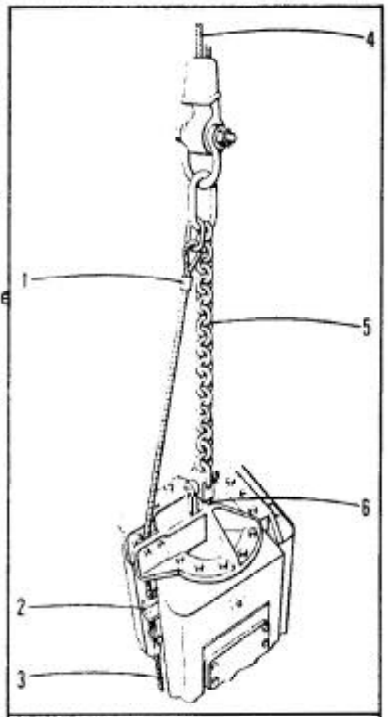


Fig. 3-3
"Y" Hitch Assembly And Connections
(1) Thimble And Wedge
(2) Wire Rope Socket
(3) Starting Device Line
(4) Hoist Line
(5) "Y" Hitch Chain
(6) Cylinder Lifting Eye

Starting

To Put The Hammer In Operation, Proceed As Follows:
(a) Install the hydraulic transmitter, (see Section 7) in a position convenient to the operator. In most cases the crane operator controls the Hammer throttle.
(b) Install guide angles or clips and check leads for proper guide rail dimensions for

Hammer operation.

(c) Connect self sealing coupling of control hose on Hammer. Bleed control as outlined in Hydraulic Control System, Section 7. Advance throttle and visually check receiver for movement.

(d) Attach hoist line per previous recommendations and install Hammer in leads.

Note: Prevent Hammer from spinning or rotating while suspended on hoist wire rope.

Use care not to snag the control hose, or else temporarily disconnect same.

(e) Assemble adaptor, (see Section 5). Place driving head and adaptor assembly under Hammer and wire rope in place. (see Section 5).

(f) Fill lube oil and fuel oil tanks and grease per specifications on Lubrication Chart. (see Section 4). For Priming Fuel Pump refer to Sect. 8; Page 8-2

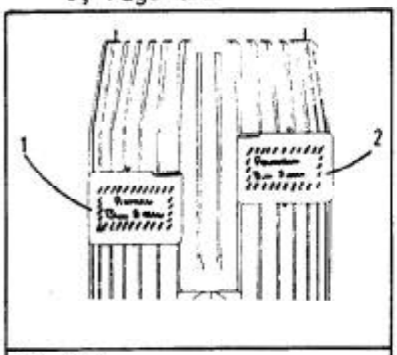


Fig. 3-4
(1) Exhaust Port And Cover
(2) Intake Port And Cover

(g) Remove intake and exhaust port covers.

(h) Place the entire assembly on firm ground, cribbing, or on a short section or driven piling. It is important that the entire weight of the Hammer is bearing on the pile so the anvil is in the "up" position, to permit latching of the starting device.

(i) Pull down on latch rope fully and hold (by ground crew).

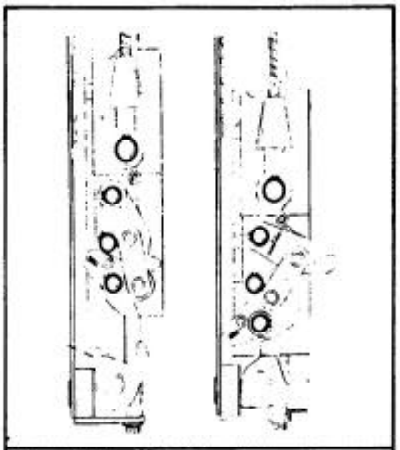


Fig. 3-5
Latching Mechanism (Typical)

Refer to Fig. 3-5.

(j) Crane operator can now lower starting device until it strikes the latching lever thereby rotating the linkage over center and latching the lifting lever with ram. (see Section 6).

(k) Ground crew should release latch rope. The latching lever is spring loaded to hold it in the "off" position and is actuated only by pulling the latch rope. The spring loading prevents accidental engagement of the lifting lever with the ram while the Hammer is in operation.

(l) Crane operator can now engage hoist clutch and lift ram to top of stroke.

(m) To release ram for free fall, stop upward movement and release hoist. A slight downward movement of the starting device will cause the release lever or "dog" to contact a groove in the pressure plate and rotate the linkage mechanism off-center, thus releasing the ram.

Note: The starting device weight is adequate to overhaul the wire rope under ideal conditions, but, if sleeve bearing drums, long booms, dragging brakes, or other line drag are encountered, it may be necessary to install some form of overhaul weight to enable engagement.

(n) With the Throttle Off, make several practice drops of the ram to get the crew acquainted with the starting procedure.

A few seconds pause is necessary between each "latching in" to allow the ram to completely settle against compression.

(o) If driven pile is available, or the cribbing and the ground conditions have proved secure under the above conditions, it is advisable to run and warm up the Hammer at part throttle (or Idle) as conditions dictate.

When latched into the ram and lifting to start Hammer, do not hold the ram in the up position for too long a time or bounce chamber compression will be lost and the ram will tend to pull a vacuum when released.

Starting under conditions of cold weather or soft driving may require the use of the Starting Fluid Injector, see instructions for it's use under this heading in Section 5.

(p) Return the throttle to the "off position to stop the Hammer.

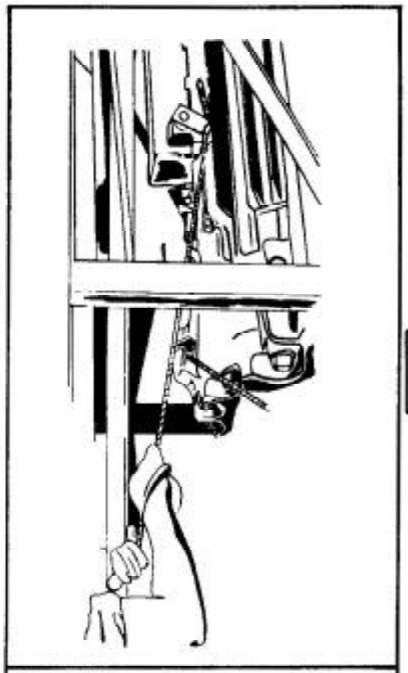


Fig. 3-6
Pulling Latch Rope

Section 3 - Continued
General Description And Operation

Note: For emergency stop only - hoist the entire hammer off the piling.

Things To Do After Starting

Proper care of the starting device after the Hammer is started is important.

(1) When the Hammer is started, position the starting device with the hoist line so it is in the approximate center position of the starting device cover. If the starting device is held in either the extreme top or bottom position in the cover, it will be subject to shock loadings which will cause undue wear or damage.
(2) Allow hoist line to spool out as the pile is driven so the starting device is kept in the center position of the cover. If the hoist line is restrained while driving pile, it will become taut, raising the Hammer off the pile. Then the energy available will not be transmitted to the pile, resulting in loss of compression and the Hammer will cease to fire.

CAUTION

Do Not Pull Latch Rope At Any Time While Hammer Is In Operation.

Running

The limit of the Hammer energy rating capacity is evident when the Hammer cylinder begins to raise off the anvil or pile. The Hammer should not be operated at this full rated capacity except for short periods of time when checking bearing value of the pile. The Hammer should not be required to drive more than 10 to 20 blows to the inch and then only for short periods of time and when checking bearing value, depending upon soil conditions and type of piling. Abusive damage can result if the Hammer is allowed to bounce on the pile while in operation. (Also see Section 9 - Rating Devices).

The term "rack" is commonly used by pile driving personnel to define excessive bounce or jumping of a Pile Hammer during the driving operation. "Rack" is caused by allowing the ram to rise too far causing the entire Hammer to jump off the pile.

In the case of the I C E Diesel Pile Hammer, air pressure is used as a stop. When the air pressure becomes great enough to counter-balance the weight of the cylinder, the entire Hammer will "rack" or jump noticeably.

Rack can result in damage to Hammer as it causes shock loads to component parts. When the Hammer begins to rack, the operator should back off on the throttle immediately.

Should the ram be allowed to raise to the racking point, the rings on the upper end of the ram could clear or pass above the bounce chamber ports. This in turn would allow compressed air to escape down around the ram causing a vacuum to be pulled in the bounce chamber as the ram descends.

When this happens, the blow count per minute will decrease noticeably as the air spring reaction will be reduced in the upper cylinder. Bouncing will probably increase until the throttle is backed off sufficiently to allow the blow count to increase to its normal speed and the pressure in the air tanks to build up again. It may even be necessary to stop the Hammer for a few seconds in order to allow the air pressure to equalize in the air tanks and bounce chamber.

After the blow count picks up to the normal rate, the throttle should be advanced to the position just before the Hammer begins to lift. This will ensure the realization of all available output energy that can be derived from the Hammer.

When the Equivalent Output "WH" Energy Indicator is used, the air pressure indicated on the gauge can be used as a guide to prevent Hammer "racking".

The air pressure indicator should not be allowed to go beyond the pressure needed to achieve the maximum output energy for the Hammer. The chart furnished with the indicator can be used to check this pressure. If the gauge indicates pressures beyond those needed for maximum output energy, the throttle should be backed off.

When driving piling on a batter it will be found that the Hammer starts to lift at lower gauge pressures as compared to driving on plumb piling. The greater the batter the lower the pressure. Since this is normal, more care must be exercised to back off the throttle control when batter piles are being driven.

Note: When driving pile observe the below safety precautions:

(a) Keep Hammer in good alignment with pile center line to avoid breaking pile or having Hammer slip off pile.
(b) Side loading on pile by swinging Hammer sideways to straighten up pile out-of-plumb or to correct angle of batter should be avoided, especially after pile has penetrated more than a few feet.
(c) Keep latching mechanism ground line clear while pile is being driven to avoid its being driven into ground with pile.
(d) Same precaution applies to control hose and gauge hose.
(e) Don't exceed capacity of crane, especially while driving batter pile.

Good Hammer Operation Depends On:

(a) Clean air.
(b) Sufficient compression for ignition ("Live" compression rings and adequate lubrication).
(c) Proper quantity of good fuel injected into the combustion chamber at the proper time.

Section 4
Lubrication And Storage

Lube And Fuel Filters
See Time Table

After storage and before putting the Hammer back into operation, the filters should be removed. The fuel filter should be changed and the lube oil filter should be washed. This will also drain condensation from lube and fuel tanks. See storage of Hammer later in this section.

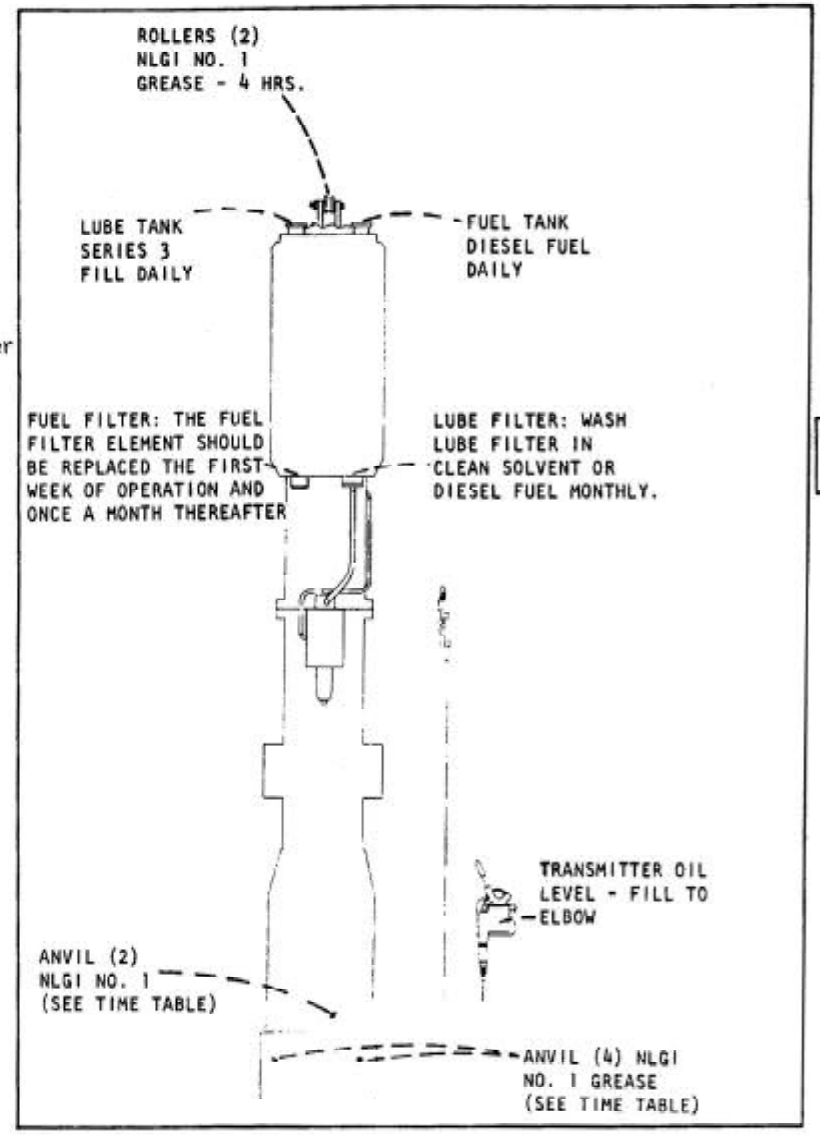
General Lubrication Information

The machine should be regularly and systematically lubricated in accordance with the lubrication chart and timbe table later in this section.

Lube And Fuel Tanks
See Time Table

Fill lube oil and fuel tanks at the end of each day's operation. A partically filled tank induces condensation resulting in ice formation in cold weather. At low temperatures, lube oil may be too heavy to properly flow to the pump; if so, drain and flush tank and replace with suitable oil.

Note: On later Hammers, the fuel and lube filters are equipped with drain plugs to remove any accumulated moisture. (See time table later in this section for when to drain these tanks).



Ref. No.	Description	Fuel	Oil	Grease	Time
1	Sheaves (Rollers).....	.....	.....	EE	
2	Fuel.....	AA,BB,CC			See
3	Lube Oil (Lube Tank).....	.....	DD		Time
4	Retainer Grease Ftgs.....	.....	.....	EE	Table
5	Anvil.....	.....	.....	EE	
6	Transmitter.....	.....	FF		

*See Fuel And Lubrication Specifications Later In This Section.

(180 DPH) - Capacity Chart	
Description	Capacity
Fuel Tank	5.5 Gal.
Lube Oil Tank	1.9 Gal.
Hydraulic Control System (Approx.)	3 Pts.
*Starting Fluid Tank	4 Oz.

*Use commerical starting fluid from pour type cans. (Chevron or equal)

Fuel And Lubrication Specifications

Note: Always specify Diesel Fuel. Do not specify fuel oil.

Fuel: Use a straight run No. 1 Diesel Fuel from a major oil company with a low sulfur content for all operations except those noted below and under "The Specification CC - Straight Kerosene.

Addition Of Oil To Diesel Fuel Or Kerosene

It has been shown by field testing that longer injector life and better fuel system operation can be obtained by adding SAE 30 non-detergent oil to the diesel fuel. To obtain these results, oil should be added as outlined below at all times.

1. Up to 70°F. add 1 qt. of oil to each 5 gallons of #1 or #2 diesel fuel.
2. Above 70°F. add 2 qt. of oil to each 5 gallons of #1 or #2 diesel fuel.
3. If hammer output falls off in hot climates and/or hard sustained driving conditions, add 3 qts. of oil to each 5 gallon of #1 or #2 diesel fuel.

Note: Use only SAE 30 non-detergent oil conforming to API spec. SA or SB. Never use a detergent oil as it will foul the injector and form deposits in the combustion chamber.

AA - No. 1 Diesel Fuel - Typical Specifications (Low Sulfur Content)

Gravity API	41.8
Corrosion - 3 hrs. at 122°F	Neg.
Lamp Sulfur, wt.%	0.1
Flash: P.M. °F	138
Ramsbottom carbon residue on 10% Bottoms, wt.%	0.061
Ash, wt.%	0.003
Pour Point, °F	-40
B.S. & W by centrifuge, %	Trace
Color: Say bolt	Plus 15
S.S.U. sec at 100°F	32.0
Cetane No	50.0
Diesel Index	63.95
BTU, Gross/gal	134,438

BB - No. 2 Diesel Fuel - Typical Specification (Low Sulfur Content)

Gravity API	33.3
Corrosion - 3 hrs. at 122°F	Neg.
Lamp Sulfur wt.%	0.3
Flash: P.M. °F	170
Ramsbottom carbon Residue on 10% Bottoms, wt.%	0.193
Ash, wt.%	0.000
Pour Point, °F	-10
B.S. & W. by centrifuge %	0.00
Color: ASTM Union	-2
S.S.U. sec at 100°F	37.4
Cetane No	45.0
Diesel Index	46.39
BTU Gross/Gal	136,241

CC - Straight Kerosene - Typical Specification

To be used for cold weather operation or for starting and running in soft conditions. Also to be used where smoke is a problem.

Gravity API	41
Flash TCC	136°F.
Pour Point	-55°F.
Sulfur	.05%
Cetane Number	49
IBP	340

DD - Lube Oil Series 3 - (MIL-L-45199B)

Lubricating oil, regardless of SAE grade, must conform to one or more of the following specifications:

A.P.I. Classification CD
Series 3
(Conforms to MIL-L-45199B)

Multi-grade oils, like 10W-30 or 10W-40 are recommended for use, especially if the air temperature varies over 30°F. in 24 hours

If single grade oil are used see below:

Grade	Air Temperature In 24 Hrs.
SAE 10	Below 0°F.
SAE 20	Between 0°F. And 50°F.
SAE 30	Above 50°F.

EE - High Temperature Grease (MIL-L-25013

Grease shall meet a N.L.G.I. #1 Specification and have a non-melting characteristic with a drop point not less than 450°F.

FF - Transmitter Control Oil (MIL-L-5606B)

"Sperry" Controloyle "A" Government Specification: MIL-O-5606B in container style no. 20A220. Sperry Products, Inc. Danbury, Connecticut. For emergency (if Sperry controloyle is not available use "GG" Dashpot oil. Never Use Lube Oil.

GG - Dashpot Oil

Automatic transmission fluid "Dexron" type "A" or Speed-o-Matic oil.

(Time Table) Before Starting Operation	
Operation	**Remarks**
Transmitter	Loosen cap before starting - tighten at end of each day.
Fuel Pump Rack	Check to see that when control handle is moved toward maximum fuel position that "all" full fuel pump rack is obtained.
Lube And Fuel Tank	Check tanks for sufficient amount of oil and fuel.
Lube System	Check to see if system is properly bled and lube points (cylinder) are receiving proper amount of lubrication. See Section 8. (Lower ram compression rings must be oily.)
Hydraulic Control System	Check to see if system is properly bled (See Section 7).
Dashpot (440 DPH)	Check dashpot tank fluid level - fluid should just run out side plug - fill if required. (Hammer in vertical position.)
Starting Mechanism	Check wire rope and starting mechanism for wear and defects. Replace if necessary. See Section 10.
Wear Rings	Inspect both wear rings through ports - replace if horizontal machine grooves have disappeared, or if breakage is visible.
General	Check all parts, nuts and bolts for looseness and tighten if necessary See Torque Chart.

Operation	Remarks 30 Min.
Anvil	Grease anvil and anvil retainer fittings.
Lube Inspection	Observe ram and cylinder walls thru exhaust-intake ports and bounce chamber vent ports to make sure that they are well lubricated. Adjust lube pumps as required. Keep compression rings on bottom of ram oily.

Operation	Remarks Every 4 Hours
Cylinder Head	Grease the 2 sheaves in the cylinder head.
Starting Mechanism	Lubricate starting device ways, latch block and push rod bearing.

Operation	Remarks Every 8 Hours
Fuel And Lube Tanks	Fill fuel and lube oil tanks at end of each day's operation.
Port Covers	Remove the port covers before starting and replace at end of each day. (While Hammer is being used, store covers where they will not be damaged.)
Fuel Injector Adaptor (440 DPH)	Retorque after first 8 hours of operation when cold, weekly thereafter. (See Section 11 for Torque Values.)
General	Visually inspect all parts, nuts, and bolts for looseness and make necessary corrections. See Torque Chart.

Operation	Remarks Every 40 Hours
Fuel Injection Pump	On new Hammer and/or installation of new fuel pump, perform pump timing procedure and retime as specified. Inspect both wear rings through ports - replace if horizontal machined grooves have disappeared, or if breakage is visible.
General	Check all parts, nuts and bolts for looseness and tighten if necessary See Torque Chart. Replace damaged or missing grommets or capscrews holding fuel and lube lines in place. Drain bounce chamber tank of accumulated oil.
Starting Mechanism	Check all wire rope and starting mechanism for wear and defects. Tighten wire rope retainer bolts. Observe the starting device and wire rope as it rolls over the sheave in cylinder head during entire starting stroke. Replace wire rope if any broken strand wires are observed. Lightly oil the starting mechanism ways and the fuel pump rack and return spring device. Check fluid level in the starting device dashpot tank - fluid should just run out side plug - fill if required.

Operation	Remarks — Every 40 Hours - Continued
Recoil Dampener	Replace recoil dampener if thickness is less than specified.
Recoil Dampener Adaptor	Replace plastic discs and aluminum discs in adaptor assembly if distance between cushion adaptor plug and adaptor is less then specified.
Fuel Filter	Replace fuel filter element the first week of operation of new hammer. Replace monthly thereafter.

Operation	Remarks — Monthly
Fuel Filter	Replace fuel filter element. (Do not attempt to clean.)
Lube Filter	Wash lube oil filter in clean fuel oil.
Fuel Injector Nozzle	Replace injection nozzle as required for good Hammer operation.
Fuel Injection Pump	Perform timing procedure. Retime as specified.
Reed Valves (440 DPH Only)	Clean and reset as required. Valves must seal against plate.
(440 DPH) Operation Only	Remarks — Every 3 Months
Reed Valves	Remove and clean with proper tools to avoid scoring or scratching. (Valves must seal against valve plate.)
Side Tanks	Clean out carbon if present.

Operation	Remarks — General
Overdriving	Extend driving at extremely small sets per blow (more than 10 to 20 blows to the inch) will result in excessive maintenance.
"Racking" Hammer	Allowing hammer to leap, rack or bounce during operation will result in excessive maintenance.
Extended Operation	If hammer is operated for two or three shifts per day instead of customary one shift, then above recommendations should be adjusted accordingly.

Operation	Remarks — Cold Weather Starting
Pre-Start And Warm-Up	Prior to starting a cold hammer it is a recommended practice to drop the ram at least six times with the fuel off to dry out the combustion chamber. To warm up hammer start hammer on a previously driven piling or cribbing and run until hammer reaches normal operating temperature.

Smoke And Exhaust Emission Reduction

The following operating and maintenance procedures will result in maximum hammer operating efficiency with minimum smoke and exhaust emissions.

A series 3 A.P.I. classification CD lube oil will help keep the inside of the Hammer clean and free of carbon. The lube pump should be adjusted so that the ram and lower rings are just lubricated. Additional oil runs down into the combustion chamber where it can cause smoke and/or be thrown out of the Hammer.

The maintenance of the fuel system is very important for control of emissions. The fuel pump must be kept timed to insure its proper operation. Proper adjustment and replacement of the injectors is critical because of the high operating temperatures of the air cooled hammer.

Inspection and maintenance of the injector (s) pressure setting and spray pattern is required once a week, or oftener in hot areas to insure that the fuel is atomized and mixed with the combustion chamber oil to burn cleanly.

Operation and control of the throttle control while driving will affect exhaust emissions as it is easy to deliver more fuel than the hammer will burn.

A hammer which is operated at "full throttle" produces a dark heavy smoke exhaust in soft driving conditions. This heavy exhaust is caused by partially burned fuel in the combustion chamber. The partially burned fuel causes smoke.

To clear up the exhaust and reduce the carbon deposit the operator must back-off on the throttle until the exhaust clears up. This will not appreciably affect the hammer driving ability, but it greatly reduces the carbon deposit.

The quality of the diesel fuel will affect the emissions and it does vary widely between suppliers and in the different locations. Kerosene produces the least smoke while "high speed diesel" and No. 1 diesel fuel produce less smoke than regular No. 2 diesel fuel.

Smoke and exhaust emission suppressants added to the diesel fuel may help to reduce such emissions. Most major diesel fuel suppliers and additive manufacturers sell these products through their fuel outlets and truck service stations.

Storage Of Diesel Fuel

The importance of buying and maintaining clean fuel for successful Hammer operation and to prolong the life of the fuel pump and injector cannot be stressed too much. The best fuel can be rendered unsatisfactory by poor storage facilities and careless handling.

Improperly constructed and unvented storage containers can contain water, dirt and sediments. Fuel delivery can cause these contaminents to be agitated and mixed with the fuel.

Storage Of Hammer

The following procedure is outlined and should be adhered to, to insure safe Hammer storage while Hammer is still vertical in leads:

(a) Remove any one of the pipe plugs from cylinder head and pour in one quart of SAE 30 lube oil to insure a protective lubricating film for top cylinder and ram. Replace plug.
(b) Bounce chamber vent port cover should be on.
(c) Special precautions should be taken with the fuel pump and injector if the Hammer will be idle for a month or more. To prevent corrosion or gumming during the shutdown period, drain the fuel and lube oil tanks by removing drain plugs from filters and disconnect the fuel supply hose from the bottom of the fuel tank.
(d) Raise the ram 17" and open the fuel pump rack, disconnect the high pressure tube at the fuel injector and hand operate the fuel pump to remove diesel fuel from injector system.
(e) Fill a clean squirt type oil can with American Bosch Flushing Oil (Calibrating Oil) and refill the supply hose. American Bosch Flushing oil is specified because it contains rust inhibitors which afford long term protection of critical injection and equipment. Continue operating the fuel pump until the flushing oil is pumped through the tubing.
(f) Reconnect the high pressure tube to the injector and, keeping the fuel pump supply hose full of flushing oil, continue to hand operate the fuel pump. 15 strokes should be sufficient to replace fuel inside of injector with flushing oil.
(g) Refill supply hose with flushing oil and attach to fuel tank.

Note: Flushing oil contains a preservative and is available at American Bosch Service Stations.

(h) Squirt lube oil through intake-exhaust ports and secure intake-exhaust port covers.
(i) Lubricate all grease fittings on lower cylinder, and anvil retainer.
(j) Store the Hammer in a horizontal position on timbers or a skid placed against the guide angle pads on the side of the Hammer. (See Fig. 3-1.)
(k) Cover all openings and unpainted metal with grease.
    (1) Push rods (440)
    (2) Starting device ways
    (3) Reed valves (440)
    (4) Base of Hammer (bottom of anvil and anvil retainer)
    (5) Coat fuel pump rack and control receiver with rust preventative grease and wrap.
    (6) Coat dashpot plunger and starting device locking pin with rust preventative. Grease and wrap. (440)
(l) Cover the entire Hammer with protective covering, especially if stored outside.

Section 5

Upper And Lower Cylinder

Upper And Lower Cylinders:

The cylinder is manufactured in two parts, the upper (1) and the lower (4), Fig. 10-3.

A relatively large clearance volume tank (9) is located outside the upper cylinder and is connected to the cylinder by ports. This clearance volume is used to shorten the stroke of the ram and resulting nearly double the number of blows per minute from the Hammer. The energy of the compressed air, stored in the bounce chamber and compression tanks, and acting like and "air spring," is given back to the ram, pushing it and accelerating it on its downward stroke.

The exhaust port in the lower cylinder has a slight lead over the intake port and the port timing is such that at the end of the exhaust "blow-down" the intake port is uncovered by the ram allowing fresh air to enter the cylinder with a minimum of mixing with the exhaust gases.

The exhaust and intake ports are equipped with removable covers (1) a d (2), Fig. 5-2. These covers must be removed prior to operation of the Hammer. Likewise, they should be used to cover the ports when the Hammer is not in operation. The latter must be done to afford maximum protection from the elements of foreing matter especially when transporting the Hammer. The ports should always be covered when the Hammer is idle for any length of time such as over night or while in storage.

Note: When reassembling the Hammer, it is a good practice to have the covers on the exhaust and intake ports to prevent getting foreign material, especially nuts and bolts, into the Hammer cylinder.

The cylinder head (8), Fig. 5-1, allows for air compression plus giving the ram and cylinder bore protection from the elements and any foreign matter which may drop from the boom point or hoisting wire rope.

An area, which is called the safety space (A), is located between the cylinder head and the compression intake ports. This area keeps the ram from striking the cylinder head as total compression would have to be overcome for it to do so. The entire cylinder will noticeably begin to lift, or rack when the ram enters this safety space. This is an indication that the limit of the Hammer output energy has been reached.

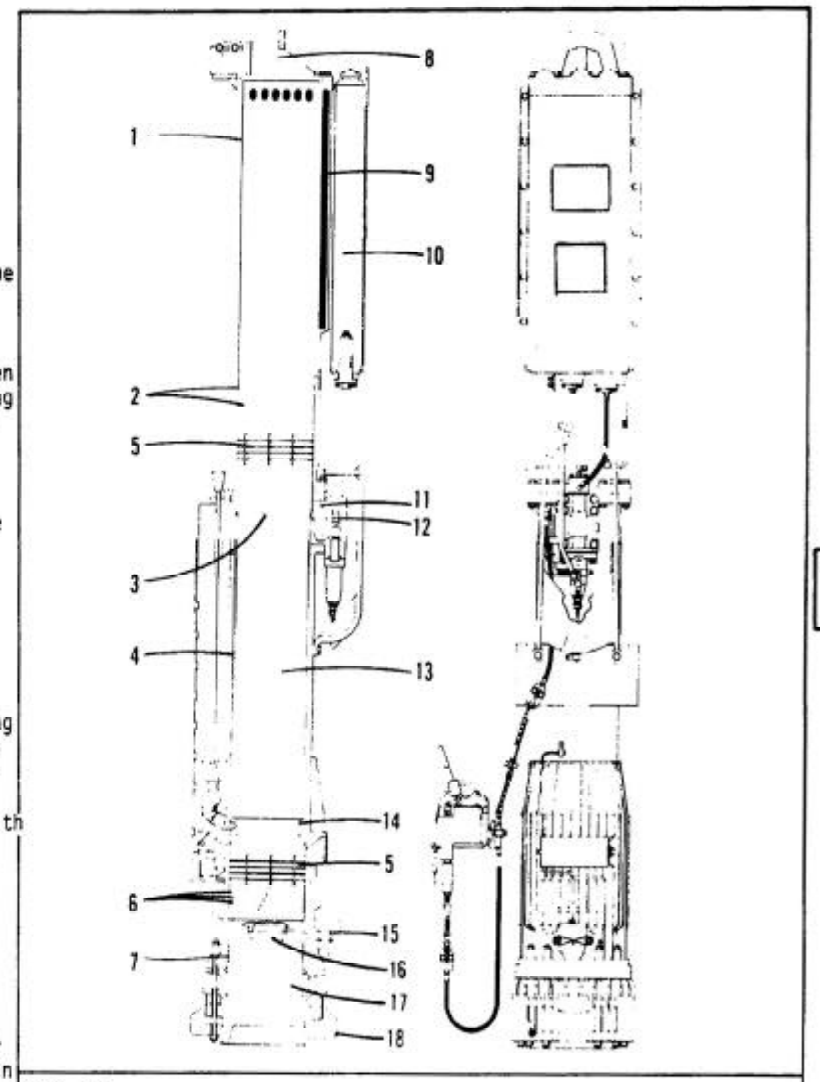


Fig. 5-1
Model Diesel Pile Hammer (180)

(A) Safety Spacer
(B) Tapped Hole For Lifting Eye
(1) Upper Cylinder
(2) Compression Rings
(3) Cam Surface
(4) Lower Cylinder
(5) Wear Ring
(6) Compression Rings
(7) Compression Rings
(8) Cylinder Head
(9) Bounce Chamber
(10) Fuel Tank
(11) Cam Roller
(12) Lube Oil Pump
(13) Ram
(14) Lifting Groove
(15) Injector
(16) Combustion Chamber
(17) Anvil
(18) Anvil Retainer

Upper And Lower Cylinder

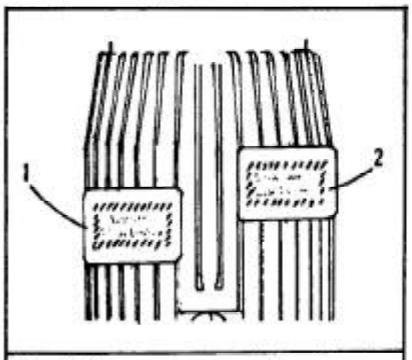


Fig. 5-2
(1) Exhaust Port And Cover
(2) Intake Port And Cover

If erratic operation and excessive lifting of the Hammer is evident, it may be due to excess cylinder bore wear. The maximum wear allowable on the cylinder bore is to 11.030:. If wear goes beyond this, re-plating will be necessary.

To check the bore of the cylinder proceed as follows:

(1) Remove the fuel and lube tank.
(2) Remove the cylinder head.
(3) Carefully remove the head gasket.
(4) Install lifting eye bolt in ram.
(5) Remove ram from cylinder.
(6) Check the bore of the cylinder using 11" plug micrometer.

To reassembly the Hammer proceed as follows:

(1) Replace ram using ring compressor (see Section 11). Ram should be wiped clean and well lubricated.
(2) Remove eye bolt from ram.
(3) Place head gasket in top of cylinder.
(4) Replace head.
(5) Start and run cylinder head capscrews down on all but four positions. Leave capscrews out of positions which support the fuel and lube tank.
(6) Tighten all capscrews evenly. If the head is allowed to cock, compression will be lost and this can cause erratic action of the Hammer. Cylinder head capscrews should be tightened to the torque value recommended.
(7) Replace fuel and lube tank and install remaining four capscrews on the head. On later Hammers the tank is not fastened by the cylinder head capscrews. Tighten these capscrews to the torque value recommended.
(8) Replace and tighten fuel and lube tank capscrews.
(9) Wire tie cylinder head capscrews in place.

Refer to the Torque Chart, Section 12 for all torque requirements.

Ram

Referring to Fig. 5-1, the ram (13) is a free piston and is the means by which the work output of the Hammer is delivered to the pile.

The ram has a lifting groove (14) machined in the outside diameter to enable the engagement of the starting device linkage when the ram is lifted.

To start, the ram is lifted mechanically, compressing air between the top of the ram and the enclosed cylinder top and in the air compression tank (9) located on the outside of the cylinder proper. The ram is dropped and accelerated downward by gravity and the expansion of the air in the compression tank.

If the ram is held in the "up" position for too long a time the compression of the air in the compression tank and the bounce chamber will be lost. If this is allowed to happen the descent of the ram will be hindered instead of helped for a vacuum will be created which will attempt to retard the descending ram.

During the downstroke, the ram forces a mixture of air and residual gases through the ports, closes off the exhaust ports and compresses the trapped air mixture in the combustion chamber between the bottom of the ram and the anvil. The compression of the trapped air mixture creates a preloading force on the anvil and the pile.

The outside diameter of the ram is machined to form a cam surface (3) which operates the fuel injection equipment. As the ram nears the end of the down stroke, it triggers a cam (11) operated fuel pump which injects a atomized fuel under high pressure into the combustion chambers (16) in the top of the anvil. The ram strikes the anvil,delivering its impact energy to the pile. The ram is then driven upward by the expansion or exploding of the gases between the ram and anvil. This expansion or explosion drives the ram upward and the pile downward.

As the ram rises the lubrication oil pump (12) is actuated by the same lever that operates the fuel pump.

When the rising ram enters the safety space (A) which is located above the compression tank ports, the cylinder will begin to raise off the anvil or pile. The Hammer should not be operated at this full rated capacity except for very short periods of time when checking bearing value of the pile.

Note: The Hammer should not be required to drive more than 10 to 20 blows to the inch, and then only when checking bearing value, depending upon soil condition and type of piling. Abusive damage can result if the Hammer is allowed to bounce on the pile while in operation.

The ram has compression and wear rings on both the top and bottom. On the very top of the ram are two ring grooves which contain the bounce chamber compression rings (2).

Just below these compression rings is a wider ring groove which contains the upper bronze wear ring. This ring provides the surface which guides the upper part of the ram within the upper cylinder. This ring has both vertical and horizontal oil distribution grooves which aid in maintaining a film of oil on its surface. When these grooves become worn smooth or are eliminated at any point on the wear ring, the ring should be replaced.

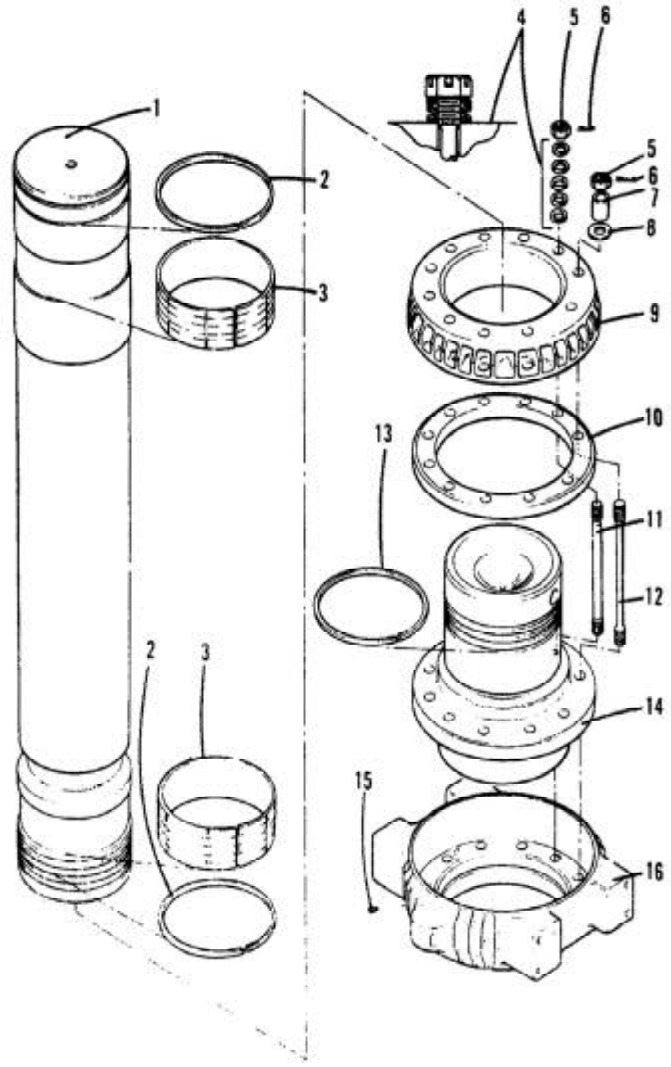


Fig. 5-3
Ram, Anvil & Adaptor Assembly

(1) Ram
(2) Piston Ring
(3) Wear Ring
(4) Springwasher
(5) Nut
(6) Cotter, 5/32" x 1-1/2"
(7) Spacer
(8) Springwasher
(9) Cooling Ring
(10) Recoil Dampener
(11) Alignment Stud
(12) Stud
(13) Piston Ring
(14) Anvil
(15) Grease Fitting, 1/8"
(16) Anvil Guide

Upper And Lower Cylinder

If replacement is not made under the above circumstances, the ram surface will contact the cylinder bore causing rapid wear and resulting in major repair.

The bottom of the ram has five compression rings (6) Fig. 5-1, and a wear ring (5A) which guides the lower portion of the ram in the lower cylinder. This wear ring is identical to the upper wear ring and is located above the compression rings. The condition of the sight check wear grooves can be observed through the intake and exhaust ports. As explained earlier should any of the ring grooves wear smooth, the wear ring should be replaced. The five compression rings are mounted in grooves located in the bottom of the ram.

Removal Of Ram From Cylinder

Two methods can be used to remove the ram from the cylinder. To accomplish the first method proceed as follows:

(1) Remove fuel and lube tank (on early Hammers with flanged tank only).
  (a) Cut tie wire on cylinder head capscrews.
  (b) Remove capscrews.
  (c) Remove fuel and lube tank mounting capscrews (early Hammers only).
  (d) Disconnect and plug fuel and lube oil lines (early Hammers only).
(2) Remove cylinder head.
(3) Remove head gasket.
(4) Screw eye bolt (provided with tools) into top of ram.
(5) Attach hoisting line and lift ram from cylinder.

When using the first method, the following procedure should be used when reinstalling the ram in the cylinder:

(1) Install ring compressor (see Tools Section 11) in top of cylinder.
(2) Remove any sharp edges from piston rings as these edges score the ring compressor.
(3) Lubricate the ram liberally with grease.
(4) Lift ram with the hoist line using the eye bolt and install in cylinder.
(5) When top of ram is half way down in top half of cylinder, check the fuel pump timing mark. (Make sure it is not out of top of window.)
(6) When ram is all the way to the anvil, again check timing on fuel pump. (Make sure mark is not out of the bottom of the window.)
  Note: The fuel pump timing mark should not at any time during Hammer operation leave the timing window completely.
(7) Remove the eye bolt from the ram.
(8) Install head gasket.
(9) Install head.
(10) Replace all but the four capscrews which support fuel and lube tank (early Hammers only).
(11) Tighten capscrews evenly. Uneven tightening could cause leakage at the cylinder head gasket. Cylinder head capscrews should be tightened as recommended on the Torque Chart - Section 11.
(12) Replace fuel and lube tank.
  (a) Install four remaining capscrews.
  (b) Install fuel and lube tank mounting capscrews.
  (c) Torque cylinder head capscrews and fuel and lube tank mounting capscrews are recommended on the Torque Chart - Section 12.

The second method of ram removal is as follows:

(1) Remove Hammer from leads.
(2) Remove anvil guide by removing (10) anvil retainer studs and (1) full bodied guide stud.
(3) Remove anvil from bottom of cylinder.
(4) Lift top of cylinder high enough to let ram slide part way out of bottom of cylinder.
(5) When the ram is out far enough to get a line on it, make a sling of rope or other material such as belting and slide the ram the rest of the way out of the cylinder.

Replacement of the ram is in reverse order to disassembly procedure. No ring compressor is needed to replace the ram as the bottom of the cylinder is beveled to receive the ram and anvil.

It is much harder to install the ram using the second method for the Hammer is lying down. The rings drop to the bottom of the grooves making it difficult to get them into the cylinder. Therefore, the first method as described earlier is recommended.

The following procedure should be followed when field installation of bronze wear rings becomes necessary:

(1) Remove ram from cylinder.
(2) Remove piston rings using ring expander. (see Tools, Section 10).
(3) Remove old ring. If broken, recover broken parts if possible. Check to be sure these particles have not jammed between ram and cylinder, anvil and cylinder, or in starting device linkage
(4) Before installation of new wear ring, roll it around the outside of its groove to insure a proper fit.
(5) Check cahmber of I.D. of wear ring to make sure it is adequate to clear the radius in the corners of the groove on the ram.
(6) Install wear ring.
  (a) Make sure O.D. of ram is free of burrs.
  (b) Lubricate surface of ram, ring will have to slide over.
  (c) Do not expand ring any more than necessary as too much expansion will set up permanent stresses. This could cause point contact of ring O.D. to cylinder and if excessive could cause ram seizure to cylinder. Slide ring on ram.
(7) Replace ram in cylinder

Note: Under no circumstances should the wear ring be installed or removed without first removing the piston rings.

Recoil Dampener

The recoil dampener is of a material that absorbs the shock loadings of the cylinder. It rides on the top part of the anvil flange just below the cooling ring,

Upper And Lower Cylinder

which vents the recoil dampener.

Wear should be checked for on the recoil dampener every week by measuring the difference in the distance between the bottom of the anvil guide and the bottom of the anvil. This measurement must be made with the Hammer setting on a piling so the anvil is in the "up" position. With no wear to the recoil dampener, the bottom of the anvil guide will be "flush" with the bottom of the anvil. As the recoil dampener wears the anvil will move up inside the anvil guide. When the bottom of the anvil has moved up 1/4" past "flush" from the bottom of the anvil guide, the recoil dampener should be replaced. Damage to the Hammer will result if operated with recoil dampener worn in excess of 1/4". Replace recoil dampener when anvil travel exceeds 1-1/4".

The recoil dampener can be visually checked by pulling the anvil guide and anvil from the Hammer by removing the (11) anvil guide studs. If the recoil dampener is found to be 1" thick or less, it should be replaced.

Anvil

General Description: The anvil is located at the bottom of the cylinder and relays the energy, delivered to it from the ram to the pile. As the ram descends, closing the exhaust ports, it compresses air between it and the anvil. This air compression preloads the anvil and pile and is contained between the ram and anvil by means of piston rings located above the flange of the anvil.

Located on the top of the anvil is the combustion chamber. The injector sprays atomized fuel into this chamber just prior to the time that the ram strikes the anvil. The residual gases explode and expand, driving the piling and anvil down and the ram upward in the cylinder.

Anvil Guide

The anvil moves up and down inside the anvil guide 1" and has its movement curtailed by a flange which is a part of the anvil casting. This flange rests against the bottom of the recoil dampener when the anvil is in the "up" position. The downward travel of the anvil is curtailed by a shoulder which is machined in the anvil guide. The anvil guide is held in place by means of anvil guide studs.

To remove the anvil with the ram cylinder use the following procedure:

(1) Hammer should be resting on a wood block large enough to hold the anvil in its "up" position.
(2) Engage starting device with ram.
(3) Remove nuts from top of anvil guide studs.
(4) Disconnect hoist line from starting device.
(5) Attach hoist line to cylinder head and lift Hammer from anvil and anvil guide.
Note: When lifting, make sure that ram is resting on lifting lever and does not drop through lower end of cylinder.

To replace anvil, reverse procedure shown above. A ring compressor is not needed for anvil rings since lower end of the cylinder is tapered for gradual compression of these rings.

When tightening the anvil guide studs, the following procedure should be followed when a torque wrench is not available. This is called the turn of the nut method for tightening anvil guide studs. This method proceeds as follows:

(1) Install (1) guide stud with (6) belleville washers first to line up anvil and anvil guide with the Hammer. Then install the (10) retainer studs with (10) spacers. Studs must all be installed with the end "up" having the greater length of threads and longer chamfer.
(2) Using any suitable wrench, apply approximately 40 Ft. Lbs. of torque to the studs. To evaluate approximately 40 Ft. Lbs. of torque, a gradual medium pull on a 12" wrench is suggested. (No extension or cheater may be used). If a longer wrench is used, the hand should be placed 12" from the nut, not at the end of the grip of the wrench. This torque will just flatten the spring washers on the studs. If a cotter slot lines up at this point, insert cotter. If not, increase the "turn of the nut" to the next slot and insert cotter. Do not back-off from initial pull to line up slot as it is desirable in this case to have studs over-torqued rather than under-torqued, within reasonable limits.

Note: Unless studs are tapped back and forth and rotated during initial tightening they will catch in a cocked position. This cocking would result in false tightening readings and cause eccentric bending loads on the stud. It is very important that studs be aligned during tightening so that the nut faces seat uniformly all around.

After reassembly, and before starting the Hammer, lubricate the four grease fittings in the lower cylinder and two fittings on the anvil guide. Lubrication of these grease fittings is critical and special grease is required. Consult the Lubrication Chart (see Section 4). Make sure grease fittings are tight Loose or missing fittings will result in loss of compression and power.

Adapter Assembly

Whenever a driving head is used, an adapter assembly is necessary. The adapter assembly consists of a male and female unit. Three plastic and three aluminum discs are placed in the female unit and the adapter cap is placed on top. The plastic and aluminum discs are to be alternated starting out with a plastic disc. The aluminum discs act as fire walls between the plastic as high temperatures are generated when driving piling. These temperatures would otherwise burn up the plastic. After proper assembly, the adapter assembly is placed between the anvil recess and the driving head.

Section 5 - Continued

Upper And Lower Cylinder

Although the adapter assembly affords protection to the pile its express purpose is to protect the Hammer. The discs should be visually checked every 2 or 3 months under normal driving conditions and more often under severe driving conditions. When the cushion discs become worn the use of foreign materials should be avoided. Worn discs should be replaced immediately with standard factory parts. Operation with excessively worn adapter discs will result in interference between adapter cap and adapter body and damage to adapter assembly will result.

The addition of discs to already compressed sets of discs is not recommended. The discs are for the express purpose of protecting the Hammer, and already compressed discs afford little protection.

When adapter assemblies and driving heads are used, factory standard parts should be used. An improper fit caused by the use of foreign parts can cause extensive damage to the Hammer.

When driving concrete piling, plywood of a satisfactory thickness is recommended as a cushion between the driving head and the piling to prevent spalling.

Note: An excessively thick pad may seriously slow driving and may affect the bearing values as computed by usual formulas.

All correspondence concerning driving head and leads should be directed to - Sales Department, FMC Corporation, Crane & Excavator Division, Cedar Rapids, Iowa.

Starting Fluid Injector

As an aid to starting the Hammer during cold weather operation and on soft piling, a starting fluid injector is installed.

Fluid placed in the starting fluid injector tank (2) Fig. 5-4 is deposited automatically into the combustion chamber through a spring loaded check valve (5) which is operated by vacuum created when the ram is raised for starting.

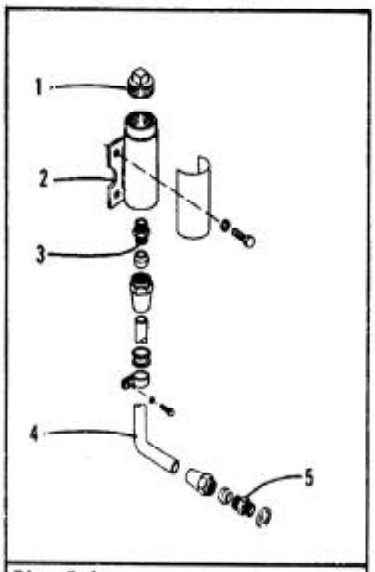


Fig. 5-4
Starting Fluid Injector
(1) Cap (4) Tube
(2) Tank (5) Check Valve
(3) Screen

Keep the following in mind regarding starting fluid:

(a) Use commerical starting fluid from pour type cans. Approximately four ounces of starting fluid is required to fill the system.
(b) Do not smoke when filling the tank. Be sure no sparks or flames from welding etc. are present in area when filling tank.
(c) Never fill tank when Hammer is at operating temperature
(d) Avoid spilling starting fluid on hands or clothing, especially during cold weather. The starting fluid evaporates rapidly, with consequent cooling which can cause severe frost bite.

Since the starting fluid enters the combustion chamber when the ram is raised, the ram should be resting on the anvil when the tank is filled, so starting fluid will be available in the combustion chamber for the initial start. To insure that a sufficient vacuum is created to draw starting fluid into the cylinder, wait at least twenty seconds between starting attempts.

If fuel has accumulated in the combustion chamber drop ram several times with the fuel off to dry out combustion chamber before filling starting fluid tank.

Check starting fluid tank cap before replacing after each fill to make sure vent hole in cap (1) is open. Operation with a clogged vent cap will result in damage to the system.

A filter screen is located in the hose connection (3) at the tank. Remove the connector and clean the screen once a month. Inspect mounting bolts and connections weekly and tighten if necessary.

If the starting fluid injector system is not required for extended periods of operation, it may be removed from the Hammer. After removal, be sure to install special capscrew and copper gasket in tapped hole in lower cylinder. These items are included loose with the Hammer.

Cold Weather Operation

In addition to using the Starting Fluid Injector previously explained, the following points may be helpful for cold weather starting and running:

(a) Start the Hammer on a partially driven piling. During extremely cold temperatures, run the Hammer at part throttle, near idle, until it reaches operating temperature.
(b) Below zero weather calls for particular care so that the Hammer is gradually brought up to operating temperature before submitting it to shock loadings of full driving force.

One method of assuring the above conditions is to store the Hammer under a heated tarp, or tent, overnight. Or, remove the Hammer from the leads and store in a heated building.

(c) Adherence to specifications for oils as indicated on the lubrication Chart is particularly important; also, diligence in checking the condition of injectors more often as instructed under Fuel Injectors pays off in easier starts and trouble free running time.

Section 5 - Continued
Upper And Lower Cylinder

(d) In the event starting fluid is not available, it is helpful to heat up the combustion chamber by dropping the ram se several times with the throttle control "off".

Good Hammer Operation Depends On:

(a) Sufficient compression for ignition.
(b) Good fuel injected into the combustion chamber - proper quantity at the proper time.
(c) Ground or piling resistance great enough to insure starting and continued operation.

Section 6
Starting Device

Starting Device
(For Hammer Installation and Starting, refer to Section 3)

The starting device is an off-center linkage mechanism designed to engage with a machined shoulder on the ram for lifting the ram, and for starting the Hammer. The starting device consists of a lifting lever (8) locking lever (10) and linkage, a release lever (11) and a latching lever (12). A wire rope (5) is connected to the housing (7) and extends upward through the cover (1) and is connected to the crane hoist line with a socket and wedge. The crane hoist cable passes between two guide rollers which are mounted in the cylinder head. For easy installation of the crane hoist line, one of the guide rollers can be removed and replaced after hoist line installation.

To start the Hammer the following procedure should be followed:

(a) Lift Hammer in leads to proper height.
(b) Set pile under Hammer. It is important that the entire weight of the Hammer is bearing on the pile so the anvil is in the "up" position, to permit latching of the starting device.
(c) Pull down on latch rope (3) fully and hold (by ground crew). Refer to Fig. 6-2.
(d) Crane operator can now lower starting device (7) Fig. 6-1, until it strikes the latching lever (12), thereby rotating the linkage over center and latching the lifting lever with ram. (See Fig. 6-3.)
(e) Ground crew should release latch rope.

The latching lever is spring loaded to hold it in the "off" position and is actuated only by pulling the latch rope. The spring loading prevents accidental engagement of the lifting lever with the ram while the Hammer is in operation.

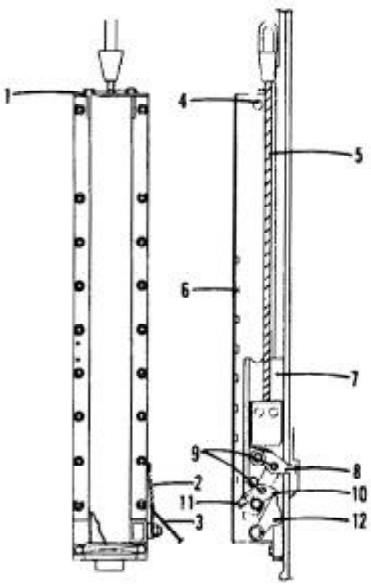


Fig. 6-1
Starting Device (Typical)

(1) Cover
(2) Spring
(3) Latch Rope
(4) Lifting Pin
(5) Wire Rope
(6) Cover-Ratchet
(7) Starting Device Housing
(8) Lifting Lever
(9) Shear Pins
(10) Locking Lever
(11) Release Lever
(12) Latching Lever

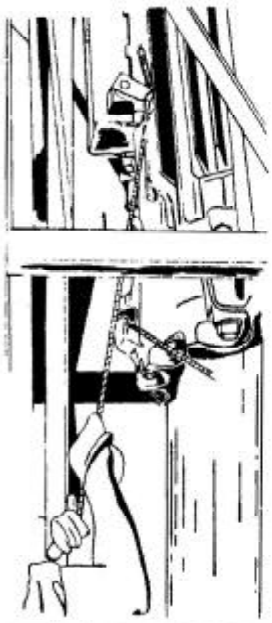


Fig. 6-2
Pulling Latch Rope

Starting Device

(f) Crane operator can now engage hoist clutch and lift ram to top of stroke.
(g) To release ram for free fall, stop upward movement and release hoist. A slight downward movement of the starting device will cause the release lever or "dog" (11) to contact a groove in the pressure plate and rotate the linkage mechanism off-center, thus relaesing the ram.

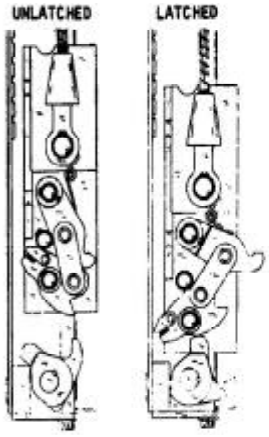


Fig. 6-3
Latching Mechanism

Note: The starting device weight is adequate to overhaul the wire rope under ideal conditions, but if sleeve bearing drums, long booms, dragging brakes, or other wire rope drags are encountered, it may be necessary to install some form of overhaul weight to enable engagement.

Things To Do After Starting

Proper care of the starting device after the Hammer is started is important.
(a) When the Hammer is started, position the starting device (7) with the hoist line so it is in the approximate center position of the starting device is held in either the extreme top or bottom position in the cover, it will be subject to shock loadings which will cause undue wear or damage.
(b) Allow hoist wire rope to spool out as the pile is driven so the starting device is kept in the center position of the cover. If the hoist line is restrained while driving pile, it will become taut, raising the Hammer on the pile. Then the energy available will not be transmitted to the pile, resulting in loss of compression and the Hammer will cease to fire.

Note: Do not pull latch rope at any time while Hammer is in operation.

Accidental engagement of the starting device linkage while the Hammer is in operation will cause damage to the ram and the starting device. Two shear pins (9) are provided in the starting device linkage as a safety measure in case the lifting lever is engaged while the Hammer is in operation.

If the starting device will not latch in with the ram or does not release properly it should be disassembled and inspected.

Disassembling Starting Device

To disassembly starting device proceed as follows:
(a) Remove cover.

Note: In removing cover special care should be given to damage to the wear shims which go between the mating surface of the starting device housing and cover. These prevent excessive wear to the shoulders of the cover and housing.

(b) Remove housing (7 in Fig. 6-1), which contains starting device, from cover.
(c) Use snap ring pliers to remove snap rings from pins which hold the linkage in housing.
(d) Remove pins.
(e) Remove linkage.
(f) Remove hollow shear pins and inspect for cracks and damage to friction assembly.
(g) Replace all damaged or worn parts.
(h) Wash all parts in diesel fuel.

Dirt, dust or other abrasive materials sometimes will cause improper operation.

Reassembly Of Starting Device

(a) Install hollow shear pins into connecting links and lifting lever.
(b) Place linkage assembly into housing.
(c) Install pins.
(d) Use snap ring pliers to install snap rings into pins which hold linkage in housing.
(e) Install housing, which contains starting device, into cover.
(f) Position wear strips in place.
(g) Install cover. Torque nuts to specified torque as shown on Torque Chart, Section 11.

To check the starting device for proper operation, proceed as follows:
(a) Lay cover on blocks or work bench, open side up.
(b) Place wear shims in position.
(c) Place starting device in cover on wear shims.
(d) Pull latching lever "full on".
(e) Slide the starting device into the latching lever. The linkage should rotate to the engaged position. If it does not rotate it may be necessary to alter the shape of the latching lever to give a more desirable impact angle. When proper latching is evident, install the mechanism on the Hammer. See Torque Chart for proper tightening of cover hold down studs.

The following procedure should be followed to check out the starting device after installation on the Hammer.
(a) Place a wood block under anvil to raise it to the "up" position.
(b) Pull latch rope "full on".
(c) Raise the starting device and let it "free fall" against the latching lever.

If the starting device fails to engage with the ram properly, it would indicate that the surface which contacts the lifting shoulder

on the ram is making contact before the linkage moves past center. It may be necessary to remove enough material from the lifting surface of the lifting lever or the latching lever on both to allow the linkage to move past center easily.

Note: It must be remembered that after a false start, compression has to dissipate before the ram will return to the starting position, lining ram lifting groove up with the latching position of the starting device.

Starting Wire Rope Assembly

If starting wire rope assembly is to be replaced, refer to parts manual code page 19-12- for proper size and type.

CAUTION

Never Use The Starting Wire Rope For Lifting Purposes Other Than Starting Or Positioning A Free Hammer - Otherwise Undue Stress Or Breakage Of Wire Rope May Occur, Resulting In Equipment Damage And Personal Injury.

Note: Weekly inspect starting and lifting wire rope for wear or damage. Replace if necessary. See Section 10 for inspection of wire rope details.

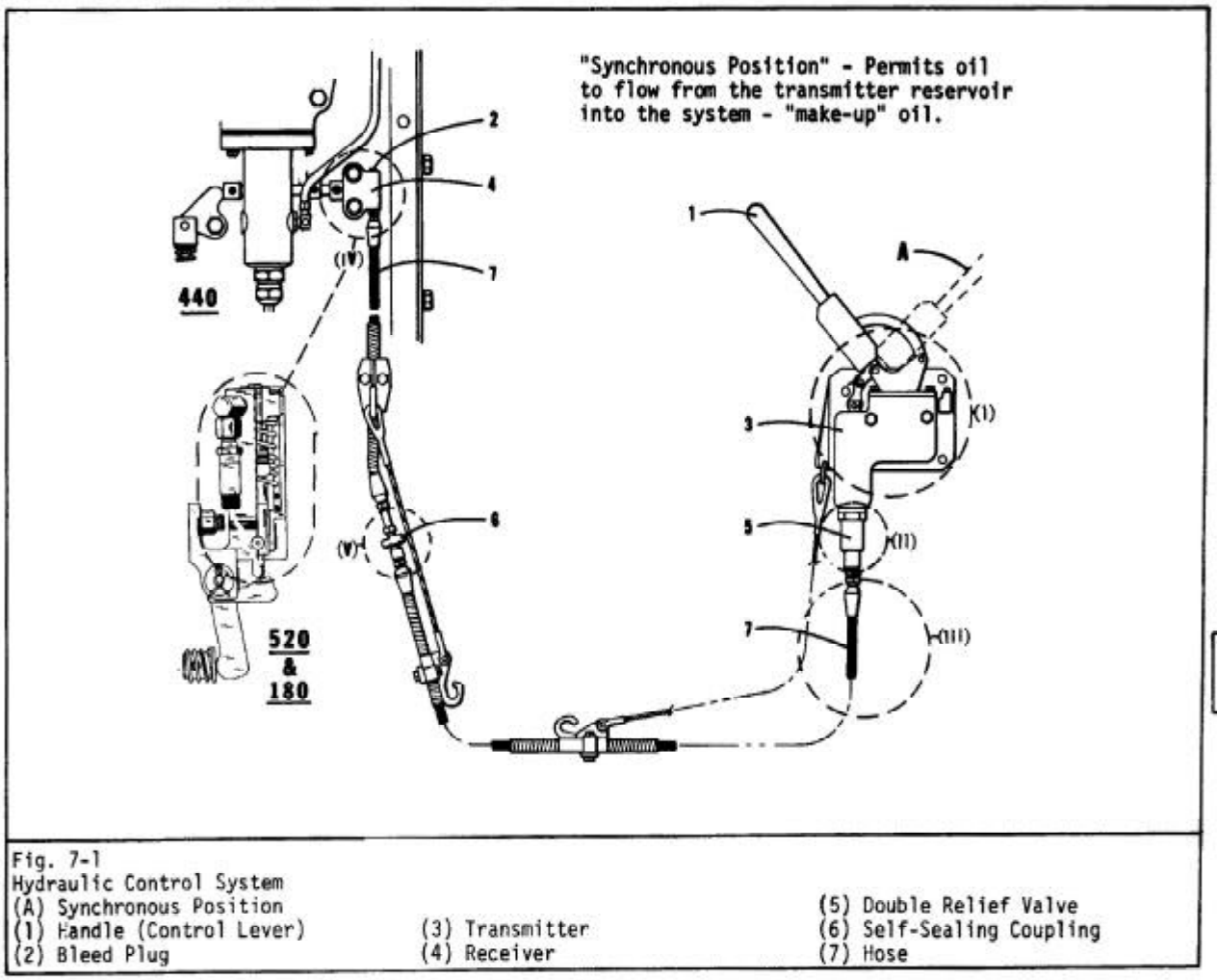


Fig. 7-1
Hydraulic Control System
(A) Synchronous Position
(1) Handle (Control Lever)
(2) Bleed Plug
(3) Transmitter
(4) Receiver
(5) Double Relief Valve
(6) Self-Sealing Coupling
(7) Hose

Hydraulic Control System

The Hammer is equipped with a hydraulic control to vary the amount of fuel delivered by the fuel pump to the injector.

Varying the amount of fuel to the Hammer will increase or decrease Hammer's output energy only. The Hammer's speed (blows per minute) will not be affected, remaining about constant regardless of ram stroke or output energy. Also "pumping" the transmitter handle does not inject more fuel as fuel injection only occurs when can roller rides over the can surface on the ram.

The control consists of:

(I) A transmitter Fig. 7-1, which is the master cylinder for the control system and is usually operated by the machine operator.

(II) A double relief valve is mounted directly below the transmitter. This is designed to hold a pressure head of oil in the control hose so that a vacuum will not be drawn in the system when operating the control lever. This is especially true when Hammer is placed on a long pile.

(III) A length of high pressure hose - 60' standard with up to 120' total.

(IV) A receiver is mounted on the Hammer.

(V) A self-sealing quick disconnect fitting at the Hammer.

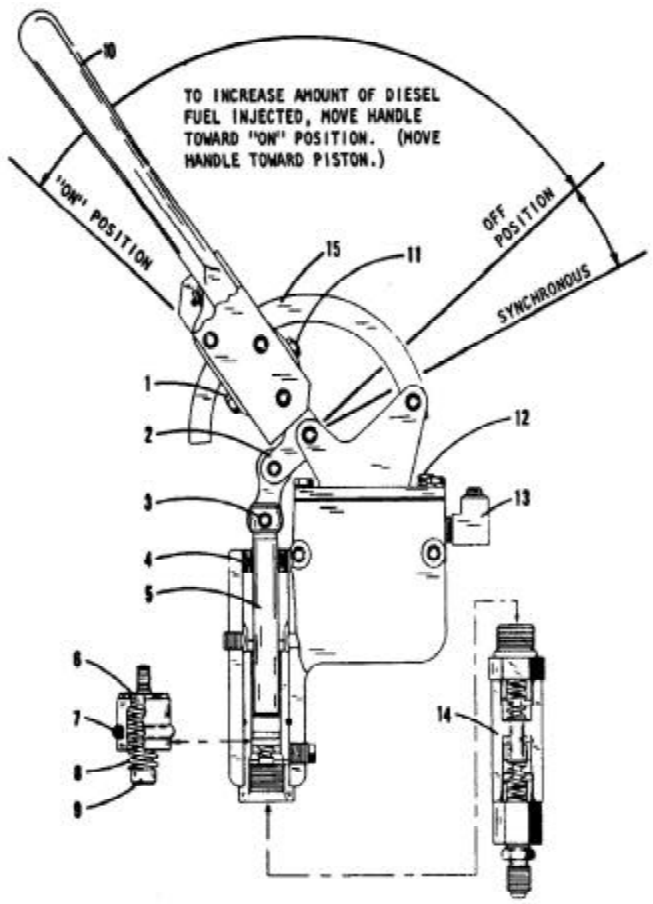


Fig. 7-2
Transmitter And Double Relief Valve

(1) Set Screw	(6) Washer Seal	(11) Set Screw
(2) Link	(7) "O" Ring	(12) Breather Cap
(3) Rollpin	(8) Spring	(13) Filler
(4) Seal	(9) Stripper Bolt	(14) Double Relief Valve
(5) Piston	(10) Handle	(15) Friction Quadrant

Transmitter

The transmitter serves as a reservoir for storage of hydraulic fluid and incorporates apiston assembly which meters hydraulic fluid to actuate the fuel pump rack through a receiver, or "slave cylinder", mounted on the Hammer. Operating fluid in the system is variable controlled by the friction type hand lever, which is connected with the piston assembly, Fig. 7-2 mechanical linkage. The transmitter assures a wide range of control of the fuel delivered to the Hammer since the positive friction lever may be set at any desired operating position.

By moving the control lever to the "on" position (towards open end of friction quadrant), a column of oil is moved thru the double relief valve thru the hose to the receiver. As the receiver piston moves out of its cylinder, Fig. 7-1, it moves the rack on the fuel pump towards the maximum fuel delivery position.

Always check receiver movement compared to transmitter movement because hydraulic hose stretch, air, hammer position, etc., may make receiver motionless.

Transmitter Handle Adjustment

The adjustment for drag on the handle must be adjusted periodically or handle will not remain where set. Adjust as follows:

(a) Back off set screw (1), Fig. 7-2, 1/4" from link.

Hydraulic Control System

(b) Turn set screw (11), Fig. 7-2, in until hand (10) does not lock when moved to the "on" position. Then back off on set screw (11) until handle does just lock when moved to the "on" position.
(c) With handle (10) in the "on" position, turn set screw (1) Fig. 7-2, until it contacts link. Then back off on set screw (1) 1-1/2 to 2 turns.
(d) Set both jam nuts on set screw (1 & 11).

Double Relief Valve

The function of the double relief valve Fig. 7-2 is to keep the control hose full of oil. No adjustment of the relief valve is provided. The preloaded head of oil in the system is maintained by springs in the relief valve. The double relief valve will maintain approximately 45 lbs. of value in either the "off" or "synchronous" position to permit operation of receiver higher than transmitter.

Hydraulic Hose

The hydraulic hose is high pressure double wire braid hose. Care should be exercised when handling this hose. If it is allowed to catch on the leads, pile, etc. in any way and be stretched, high pressures can be built up inside the hose. The stretching of the hose reduces its inside diameter causing a build-up of pressure resulting in damage to the control hose, or other parts of the control system.

A self-sealing coupling, Fig. 7-1, is located on the Hammer, permits removal of the hose without losing oil pressure or admitting air into the system while transporting the Hammer. This must be kept screwed tight or operator may not be able to shut Hammer off.

Bleeding The System

Bleeding the control system should be done by carefully going through the following steps. This procedure should be followed on initial start up:

(a) Make sure all hydraulic hoses are full of oil and connected at Hammer and a double relief valve on transmitter. Tighten all hose connections.
(b) Loosen breather cap, Fig. 7-2 located on top of transmitter. (Breather cap must loosen before operating and be left open during operation.) With transmitter lever in "full on" position, fill reservoir through elbow fitting located on side of transmitter, until oil is visible at top of fitting.
(c) After filling reservoir, pull lever all the way back toward operator and hold for a few seconds against internal spring tension. This is "synchronous" position which permits oil flow from the transmitter reservior into the system.
(d) Release control lever which will return to "off" position through internal spring tension.
(e) Remove bleed plug Fig. 7-1, located on top of receiver cylinder.

Note: Any air trapped in control system must move thru hose to the receiver. This receiver must be the highest point with transmitter being the lowest point.

Note: Also the hydraulic hose connecting the transmitter to the receiver must be kept in a straight line, free of twists or pigtails, to allow the air to escape.

(f) Move lever back and forth from "synchronous" to "full on" position until all air has been expelled from receiver through hole. Each time prior to moving lever to "synchronous" position, replace and tighten the plug. If plug is not replaced each time prior to moving lever to "synchronous" position, air will be sucked into system and additional bleeding will be necessary.
(g) Move lever to "synchronous" position and then push forward. If full fuel pump rack opening is not obtained, air is still entrapped in line.
(h) Fill transmitter reservoir through elbow fitting until oil is visible at top of elbow. and replace plug in elbow.

Note: If control system is bled properly it should not be necessary to pump up control to get full rack. However, because of the effect gravity and pressure has on a vertical length of hose (causing it to stretch) it may be necessary to pump up system using the control lever.

Note: When Hammer's height in leads (above transmitter) exceeds about 120', weight of column of oil may tend to create a vacuum in oil column at receiver. If transmitter lever is moved to synchronizing position, vacuum will form in receiver allowing oil to flow backwards from hose to transmitter reservoir thus losing all synchronization. This synchronization and bleeding of the system should be done while Hammer is not elevated more than 80 feet above transmitter level.

Few problems will be experienced if the hydraulic system is properly cared for. Always use the recommended type of control oil. Make sure control oil and component parts of the system are kept free of contaminents and foreign materials. The hydraulic components in the system are machined to precision tolerances and the presence of water or an abrasive material will appreciably shorten their useful life.

Hydraulic Fluid

Refer to lubrication chart for recommended hydraulic fluid for the control system. Hydraulic brake fluid must never be used, as use of this will result in rapid deterioration of the "O" ring packings. Approximately three pints of fluid or more is required to fill the system depending on length of hose.

Cleanliness

The utmost care should be used when handling the parts of the hydraulic control system. If dirt or any abrasive material is allowed to enter the system it will score cylinder walls and pistons, damage packing and prevent the system from operating properly.

Receiver

The receiver consists of a housing and a piston which are mounted on the Hammer. The hydraulic hose is attached to the side of the receiver housing cylinder. As the throttle control lever is moved towards the maximum fuel delivery, a column of oil moves thru the control hose. The oil pressure moves the receiver piston to engage and open the rack on the fuel pump. A spring assembly serves to return the fuel pump rack and receiver piston, closing the fuel pump rack when the hydraulic transmitter lever is moved toward "off" position.

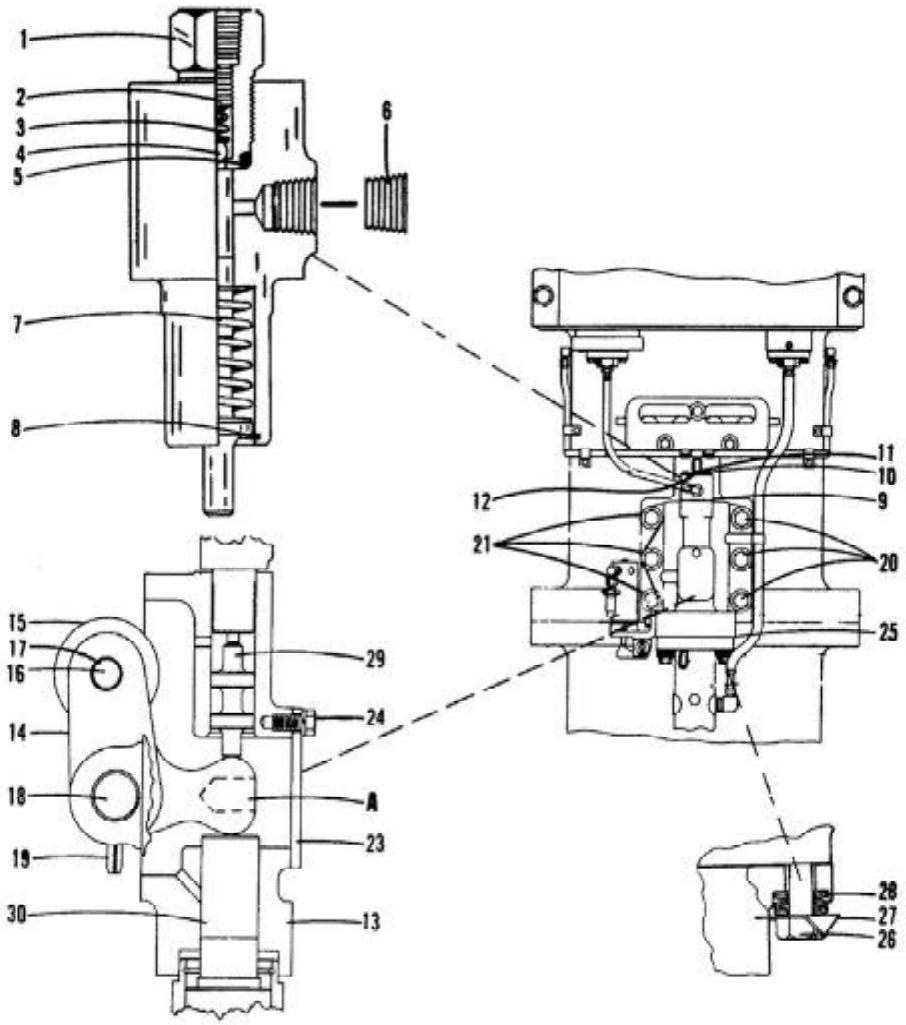


Fig. 8-1
Fuel And Lubrication Oil Pump Assemblies (Typical of 520 & 180 DPH)
A = Recess For Priming Lever

(1) Discharge Fitting
(2) Lock Screw
(3) Spring
(4) Steel Ball
(5) "O" Ring
(6) Pipe Plug
(7) Spring
(8) Ring
(9) Shim
(10) Capscrew
(11) Belleville Washer
(12) Wire
(13) Pump Drive Housing
(14) Pump Lever
(15) Cam Roller
(16) Pin
(17) Set Screw
(18) Pump Lever Shaft
(19) Rollpin
(20 Capscrews
(21) Belleville Washer
(22) Wire
(23) Cover
(24) Capscrew
(25) Shims
(26) Capscrew
(27) Lock Plate
(28) Belleville Washer
(29) Tappet
(30) Tappet

Fuel Injection System

Diesel fuel is contained in a tank which is mounted on the top half of the cylinder. It is filtered by an element which is located inside the tank. The fuel is supplied to the fuel injection pump by gravity flow through a hose from the fuel tank.

A high pressure fuel line delivers the fuel from the fuel pump to the injector. When the fuel pressure reaches the "pop-off" setting of the injector, fuel is introduced in atomized form into the combustion chamber in the ram and anvil.

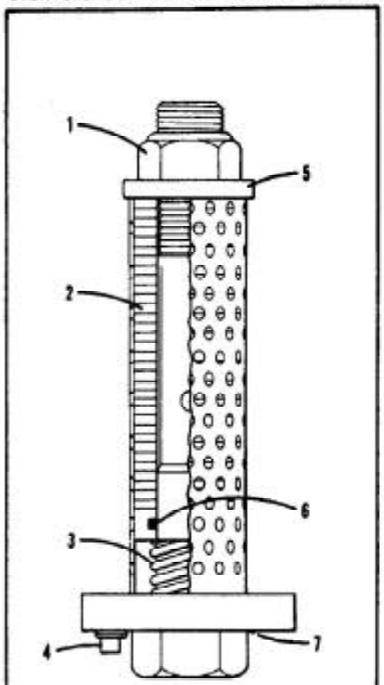


Fig. 8-2
Fuel Filter Assembly
(1) Locknut
(2) Filter Element
(3) Spring
(4) Tank Drain Plug
(5) End Plate, Top
(6) "O" Ring
(7) Filter Head

Fuel Filter

The filter element which is mounted in the bottom of the fuel tank should be replaced after the first week of operation and once a month thereafter. (Oftener under dusty conditions.) The filter has a paper disc type element, Fig. 8-2 and can be removed by removing the four capscrews which hold it into the bottom of the tank.

(a) Drain tank by removing plug from bottom of filter assembly. (See (4) in Fig. 8-2.)
(b) Remove capscrews holding filter in place and remove filter from tank.
(c) Remove large nut from top of filter.
(d) Remove and replace paper elements and screen as a unit. Also check condition of "O" ring and replace if necessary.
(e) Replace large nut.
(f) Flush tank with diesel fuel.
(g) Replace gasket between filter and tank.
(h) Replace filter in tank.
(i) Refill tank with a diesel fuel conforming to the specifications listed on the lubrication chart.

Fuel Injection Pump

The fuel injection pump Fig. 8-1, is supplied with fuel, gravity fed through a hose from the fuel tank to the entrance located on the side of the pump.

The pump is operated by a bell crank lever with a neddle-bearing roller which contacts the machined cam surface of the ram. As the ram's cam surface contacts the roller, the bell crank forces the pump piston downward placing fuel under pressure in the fuel line to the injector. The fuel pump is an American Bosch Type, manufactured to ICE specifications.

Fuel Pump Rack

The fuel pump rack is located in the center of the pump body. It is spring loaded for fuel shut off. The rack limiting stop consists of two rack stops at each end of the rack. The "rack-stops" contact the pump body on either side to limit both "full" and "off" positions of the rack. For information concerning fuel rack movement or operation, see Receiver, Section 7.

Fuel Pump Priming Procedure

Fuel pump priming is necessary to rid (bleed) the fuel system of air in order to have proper fuel pump and injector operation.

Note: If air is present in fuel system it will result in hard starting or poor Hammer operation.

The fuel pump should be bled upon initial delivery of the Hammer, when Hammer has laid idle for some time, and when Hammer has accidently ran empty of fuel. To prime the fuel pump as follows:

(a) Remove screw plug from pump and allow a small quantity of fuel to drain from the fuel tank to remove any trapped air or moisture in fuel line.
(b) Reinstall screw plug and tighten.
(c) Next remove cover plate between lube pumps. See Fig. 8-1.
(d) Raise ram 17". (This will raise cam surface from fuel pump bell crank.
(e) Lock hoist brake.
(f) Open throttle. Observe fuel pump rack operation.
(g) Loosen injector line fittings at the injector. (First loosen bronze nut, then the steel nut.)
(h) Insert small diameter end of priming lever in bell crank at point (A) Fig. 8-1.
(i) Hand operate fuel pump until fuel alone is escaping from the loose injector line.
(j) Tighten injector line.
(k) Hand operate fuel pump until heavy resistance is felt, then jerk down on lever to pop injector. (Injector should make loud squeaking noise.)
(l) Reinstall cover plate between lube pump.

Fuel Pump Timing

The fuel pump timing window is loacted left of center and just below the pump mounting flange.

Fuel pump timing is required to prevent serious damage to the pump and to insure proper pump filling and pumping strokes.

The following procedure may be used to check or retime the fuel pump:

(a) Lift entire Hammer clear of piling, anvil and ram in down position, and tip the Hammer forward slightly, toward the fuel pump. This assures that the weight of the ram is against the cam roller (15) Fig. 8-1, forcing the tappet to the lowest position it goes during operation.

(b) The relative positon of the timing marks should appear respectively as pictured in Detail (B) of Fig. 8-3. Timing marks should be at least 1/32" above the bottom of the window to prevent possible bottoming of the internal parts of the pump.

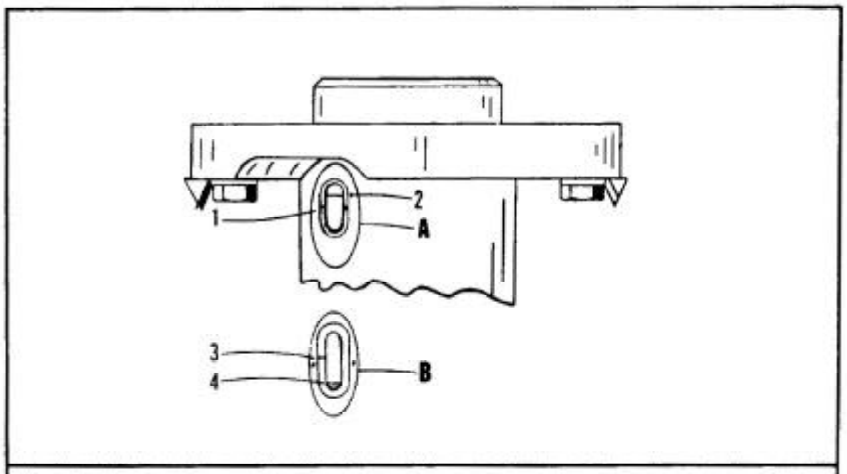


Fig. 8-3
Fuel Pump Timing
Detail (A) - Timing Marks With Ram Up
Detail (B) - Timing Marks With Ram Down
(1) Index Marks On Window
(2) Timing Mark
(3) Index Marks
(4) Timing Mark

CAUTION

The Timing Mark, Fig. 8-3, Should Never Be Allowed To Leave The Window Either During Hammer Operation Or While Checking Timing Or Pump May Be Severely Damaged Or Completely Ruined.

Add shims to increase or remove shims to decrease this dimension and obtain as close to 1/32" plus as possible.

When installing a new pump, leave capscrews (18) Fig. 8-1, loose so that the timing mark never leaves the window; tighten to position timing mark and determine shims required to obtain as close to 1/32" as possible. Insert shims and tighten per recommended torque value as shown on torque chart, Section 11. Check this dimension again.

(c) Set Hammer on a piling, or driving head, latch in and raise the ram about 17". At this time the timing marks will appear as in Detail (A), Fig. 8-3. Timing mark (2) should be a minimum of 3/32" above index mark (1). Loosen capscrews, (18) Fig. 8-1, and determine number of shims needed to obtain this dimension and in no case should timing mark (2), Fig. 8-3, be less than 3/32" above index mark (1).

(d) Insert shims and replace capscrews and torque to value shown on torque chart, Section 11. For servicing fuel pump, see SM 19-6 in Section 19.

8

Note: American Bosch has changed their fuel pump guide cup design. The bottom of the cap is now used as the timing mark where as before the center of the cap was. Fig.8-4.

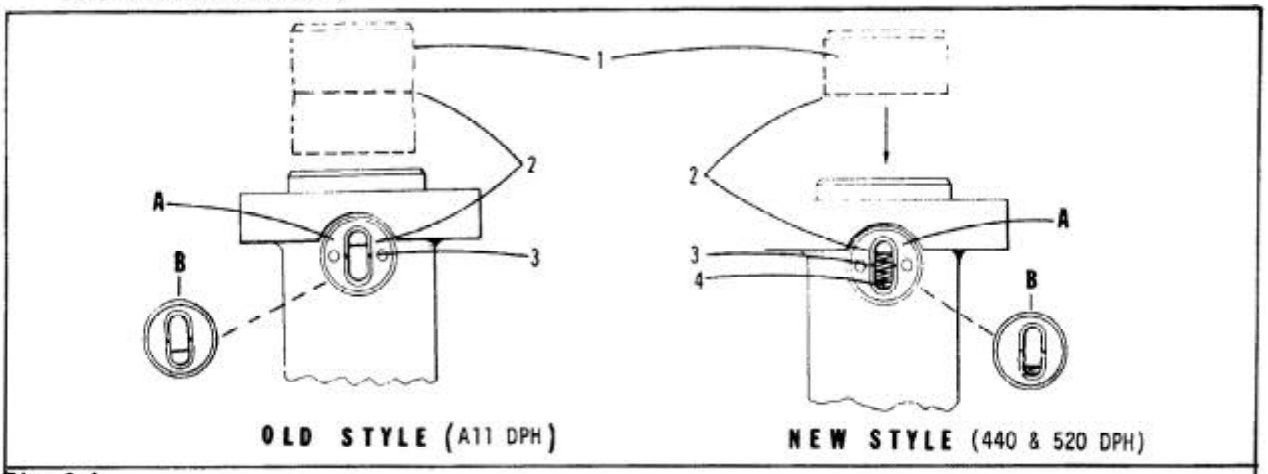


Fig. 8-4
Fuel Pump Timing Mark
(1) Cap
(2) Timing Mark (Cap)
(A) Timing Mark (Ram Up)
(B) Timing Mark (Ram Down)
(3) Index Marks (Window)
(4) Spring (New Style Only)

When ram is raised you will look through the timing window and see a spring instead of bottom of cap. Fig. 8-4. The window index marks are still in the same location. Use the bottom of cap for timing mark on plunger cap as reference when timing pump on new hammers. Fig. 8-4

Satisfactory operation of the fuel pump depends upon proper care and maintenance of its precision parts. Above all, the working parts of the pump must be kept dirt free. Weekly inspect the control rack Fig. 8-1, for possible dirt accumulation and clean with a clean, soft bristle brush and fuel oil to prevent excessive wear of rack and mating gears.

Periodically check the control rack actuating mechanism (links, pin and rack return spring assembly) for wear, looseness, binding or misalignment. Replace all worn or questionable parts. Replace if parts are worn or tend to bind.

Fuel Injector

The fuel injector nozzle and holder is made by American Bosch. It is advisible to inspect the injector nozzle assembly periodically and replace as necessary. (See Service Section (15) for testing and servicing injectors.)

Note: The injector is manufactured by American Bosch to ICE increased specifications. Due to high cylinder temperatures encountered in the air cooled cylinder, injector replacement should be made with ICE parts to insure long life and proper operation.

To Visually Check An Injector

(a) Before loosening any lines, apply kerosene or diesel fuel freely to all connections in order that dirt and grease may be removed.
(b) Loosen the bronze nut containing the rubber seal ring. See Fig. 8-5.
(c) Loosen the steel nut which connects the nozzle holder to the high pressure fuel line. See Fig. 8-5.

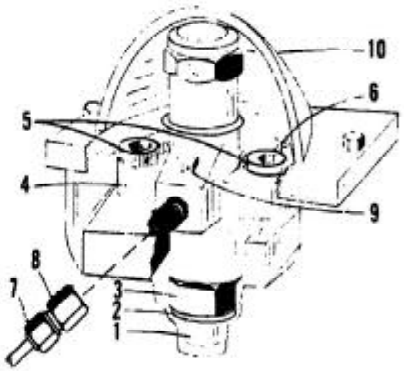


Fig. 8-5
Injector Assembly
(1) Nozzle
(2) Belleville Washer
(3) Retaining Nut
(4) Nozzle Holder
(5) Capscrews
(6) Safety Wire
(7) Bronze Nut
(8) Steel Nut
(9) Leak Off Plug
(10) Cover

(d) Remove the socket head capscrews (5) Fig. 8-5, and pull injector assembly from the Hammer.

Note: Be Careful Not To Strike Nozzle Against Any Hard Surface. Do Not Wipe Injector Tip Or Grit May Be Forced Into Opening, Ruining Nozzle.

(e) Assemble the injector on the high pressure fuel line facing outward.
(f) Remove cover plate Fig. 8-1.
(g) Raise the ram 17" and lock hoist brake.
(h) Open fuel rack.
(i) Insert hand priming lever, supplied with tools, in the hole provided in the bell crank.

CAUTION

The Penetrating Power Of Oil Under Pressure Is Sufficient To Puncture The Skin And May Cause Blood Poisoning. Therefore, Hands And Other Parts Of The Body Must Be Kept Away From The Spraying Nozzle.

(j) Using a sharp pull on the lever hand operate the fuel injection system. Nozzle should emit a fine narrow cone shaped fuel spray. A sharp "squeak" should also be heard. If any "flags" or "streamers" of fuel are observed, have nozzle replaced, see Fig. 8-6. It is wise to have new nozzle assemblies on hand so no time will be lost while the defective assemblies are being replaced.

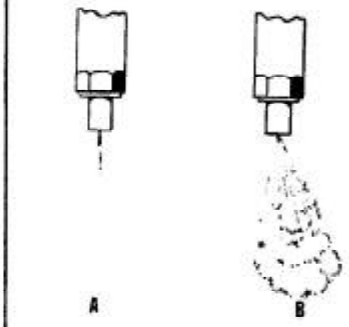


Fig. 8-6
Nozzle Spray Patterns
(A) Good Nozzle Spray Pattern
(B) Poor Nozzle Spray Pattern

Fuel injector problems are many time the result of improper injector maintenance and improper mounting of holder on the Hammer. They are usually accompanied by one or more of the following symptoms:

injector leakage; fuel line breakage; nozzle holder capscrew failure; fuel pump capscrew breakage; loss of compression and lowered Hammer energy output. Operating with a "coked" up injector assembly or dirty fuel can also cause some of the problems mentioned above.

Note: The nozzle retaining nut (3) Fig. 8-5 must be tight at all times - otherwise excessive amount of fuel will be expelled from the leak off plug. Torque retaining nut to torque values shown on Torque Chart, Section 11.

Note: Do not replace leak off plug (9) Fig. 8-5 with a solid plug. The leak off plug is necessary to relieve internal nozzle pressure - preventing nozzle failure and damage.

Note: For servicing injector nozzle refer to SM19-6-.

Lubrication System (See Fig. 8-1)

The cam and fuel pump drive assembly is lubricated by a single plunger lube oil pump. Lube oil is supplied to the pump by gravity flow from the lube oil tank passing through a screen filter inside tank.

The pump is operated by the same bell crank assembly that operates the fuel pump. As the ram rises, the bell crank moves rapidly upward and moves the lube oil pump plunger (4), Fig. 8-7, in the same direction forcing a small amount of lube oil past a spring (2) loaded ball check (6) and on through the hose (1) which connects to the lube oil header. This header, in turn, delivers this oil to three hoses. Two of these hoses lubricate the ram and cylinder bore. The other lubricates the fuel pump drive mechanism.

Routine inspection should be made of the ram to insure proper lubrication. The ram can be observed through the exhaust and intake ports and should always be covered with a film of oil. Insufficient lubrication will result in damaged rings and scored cylinder walls.

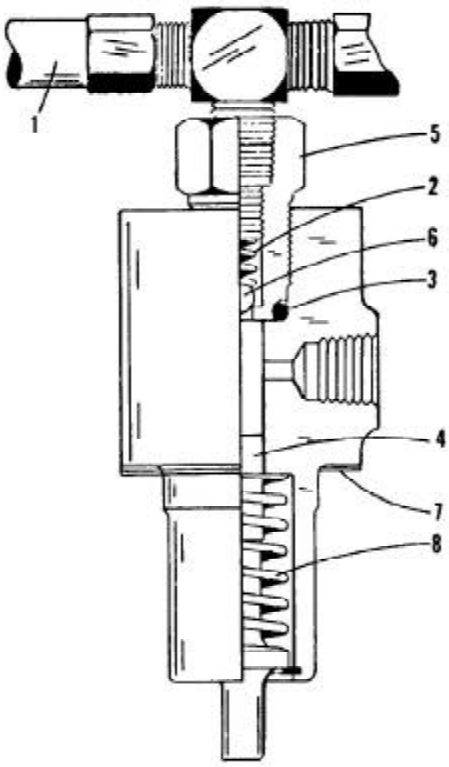


Fig. 8-7
Lubricating Oil Pump
(1) Hose
(2) Spring
(3) "O" Ring
(4) Plunger
(5) Fitting
(6) Check Ball
(7) Shims
(8) Spring

If a dry ram is observed through the exhaust or intake ports, shut down the Hammer immediately and inspect the entire lubrication system. Check for the following:
(a) Empty lube oil tank. To avoid running out of lube oil, fill the lube oil tank every four hours or whenever filling the fuel tank.
(b) Clogged filter screen in tank due to dirt and foreign material in the oil. This filter is cadmium plated and can be washed with diesel fuel
(c) Lube supply line broken, loosened or clogged.
(d) Incorrect weight lube oil being used.
(e) Water or ice in lube tank.
(f) Faulty lube oil pump.

To check lube oil pump operation the following procedure should be followed:
(a) Latch into ram with starting device.
(b) Raise ram 6" to 8".
(c) Remove lube oil hose (1), Fig. 8-7 form top of lube pump.
(d) With the fuel pump rack in the "off" position, insert the hand priming lever and manually operate the lube pump. At least one drop of lube oil should be visible per stroke.

To increase the amount of lube oil discharge, shims (7) should be removed from beneath the lube oil pump. This will increase the length of lube oil pump stroke. To decrease the lube oil discharge, add shims (7).

Excessive lubrication can be caused by a jammed or poorly seated ball check (6) in the lube oil pump

Section 8 - Continued
Fuel And Lube System

To check for this defect, fill lube oil tank at least half full. Remove the discharge line (1) from the top of the pump. If oil siphons out the top of the pump, the ball check is not properly seated and is not curtailing the flow of lube oil.

Excessive lube oil may cause flaming in the combustion chambers after normal comubstion of fuel has taken place, thus robbing oxygen in the cylinder for the suceeding power stroke.

The lube oil filter should be thoroughly washed with clean diesel fuel at least every three months, or oftener, depending on jib conditions. The following procedure may be used for removing and cleaning the filters:

(a) Drain oil from tank by removing plug from lower neck of tank.
(b) Remove four nuts, holding filter head (5), Fig. 8-8, in place and lower filter.
(c) Remove large nut (1) from top of filter.
(d) Remove screen type filter (7) and wash in solvent or diesel fuel.
(e) Check condition of "O" ring (4) in bottom end plate (3). Replace if necessary.
(f) Replace gasket (8) if necessary and reinstall filter by reversing removal procedure.

At low temperatures, oil may be too heavy to properly flow to the pump. If so, drain and flush tank and replace with lighter oil. The lube oil tank should be cleaned and flushed seasonally to insure cleanliness. Tank should also be flushed before changing to different oil weight. Check the lubrication chart for oil recommendations.

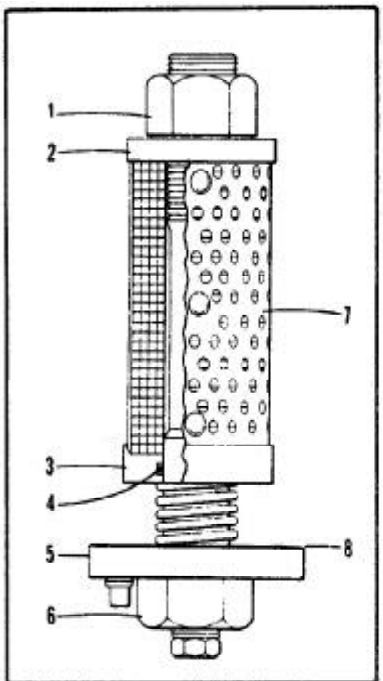


Fig. 8-8
Lubricating Oil Filter
(1) Nut
(2) Top End Plate
(3) Bottom End Plate
(4) "O" Ring
(5) Filter Head
(6) Nut
(7) Filter
(8) Gasket

Section 9

Rating Devices Equivalent Output Energy Rating Instrument

Basic Purpose Of Rating Device

The equivalent output energy rating instrument is supplied with charts to convert the bounce chamber pressure into output energy per blow.

Additional copies of the energy charts, sample calculations, etc., may be obtained from the dealer or from the factory.

How The Rating Instrument Works

In the ICE Diesel Hammer, as the ram travels upward, it traps and compresses air above the ram and in the bounce chamber. The compressed air represents stored energy which in addition to gravity accelerates the ram on its downward movement toward the anvil.

The output energy of the Hammer is thus made up of three parts:

(1) Potential energy in the ram = ram weight X ram stroke (the familiar WH).
(2) The energy stored in the trapped air in the bounce chambers.
(3) Energy from combustion transmitted directly to the anvil - mean effective pressure during anvil movement X anvil movement.

Both the potential energy in the ram and the stored energy in the bounce chamber can be evaluated by measurement of bounce chamber pressures. Since bounce chamber pressure can be related to ram stroke and bounce chamber energy is a function of this pressure, the bounce chamber pressure vs. ram stroke relationship and the bounce chamber pressure vs. bounce chamber stored energy relationship have been determined by theoretical calculations and verified by test. By calculating the potential energy in the ram (W X H) and adding it to the stored energy from the bounce chamber, the Equivalent WH rating for the Hammer has been determined for the normal range of bounce chamber pressures. The curves supplied with the Rating Instrument are based on this procedure.

The Equivalent WH Energy charts do not include the energy transmitted directly to the pile by the diesel combustion and thus, they are conservative. The energy from combustion varies because of pile resistance, pile and soil resilience, etc. For this reason, no attempt has been made to include this combustion energy in the charts. The Rating Instrument is thus not affected by these variables and reflects only ram stroke and bounce chamber energy which are directly tied together.

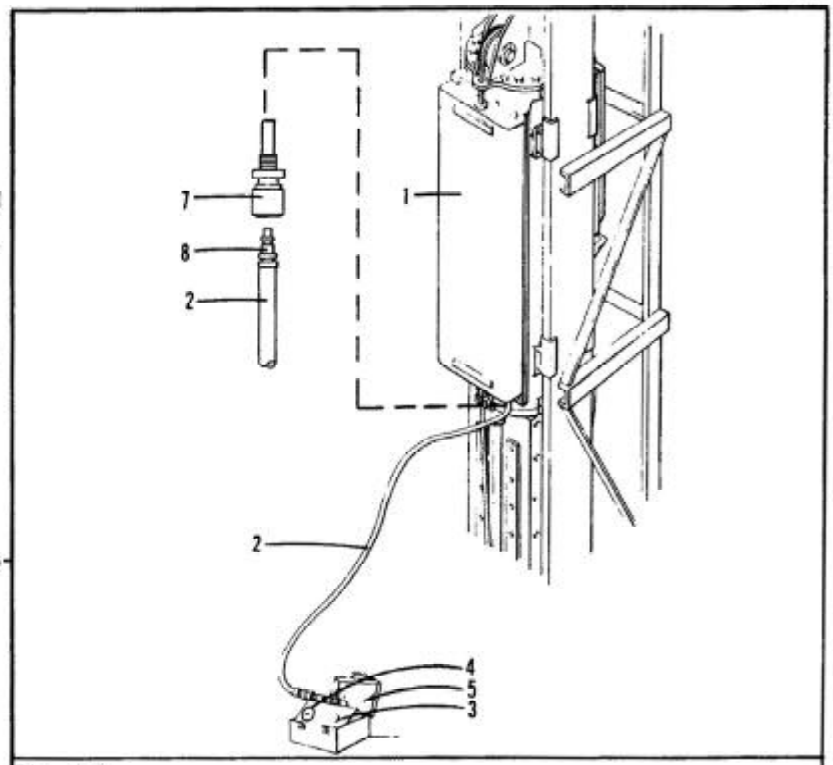


Fig. 9-1
Output Energy Rating Instrument (Typical)

(1) Bounce Chamber	(5) Graph
(2) Hose	(6) Adaptor
(3) Push Button	(7) Socket
(4) Gauge	(8) Plug

How To Use The Rating Instrument

(1) Drain both sides of the bounce chamber by removing the threaded plugs provided in the lower end of each side.
(2) Replace one of the threaded plugs and install the threaded adaptor and brass quick disconnect coupling in place of the second threaded plug.
(3) Runn the Hammer until it reaches operating temperature, normally 30 to 45 minutes.
(4) Plug the hose into the coupling in the bounce chamber and into the fitting provided in the gauge box.
(5) Select the Equivalent WH Energy Chart which corresponds to the model of Hammer being used and place it on the chart holder in the gauge box lid.
(6) When a reading is desired, firm ly depress the push button adjacent to the pressure gauge and hold it down. After the gauge hand has made three or four swings, read the pressure at maximum needle swing.
(7) Determine the Equivalent WH Energy by following the indicated pressure line horizontally across the graph to the curve corresponding to the length of rating hose being used and then read the Equivalent WH Energy vertically under this point on the bottom of the chart.

Section 9 - Continued
Rating Devices Equivalent Output Energy Rating Instrument Hose Lengths

(1) A 50 foot length of hose is supplied with the gauge box. A maximum of two additional lengths of 30 foot each can be obtained for a total maximum gauge reading hose length of 110 feet.
(2) The rating curves are correct only for the hose as furnished by the factory and for the overall lengths of hose as specified on the graph. If other lengths of rating hose are required; do not interpolate, consult the factory.

Care And Maintenance

(1) Drain both sides of the bounce chamber daily by removing the threaded plug or threaded brass quick disconnect coupling. Also drain the rating hose daily of any accumulated oil. It is also suggested that approximately once a week, the instrument be drained of any accumulated oil.
(2) No maintenance other than care in handling cleanliness, and occasional calibration should be required. If the instrument becomes damaged or inoperative, ut should be returned to the factory for repair and recalibration.
(3) Although the instrument is ruggedly built, it is an instrument and should be handled with care as such. Keep it clean and the hose connections sealed at all times.
   (a) Do not hold or jam the push button down for long periods of time as continuous swinging of the gauge hand will cause undue wear and may affect its calibration.
   (b) The hose should be kept in good condition, and free of foreign matter, obstructions, and leaks. When not in use, store the sections with the ends fastened together.
(4) The gauge should be recalibrated periodically to insure its accuracy. The period will depend upon the amount of use and care given the instrument.

To recalibrate:
(a) Connect the instrument to a known source of air pressure in the 15 to 25 PSI range that is equipped with an accurate gauge.
(b) Carefully pry off the gauge glass retaining rim and remove the glass.
(c) Depress the push button and turn the recalibration screw on the face of the gauge until the pointer indicates the same pressure as the accurate gauge.
(d) Replace the glass and rim.

This operation should be done in a clean dust-free place and care should be taken to keep dirt out of the gauge interior. Recalibrating as shown above should adjust the gauge to read accurately over its expected operating range if it has not been damaged.

Operation Factors

(1) Temperature changes have no signigicant effect on the ratings; within the temperature range where it is possible to operate the Hammer, the Equivalent WH ratings are essentially correct. However, the gauge lubricant may congeal at low temperatures and cause the gauge to read low. Under such conditions, it will be necessary to warm the instrument in order to obtain correct values.
(2) Altitude does affect the ratings. The charts are drawn for use from sea level to 2,000 ft. elevation. Above this, the ratings obtained from the charts should be increased by 1% for each 1,000 ft. up to 6,000 ft. and 2% for each 1,000 ft. from 6,000 ft. to 10,000 ft.

This phenomenon occurs because the atmospheric pressure is less at higher elevations. Therefore, lower absolute pressures in the bounce chamber are encountered which allow in greater ram strokes and thus higher Equivalent WH Energies.
(3) Operating the Hammer at an angle as encountered when driving batter piles does reduce the Equivalent WH Energy. The Equivalent WH Energy for the Hammer is reduced approximately by 1% at a 6 to 1 batter, 2% at a 4 to 1 batter and 4% at a 3 to 1 batter.

The reduction is less with ICE Hammers than Hammers without the bounce chamber since the bounce chamber energy is unaffected by the angle of the Hammer.
(4) Contact the factory for further information on applying the Equivalent WH rating correction factors. Charts and calculation can be supplied if required.

Prevent Hammer From "Racking"

The term "rack" is commonly used by pile driving personnel to define excessive bounce or jumping of a Pile Hammer during the driving operation. "Rack" is caused by allowing the ram to rise too far causing the entire Hammer to jump off the pile.

CAUTION

Damage Can Result If The Hammer Is Allowed To Bounce Or Jump (Rack) On The Pile While In Operation. There is Also Danger To Personnel Should Hammer Leap Off Pile And Fall.

In the ICE Diesel Pile Hammer, air pressure is used as a stop. When the air pressure becomes great enough to counterbalance the weight of the cylinder the entire Hammer will "rack" or jump noticeably.

Rack can result in damage to any Hammer as it causes shock loads to component parts. When the Hammer begins to rack, the operator should back off on the throttle until the Hammer runs without jumping.

When the Equivalent Output "WH" Energy Indicator is used the air pressure indicated on the gauge can be used as a guide to prevent Hammer "racking". The air pressure indicator should not be allowed to go beyond the pressure needed to

Rating Devices Equivalent Output Energy Rating Instrument

achieve the maximum output energy for the Hammer. The Chart furnished with the indicator can be used to check this pressure. If the gauge indicates pressures beyond those needed for maximum output energy, the throttle should be backed off.

When driving piling on a batter it will be found that the Hammer starts to lift at lower gauge pressures as compared to driving on plumb piling. The greater the batter the lower the pressure. Since this is normal, more care must be exercised to back off the throttle control when batter piles are being driven.

INTERNATIONAL CONSTRUCTION EQUIPMENT, INC.

Operator's Manual

Section 10
Tools And Specifications

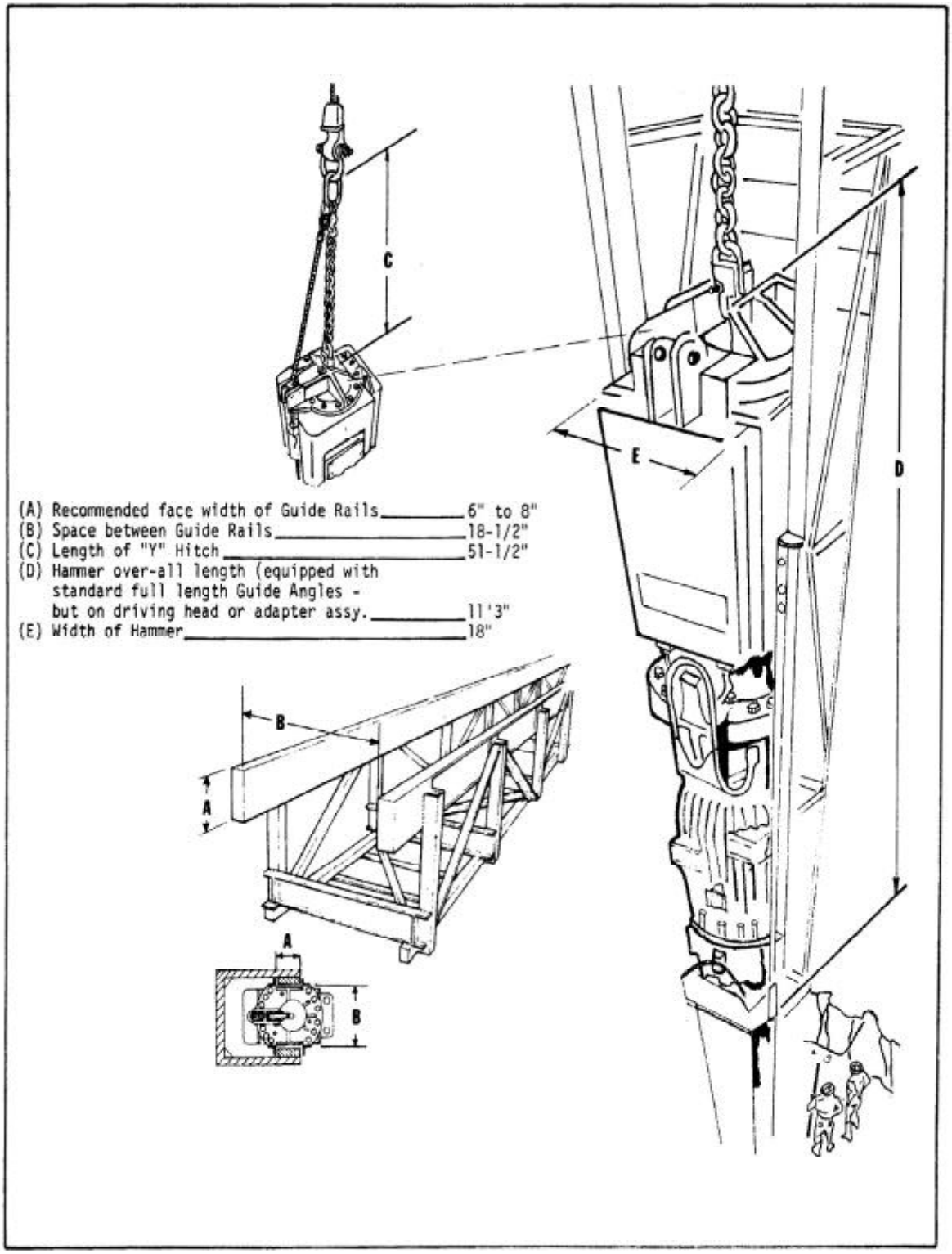
Specifications - Dimensions - Weights

Total Net Operating Weight, (Approx.) Lbs. *	4,550
Ram Net Weight, Lbs.	1,725
Anvil Net Weight, Lbs.	377
Hammer Over-All Length *	11'3"
Rated Ram Stroke, (At Sea Level), Inches	37.60
Maximum Equivalent Additional Ram Stroke From Bounce Chamber - Air Srpings, (At Sea Level), Inches	18.08
Maximum Equivalent "WH" Ram Stroke From Free Fall Plus Equivalent Bounce Chamber Stroke, (At Sea Level), Inches	55.68
Equivalent "WH" (Gage) Energy Rating, Max. Ft. Lbs. **	8,000
Blows Per Minute	90-95
Fuel Oil Tank Capacity, Gals.	5.5
Fuel oil Consumption, Normal, Gals. Per Hour	.65
Lube Oil Tank Capacity, Gals.	1.9
Lube Oil Consumption, Normal, Gals. Per Hour	.20
Hydraulic Transmitter And Hose Capacity, (Approx.) Pints	3
Starting Fluid Tank Capacity, Ounces	4
Shipping Weight, (Approx.), Lbs.	5,000
Shipping Weight Boxed For Export, (Approx.), Lbs.	5,300
Shipping Dimensions Boxed For Export, (Approx.)	
Width, Inches	33"
Depth, Inches	35"
Length, Feet	12'
Recommended Face Width Of Guide Rails, Inches	6" to 8"
Minimum Distance Between Guide Rails, Inches	18-1/2"

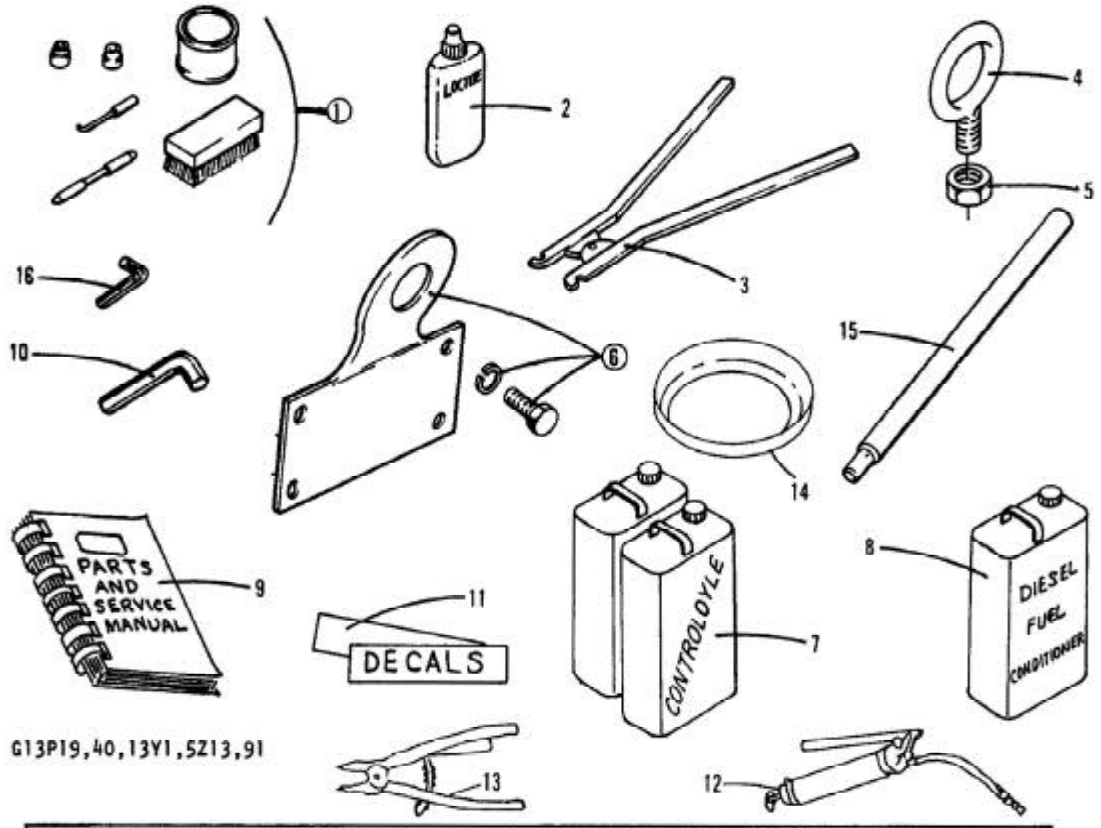
* Equipped With Standard Full Length Guide Angles
(But No Driving Head Or Adapter Assembly)

** Disregards Driving Affect Of Fuel Combustion

10



(A) Recommended face width of Guide Rails _____ 6" to 8"
(B) Space between Guide Rails _____ 18-1/2"
(C) Length of "Y" Hitch _____ 51-1/2"
(D) Hammer over-all length (equipped with standard full length Guide Angles - but on driving head or adapter assy. _____ 11'3"
(E) Width of Hammer _____ 18"



G13P19,40,13Y1,5Z13,91

TOOLS, SERVICE ITEMS, SPECIFICATIONS

REF.	PART NO.	QTY.	DESCRIPTION	REF.	PART NO.	QTY.	DESCRIPTION
①	5Z469	1	Nozzle Cleaning & Maintenance Kit		15P19	1	Model 180 DPH Parts & Service & Operators
2	13P12	1	Loctite "A", 50cc			1	Model 520 DPH Parts & Service & Operators
3	7Z269	1	Ring Expander, 12" (440, 180 DPH)	10	1X1040	1	Hex Wrench, 1/2" (Injector Adaptor) 440
	5Z507	1	Ring Expander, 18" (312, 440, 520 DPH)	11	PX333	1	Decal Kit (440 DPH)
4	5Z263	1	Eye Bolt (Ram & Adaptor Cap Removal) - 312, 440 520 DPH	12	PC45	1	Grease Gun
				13	5Z261	1	Snap Ring Pliers (Straight Tip - #24)(180,312,520)
	7Z149	1	Eye Bolt (Ram) (180 DPH)		5Z262	1	Snap Ring Pliers (Straight Tip - #26)(180,312,520)
5	1X191	1	Jam Nut (For Eye Bolt) - 312, 440, 520 DPH	14	7Z146	1	Ring Compressor (105,1)
					5Z258	1	Ring Compressor (312,520)
⑥	13Y1	2	Lifting Lugs				
	1X571	8	Capscrew (For Lifting Lug)				Standard Tools
	1C34	8	Lockwasher	15	13P27	1	Priming Lever (All DPH)
7	5Z379	2	"Sperry" Controloyle 1 Qt.	16	PA37	1	Hex Wrench, 3/8" (Fuel Injector) - 440
8	7Z536	1	Diesel Pep Diesel Fuel Conditioner 1 Qt.				
9	13P13	1	Model 440 DPH Parts & Service & Operators				

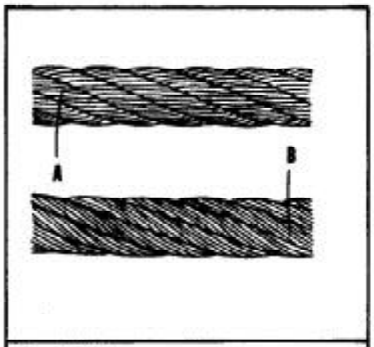


Fig. 10-1
Wire Rope
(A) Right Regular Lay
(B) Right Lang Lay

General Information

Wire ropes are made with two types of "lay". Lay refers to the direction in which the wires and strands are twisted to form the rope.

Regular lay as opposed to lang lay denotes the direction of wire twist in the individual strands. In regular lay rope, the wires in each stran lay in the opposite direction from the strands.

In lang lay rope the wires in each strand lay in the same direction as the strands.

Righ or left are used to refer to the lay of the strands.

Right regular lay rope is the most commonly used, and will be furnished on an order unless other lay is specified.

Measuring Wire Rope Diameter

As the illustrations in Fig. 10-2 indicate, there is a right and wrong way to measure wire rope diameter. Wire rope is always measured across the largest diameter that will fit inside a true circle.

Wire rope is always made larger, not smaller, than the nominal diameter. The allowable tolerances on wire rope diameters are:

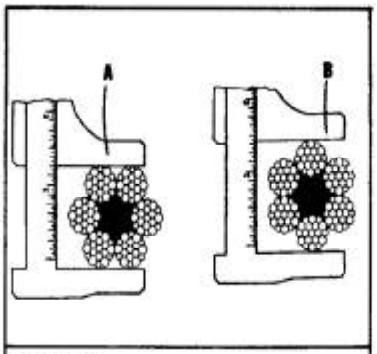


Fig.10-2
Measuring Wire Rope Diameter
(A) Incorrect
(B) Correct

Nominal Dia. In Inches	Allowable Over Size In Inches
To 3/4	1/32
13/16 to 1-1/8	3/64
1-3/16 to 1-1/2	1/16
1-9/16 to 2-1/4	3/32
2-5/16 and Larger	1/8

In standard practice, the nominal diameter is the minimum diameter. A rope is not considered oversized until its diameter exceeds the maximums listed above.

Ordering Wire Rope

When ordering wire ropes, the following information must be furnished, to be sure of receiving the correct wire rope. This is especially true when ordering wire rope from other sources than FMC.

(a) Length required.
(b) Diameter
(c) Construction (type and number of strands, and wires per strand.)
(d) Type of core (hemp or wire center).
(e) Grade of steel.
(f) Direction of lay (right or left lay).
(g) Regular lay or lang lay.
(h) Class of service wire rope is intended for; that is drag wire rope on a drag line, hoist wire rope on a shovel, etc.
(i) Preformed or not preformed.

When the above information is not specified, the wire rope manufacturer will generally furnish right, regular lay, ordinary fabrication, hemp center wire ropes.

Wire Rope Inspection And Replacement

All wire rope will eventually deteriorate to the point where it must be replaced. There are three basic reasons for this deterioration, as follows:

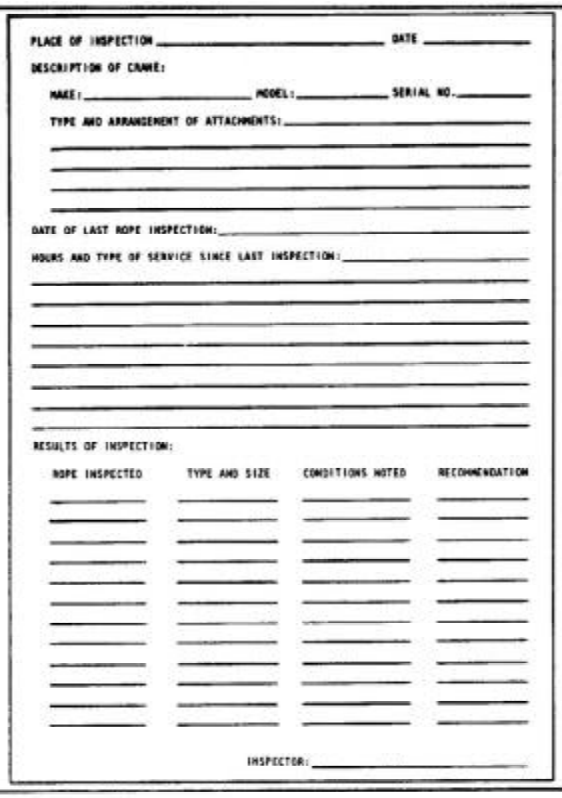
(1) Abrasion or wear.
(2) Corrosion
(3) Fatigue, caused by constant pulling, bending, crushing, or kinking forces acting against the rope during normal useage.

When wire rope is replaced, use the type specified in the parts manual. Machines are designed to use a specific type and size of rope. Using anything but the recommended rope may result in short life, or even breakage.

All wire ropes in active service must be inspected daily. Dated records should be kept on this inspection. A sample inspection report is shown in Fig. 10-3.

This inspection should determine the degree of deterioration at the worst rope lay, as this will determine the suitability of the rope for continued service. By definition, a rope lay is the axial distance along the rope in which one strand makes one complete turn around the rope. Conditions such as the following would be reason to question rope safety:

(a) Evidence of rope deterioration from corrision should be cause for replacement.
(b) More than one broken wire in any one strand should be cause for caution. Breaks that occur on the worn crowns of the outside wires indicate normal deterioration. Breaks that occur in the valleys between strands indicate some abnormal condition, possibly fatigue and breakage of other wires not readily visible. One or more valley breaks should be cause for replacement.
(c) Wire breaks generally occur in those portions of a wire rope which passes over sheaves, wind onto drums, or receive mechanical abuse.



PLACE OF INSPECTION _____ DATE _____

DESCRIPTION OF CRANE:

MAKE: _____ MODEL: _____ SERIAL NO. _____

TYPE AND ARRANGEMENT OF ATTACHMENTS: _____

DATE OF LAST ROPE INSPECTION: _____

HOURS AND TYPE OF SERVICE SINCE LAST INSPECTION: _____

RESULTS OF INSPECTION:

ROPE INSPECTED	TYPE AND SIZE	CONDITIONS NOTED	RECOMMENDATION

INSPECTOR: _____

Fig. 10-3
Wire Rope Inspection Report

Breaks that occur near attached fittings are apt to result from fatiguing stresses concentrated in these localized sections. Breaks of the latter type should be cause for replacement of the rope or renewal of the attachment to eliminate the locally fatigued area.

(d) Heavy wear or broken wires may occur in sections under equalizer sheaves or other sheaves where rope travel is limited, or in contact with saddles. Particular care should be taken to inspect ropes at these points.

(e) Rope stretch is generally greatest during initial stages of operation when the strands are becoming adjusted and seated. This is accompanied by some reduction in rope diameter, but not to the extent that the condition of the rope can be judged on this basis.

(f) Time for rope replacement is indicated by the extent of abrasion, scrubbing and peening on the outside wires, broken wires, evidence of pitting or severe corrosion, kink damage, or other mechanical abuse resulting in distortion of the rope structure.

(g) Sheaves, guards, guides, drums, flanges, and other surfaces contacted by wire rope during operation should be examined at the time of inspections. Any condition harmful to the rope in use at the time should be corrected. The same equipment, and particularly sheave and drum grooves, should be inspected and placed in proper condition before a new rope is installed.

(h) Any of the following listed conditions should be cause for rope replacement:
(1) In running ropes, six randomly distributed broken wires in one rope lay, or three broken wires in one strand in one rope lay.
(2) In pendants or standing ropes, evidence of more than one broken wire in one rope lay.
(3) Abrasion, scrubbing or peening causing loss of more than 1/3 the original diameter of the outside wires.
(4) Evidence of rope deterioration from corrosion.
(5) Severe kinking, severe crushing, or other damage resulting in distortion of the rope structure.
(6) Evidence of any heat damage resulting from a torch or arc caused by contact with electrical wires.
(7) Reduction form nominal diameter of more than 3/64" for diameters up to and including 3/4"; 1/16" for diameters 7/8" to 1-1/8"; 3/32" for diameters 1-1/4 to 1-1/2". Marked reduction in diameter indicates deterioration of the core resulting in lack of proper support for the load carrying strands. Excessive rope stretch or elongation may also be an indication of internal deterioration.
(8) Evidence of "bird-caging" or other distortion resulting in some members of the rope structure carrying more load than others.
(9) Noticable rusting or development of broken wires in the vicinity of attachments.

Note: If this condition is localized in an operating rope and the section in question can be eliminated by making a new attachment, this can be done rather than replacing the entire rope.

Lubrication

Wire rope is a machine. Each time a wire rope bends over a sheave, or straightens from a slack position, many wires move against each other. Lubrication is necessary to help prevent wear caused by this movement. Lubrication also helps prevent deterioration of

wire rope due to rust and corrosion.

Note: Rusty rope is dangerous since there is no way of determining its remaining strength.

Most wire ropes are lubricated during manufacture, but the lubricant doesn't last the life of the rope. The lubricant is squeezed out of the rope as it runs over sheaves under tension, washed off by rain, etc.

For the above reasons, wire ropes must be periodically relubricated. Crude or used oils and grease should not be used as lubricants because they may be grit or acid laden. Either of these conditions would be bad for the rope.

No set rule can be given for lubrication frequency. This will depend on the conditions the rope is operating under. A rope operating in wet conditions, would need lubrication more often than one operating under dry conditions to prevent rust and corrosion.

Note: It is not recommended to lubricate ropes used for dragline operation.

Lubricants used for wire rope lubrication should have the following properties:
(a) They must contain no acids or alkalies.
(b) They must have enough adhesive strength to stay on the rope.
(c) They must be able to penetrate between the wires and strands.
(d) They must have high film strength.
(e) They must resist oxidation.
(f) They must remain soft and pliable.

Applications Of Lubricant: Wire ropes that have been in service must be cleaned before lubrication. Use a wire brush, and compressed air to clean the rope. All possible foreign material and old lubricant must be removed from the rope before lubrication. Use one of the following methods to apply the lubricant:
(a) Continuous Bath: Run the rope through a container filled with lubricant. A sheave mounted in the center of the container will hold the rope submerged as it passes through the container. Use swabbing to remove excess lubricant as the rope leaves the container.
(b) Dripping: Place a container above a sheave so that a spigot may be opened to drip oil on the wire rope as it passes through the sheave groove.
(c) Swabbing And Painting: Two fast methods are swabbing the lubricant on with rags, or painting it on with a brush.
(d) Spraying: Light lubricants may be applied with a spray gun. Aerosol cans of lubricant are also available.

Unreeling Wire Rope

When unreeling wire rope, set the reel up horizontally so it can rotate as the rope is reeled off. Reel the rope off slowly, so the reel won't tend to "throw" the rope off. Avoid reverse bends. If installing rope over the top (over winding drum), of a drum, set the reel up so the rope is removed over the top of the reel. When installing rope around the bottom of a drum (underwinding drum) set the reel up so rope is removed under the bottom of the reel. To obtain snug and uniform winding on the drum, brake the reel with a large timber to provide back tension.

Proper winding of the first rope layer on a multiple wrap drum is important. If the first layer is properly wound, suceeding layers will automatically be controlled. This is especially important on "plain" faced drums. When starting new wire rope on such drums, drive each wrap of the first layer lightly with a wooden mallet so each wrap barely contacts the preceeding one.

When uncoiling wire rope, roll the coil along the ground and the rope will be as straight as it was before being coiled for shipment. Don't uncoil rope where it may be run over by trucks or other equipments.

Note: A new rope should be broken in by running it slowly through its working cycle for a short period under a light load.

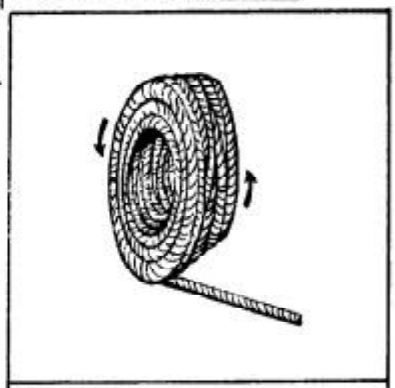


Fig. 10-4
Uncoiling Wire Rope

Sheave Inspection

Whenever wire rope is replaced, the sheaves, and grooves in drums should be checked for wear or damage and replaced if necessary. Damaged, worn, or undersized sheaves will damage the rope. On older equipment remember that new rope is always bigger in diameter than the worn rope it replaces. The sheave grooves may be worn to the smaller diameter of the old rope.

Cutting Wire Rope

When wire rope is to be cut, seizings should be placed on each side of the point where the rope is to be cut, to keep the strands in place. On preformed rope, one seizing on each side of the cut is enough. On non-preformed rope less than 7/8" diameter, two seizings are recommended. On non-preformed ropes over 7/8" diameter, three seizings are recommended.

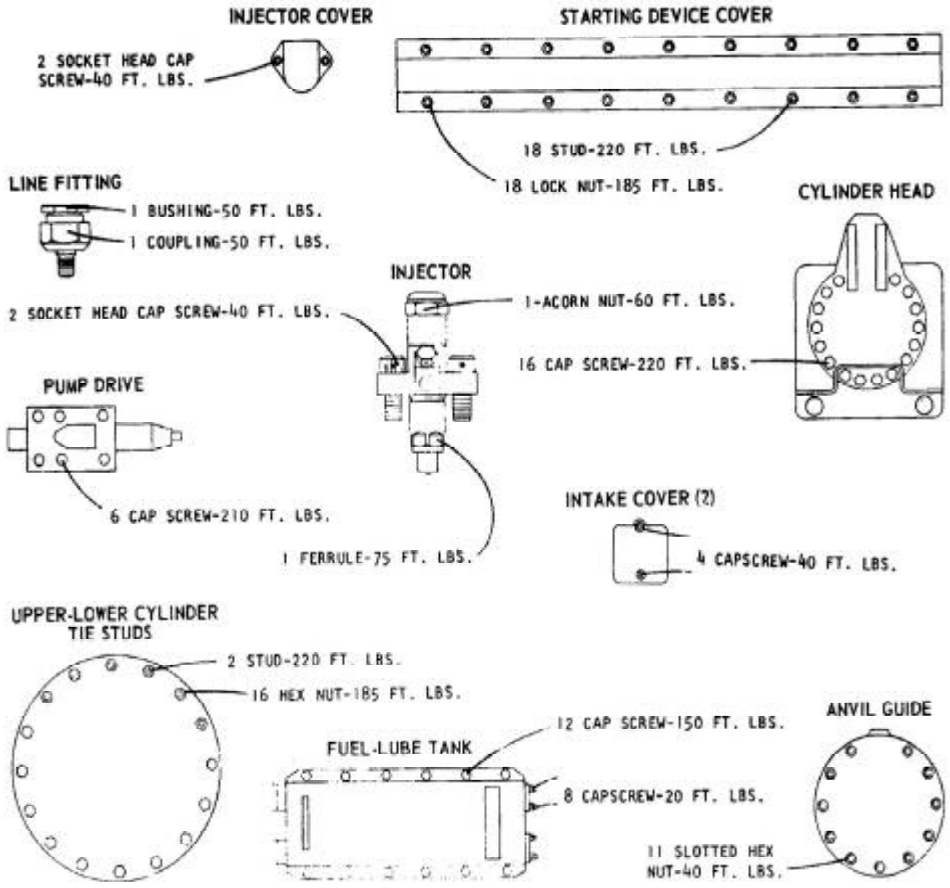
Three basic methods of cutting wire rope are recommended.
(1) Abrasive cutting tools.
(2) Shearing tools. (Wire cutters on small rope, a wire rope cutter and hammer for larger ropes.)
(3) Acetylene cutting torch.

Socket And Wedge Connections

The correct and incorrect methods of attaching a wedge and socket to wire rope are shown in Fig. 10-5

Operator's Manual

Section 11
Torque Chart



Torque, in foot-pounds, is determined by the length of the wrench handle (in feet) multiplied by the weight (or force - in pounds) applied at the end of the handle. For example, if the wrench is one foot long and five pounds of force is applied at the end of the handle, the total torque applied would be five foot pounds; a six inch wrench would require ten pounds of force to obtain five foot pounds torque.

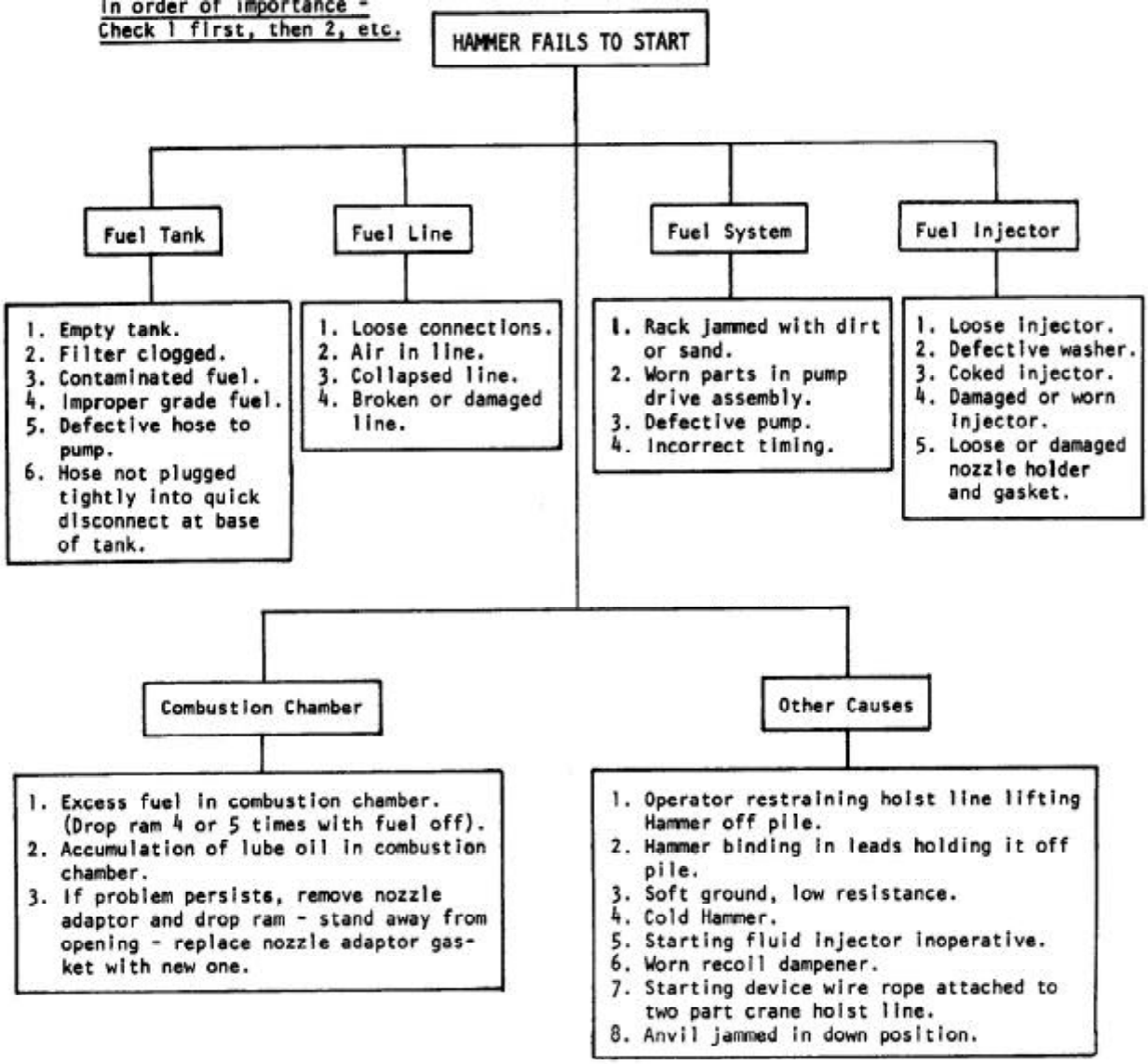
Proper use of the torque wrench is important. To obtain the listed torques, a steady pull should be exerted to the handle until the desired torque is reached.

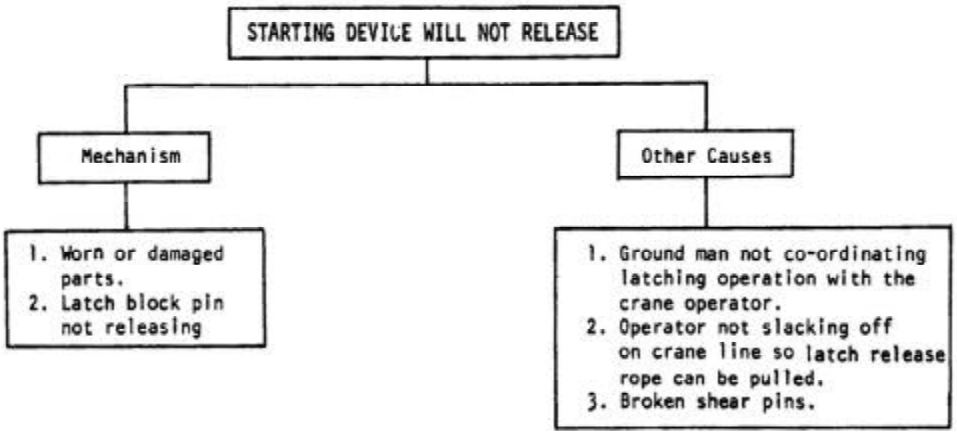
Application of a sealer is recommended whenever replacing or re-tightening any bolts, and hardware. Before applying sealant, make sure threads are clean. Grease or oil on studs will interfere with proper bonding and a good seal will not be obtained. Use of Loctite Sealant Type "A" meeting specification MIL-S-22473A is recommended. An antistick compound lime "Neverseize" is recommended for nozzle and nozzle adaptor threads. Do not use sealer on threads on which anti-stick compound is used. Also do not use anti-stick compound on threads on which sealant is to be used.

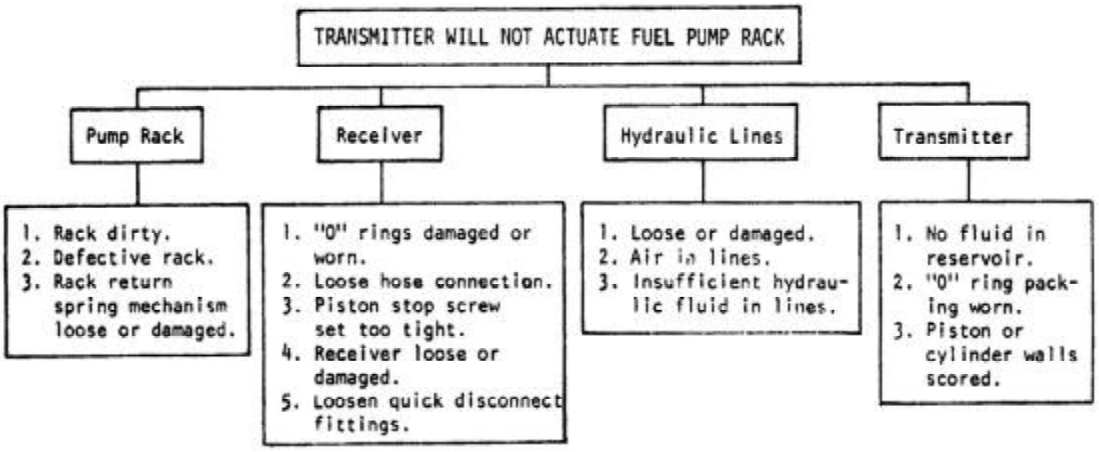
If castellations on anvil retainer nut do not line up with drilled cotter pin hole on bolt after torque value is obtained, increase torque until cotter pin can be inserted.

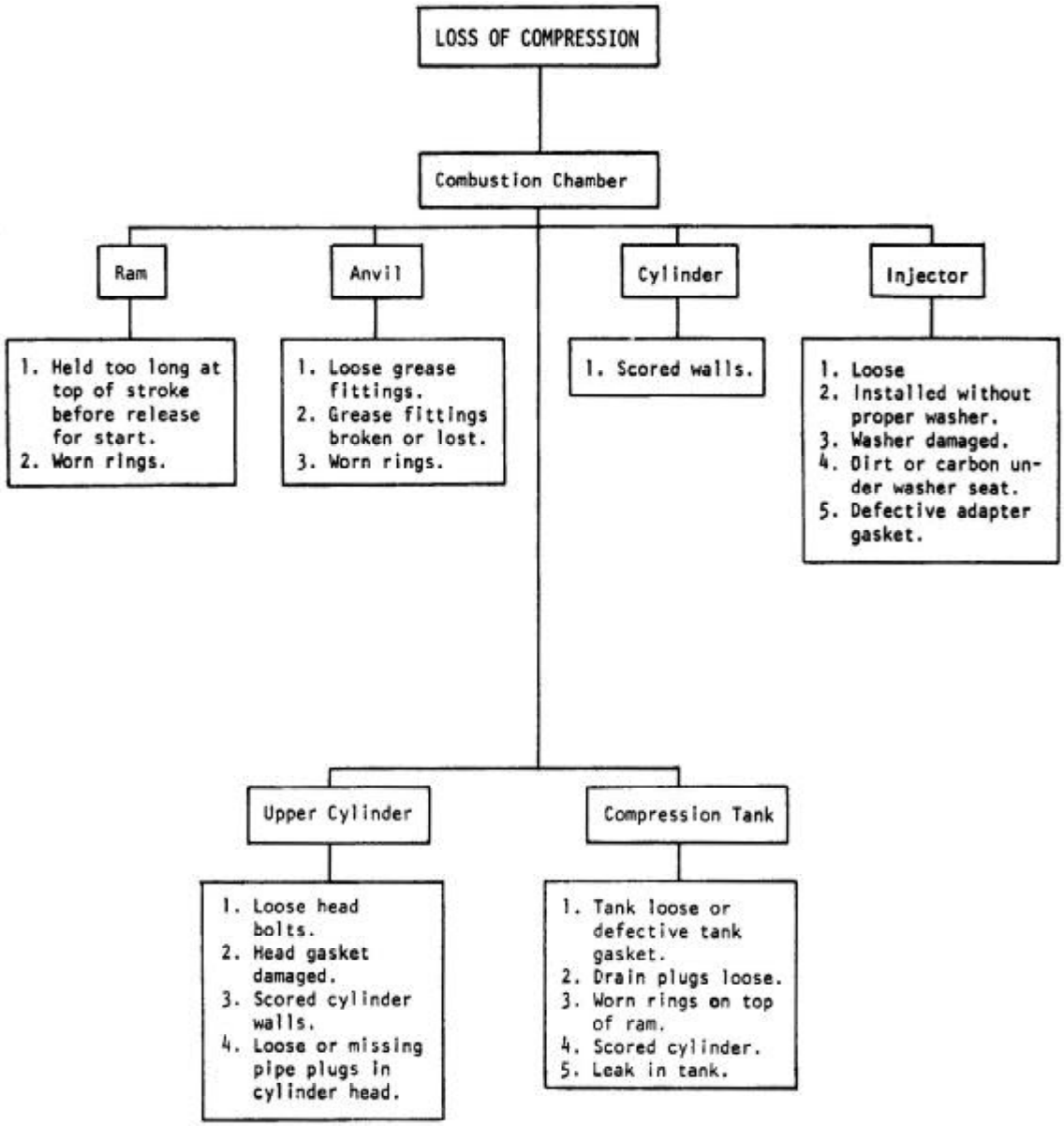
All drilled head capscrews must be secured with tie wire. Wire must wrap tightly off each capscrew in clockwise direction (so screw tends to stay tight).

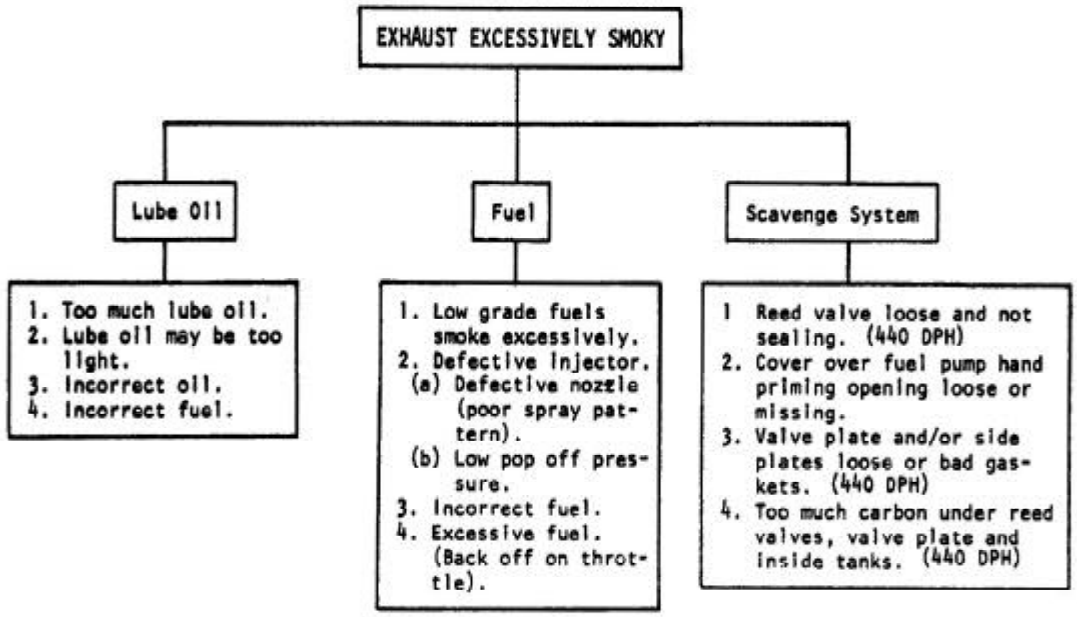
NOTE: Probable causes are listed in order of importance - Check 1 first, then 2, etc.

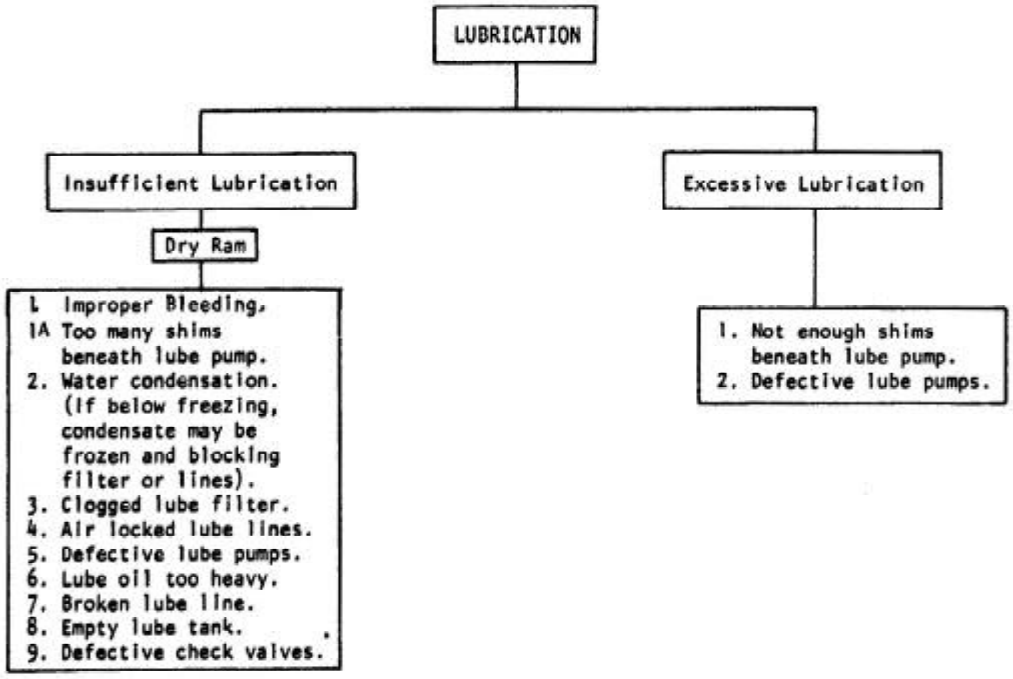



STARTING DEVICE WILL NOT RELEASE
Mechanism
Other Causes
1. Worn or damaged parts.
2. Latch block pin not releasing
1. Ground man not co-ordinating latching operation with the crane operator.
2. Operator not slacking off on crane line so latch release rope can be pulled.
3. Broken shear pins.


TRANSMITTER WILL NOT ACTUATE FUEL PUMP RACK
Pump Rack
Receiver
Hydraulic Lines
Transmitter
1. Rack dirty.
2. Defective rack.
3. Rack return spring mechanism loose or damaged.
1. "O" rings damaged or worn.
2. Loose hose connection.
3. Piston stop screw set too tight.
4. Receiver loose or damaged.
5. Loosen quick disconnect fittings.
1. Loose or damaged.
2. Air in lines.
3. Insufficient hydraulic fluid in lines.
1. No fluid in reservoir.
2. "O" ring packing worn.
3. Piston or cylinder walls scored.


LOSS OF COMPRESSION
Combustion Chamber
Ram
Anvil
Cylinder
Injector
1. Held too long at top of stroke before release for start.
2. Worn rings.
1. Loose grease fittings.
2. Grease fittings broken or lost.
3. Worn rings.
1. Scored walls.
1. Loose
2. Installed without proper washer.
3. Washer damaged.
4. Dirt or carbon under washer seat.
5. Defective adapter gasket.
Upper Cylinder
Compression Tank
1. Loose head bolts.
2. Head gasket damaged.
3. Scored cylinder walls.
4. Loose or missing pipe plugs in cylinder head.
1. Tank loose or defective tank gasket.
2. Drain plugs loose.
3. Worn rings on top of ram.
4. Scored cylinder.
5. Leak in tank.


EXHAUST EXCESSIVELY SMOKY
Lube Oil
Fuel
Scavenge System
1. Too much lube oil.
2. Lube oil may be too light.
3. Incorrect oil.
4. Incorrect fuel.
1. Low grade fuels smoke excessively.
2. Defective injector.
(a) Defective nozzle (poor spray pattern).
(b) Low pop off pressure.
3. Incorrect fuel.
4. Excessive fuel. (Back off on throttle).
1 Reed valve loose and not sealing. (440 DPH)
2. Cover over fuel pump hand priming opening loose or missing.
3. Valve plate and/or side plates loose or bad gaskets. (440 DPH)
4. Too much carbon under reed valves, valve plate and inside tanks. (440 DPH)


LUBRICATION
Insufficient Lubrication
Excessive Lubrication
Dry Ram
L Improper Bleeding.
1A Too many shims beneath lube pump.
2. Water condensation. (If below freezing, condensate may be frozen and blocking filter or lines).
3. Clogged lube filter.
4. Air locked lube lines.
5. Defective lube pumps.
6. Lube oil too heavy.
7. Broken lube line.
8. Empty lube tank.
9. Defective check valves.
1. Not enough shims beneath lube pump.
2. Defective lube pumps.