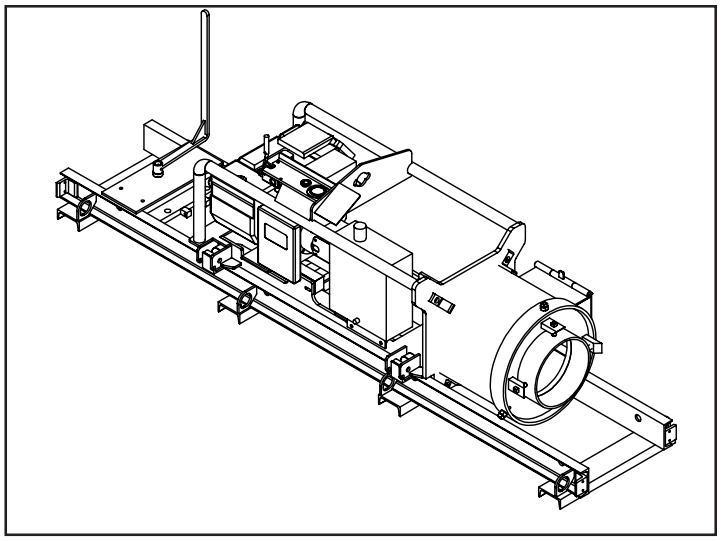
McLAUGHLIN BORING SYSTEMS

MIGHTY MOLE

COMPONENTS AND REPAIR MANUAL

MODEL McL-20C EARTH BORING MACHINE

PART NO. 2050000



Repair Manual Part No.: E250115

Machine Serial # _____

Purchased & Serviced Thru: _____

Purchased Date: _____

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Revision Date: 011810

SPECS & MAINTENANCE
McL-20C

SPECIFICATIONS OF MCL-20B EARTH BORING MACHINE

Tunnel Diameter	**ENGLISH**	**METRIC**
Free Bore	3" - 12"	7.6 cm - 30.5 cm
Cased Bore	4" - 20"	10.2 cm - 50.8 cm
Planetary Final Drive		
Hex Size	2-1/4"	5.7 cm
Dimensions		
Carriage and Pusher		
Centerline Height	14-1/4"	36.2 cm
Width	29"	73.6 cm
Height	50"	127 cm
Weight	1285#	584 kg
Master Track		
Length	120"	305 cm
Weight	330#	140 kg
Extension Track		
Length	120"	305 cm
Weight	310#	140 kg
Performance		
Power Unit	16HP S.A.E.	12kW S.A.E.
Advance Thrust		
@ 3,000 PSI @ 207 BAR	42,000#	19,000 kg
Drive Chuck Speed		
@ 3600 engine RPM		
3rd Gear	100 RPM	100 RPM
2nd Gear	53 RPM	53 RPM
1st Gear	32 RPM	32 RPM
Reverse	26 RPM	26 RPM
Drive Chuck Torque		
@ 2600 engine RPM		
3rd Gear	1008 ft lbs.	1366 NM
2nd Gear	1872 ft lbs.	2538 NM
1st Gear	3132 ft lbs.	4247 NM
Reverse	3780 ft lbs.	5125 NM

REPAIR AND MAINTENANCE / GENERAL

Carriage/Tightness of Nuts and Bolts
Check bolts that mount chuck to the drive shaft flange of the machine initially, then check each week when in continuous use. Each bolts should have lock washer. Tighten as needed.

Check all hydraulic fittings initially then check each week when in continuous use. Tighten as needed, taking care not to twist hoses from original positions.

Check bolts (4) on cam rollers inititally then once each month when in continuous use. Tighten as needed. Check and torque all bolts in engine mounts, transmission, planetary, flexible coupling and pump mount every 50 hours. See parts and service manual for proper bolt torque specifications.

Carriage/Miscellaneous
Once a month, inspect the hitch pins (also called auger pins, R. clips, R. pins) that hold the clevis pins in place. Replace if worn or damaged.

Also, check clevis pins that hold machine down in place. Replace if worn or damaged.

After each boring operation is completed, clean the carriage to remove dirt and mud. Use water if available. Always clean the unit before storage.

Track/General Maintenance
Check the rolling surfaces of the track for dirt or contamination. Clean as required. Tighten push plate bolts periodically. Always inspect bolts before boring begins.

Inspect the track for fractures and reweld as necessary.

Engine/General Maintenance
Review the engine manual supplied before starting and operating the engine. Follow manufacturer's recommendations for operation and manintenance to maintain your engine warranty.

Check fluid levels as follows:
Engine Check oil level daily, fill with seasonal grade oil as recommended in manufacturers manual provided. Change oil per engine manufacturers recommendation.

Transmission Fill to check point with EP 90 gear oil, change after first 50 hours of use, then every 1000 hours or annually.

Final Drive Fill to check point with EP 90 gear oil, change after first 50 hours of use, then every 1000 hours or annually.

Hydraulic Reservoir Fill (with cylinders retracted) with 300SSU oil, change oil after first 1000 hours of use, then annually. Recommended Hydraulic Oils, Mobile Fluid 350 or 423, Shell Tellus 29, Sunoco Sunvis 831-WR.

Hydraulic Filter Replace with every oil change and every 750 hours or three months.

Dog Plate Oil all members, including dogs, initially and then weekly when in continuous use. A light machine oil or spray lubricant is recommended. It is also recommended that the dog plate be disassembled and cleaned periodically, especially after use in sticky clay conditions or sand.

Fuel Refer to engine manual supplied for gasoline or diesel grade recommendations.

Auger Couplings Clean and coat with light oil after every use.

Cutting Heads Examine all teeth and replace as necesary before use. Check all conical bits on rock heads for rotary freedom. Check condition and freedom of wing cutters.

Auger Examine after use for fractures and reweld as necessary.

NOTE: USE ONLY GENUINE McLAUGHLIN REPLACEMENT PARTS.

REPAIR INSTRUCTIONS
McL-20C

WARNING:
Moving parts. Keep all guards in place. Shut down engine before service or maintenance. Being caught in machinery may cause serious injury.

WARNING:
Crushing weight can cause serious injury. Place mahine on solid surface to prevent rollover or falling.

WARNING:
High pressure. Leaking hydraulic fluid under pressure can penetrate and cause serious injury. Check for leaks with card board. Relieve pressure before working on any system.

WARNING:
Do not modify this machine. Use only authorized McLaughlin repair parts. Failure to comply can result in serious injury. Service this equipment according to maintenance instructions in this manual.

FILTERS AND FILL POINTS
McL-20C

1. Engine Oil Fill - change oil after every 25 hours of use. Use SAE 30 when the temperature is over 32°F. Use SAE 5W20 or SAE 5W30 when the temperature is below 32°F.

1

2. Dip Stick - Check daily with engine warm. Fill as needed to the full mark on the dip stick.

2

3. Fuel Level - Fill as needed with branded grades of gasoline.

3

4. Hydraulic Oil Fill - Fill as needed (with cylinders retracted) with 300SSU oil. Change oil after first 1,000 hours of use, then annually. Recommended Hydraulic oils: Mobile Fluid 350 or 423, Shell Telus 29, Sunoco Sunvis 831-WR.

4

5. Hydraulic Oil Filter - Replace with every oil change and every 350 hours or three months. Replacement number: 921-999 (T700090 McL#).

5

6. Transmission Oil Fill - Fill to check point with EP 90 gear oil. Change after first 50 hours of use, then every 1,000 hours or annually.

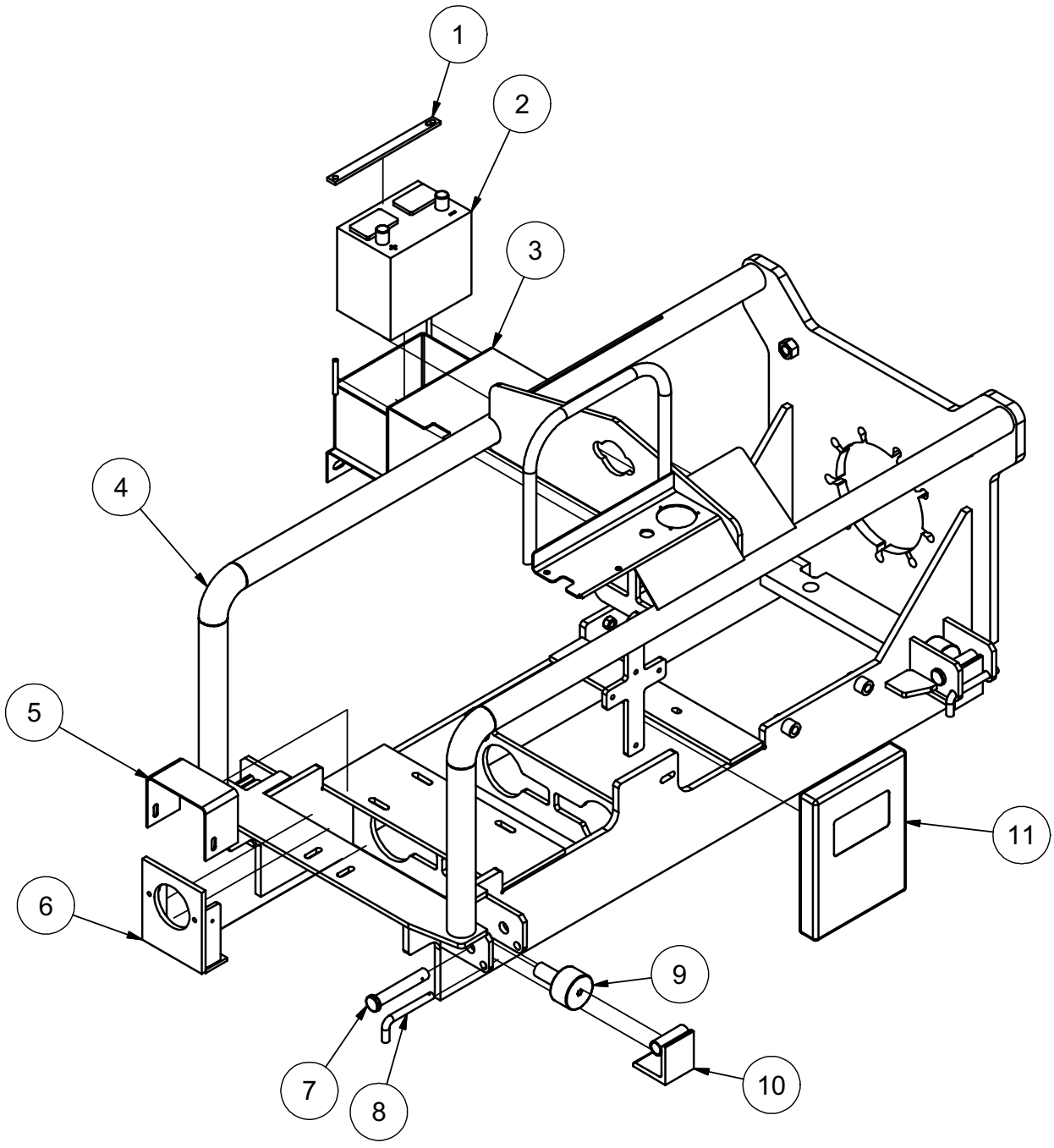
6

7. Planetary Oil Fill - Fill to check point with EP 90 gear oil. Change after first 50 hours of use, then every 1,000 hours or annually.

7

Carriage Assembly

McL - 20C



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BORASSY002

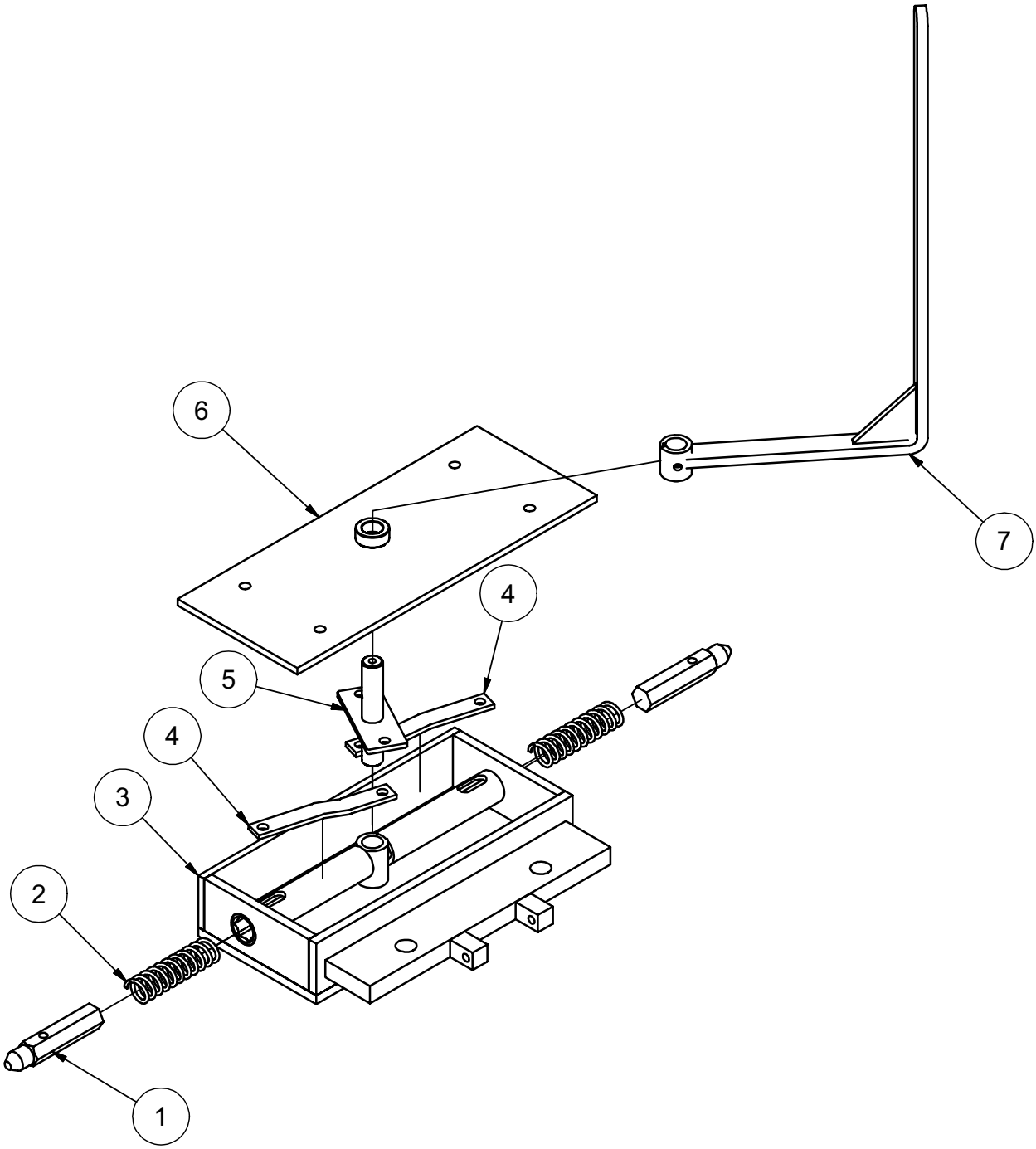
Carriage Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	2011115	BATTERY HOLD DOWN
	2	U130020	NUT, WING .312 - 18
2	1	X400040	BATTERY, SP-35
3	1	2050115	COUPLING GUARD
	2	U000400	SCREW, HC .375 - 16 X .750
	2	U210060	WASHER, LOCK .375
	2	U000810	SCREW, HC .500 - 13 X .750
	2	U210100	WASHER, LOCK .500
4	1	2099006	CARRIAGE WELDMENT
5	1	2011144	PUMP GUARD
	2	U000020	SCREW, HC .250 - 20 X .500
6	1	2011140	HYD. PUMP MOUNT BRACKET
	2	U000440	SCREW, HC .375 - 16 X 1.25
	2	U100060	NUT, HEX .375 - 16
	2	U210060	WASHER, LOCK .375
7	4	2099035	PIN, CLEVIS .745 X 4.9375”
	4	U340045	PIN, R-CLIP
8	4	2099034	PIN, L .500 X 4.5”
	4	U340045	PIN, R-CLIP
9	4	W000075	2 1/2” CAM ROLLER W/ 1”DIA STUD
10	4	2099017	HOLD DOWN - WELDMENT
11	1	8030689	BOX, PLASTIC for SAFETY MANUAL
	4	U000040	SCREW, HC .250 - 20 X .75
	4	U200020	WASHER, FLAT .250
	4	U230040	WASHER, RUBBER .250
	4	U120100	NUT, LOCK .250 - 20

Dog Plate Assembly

McL - 20C



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BORASSY003

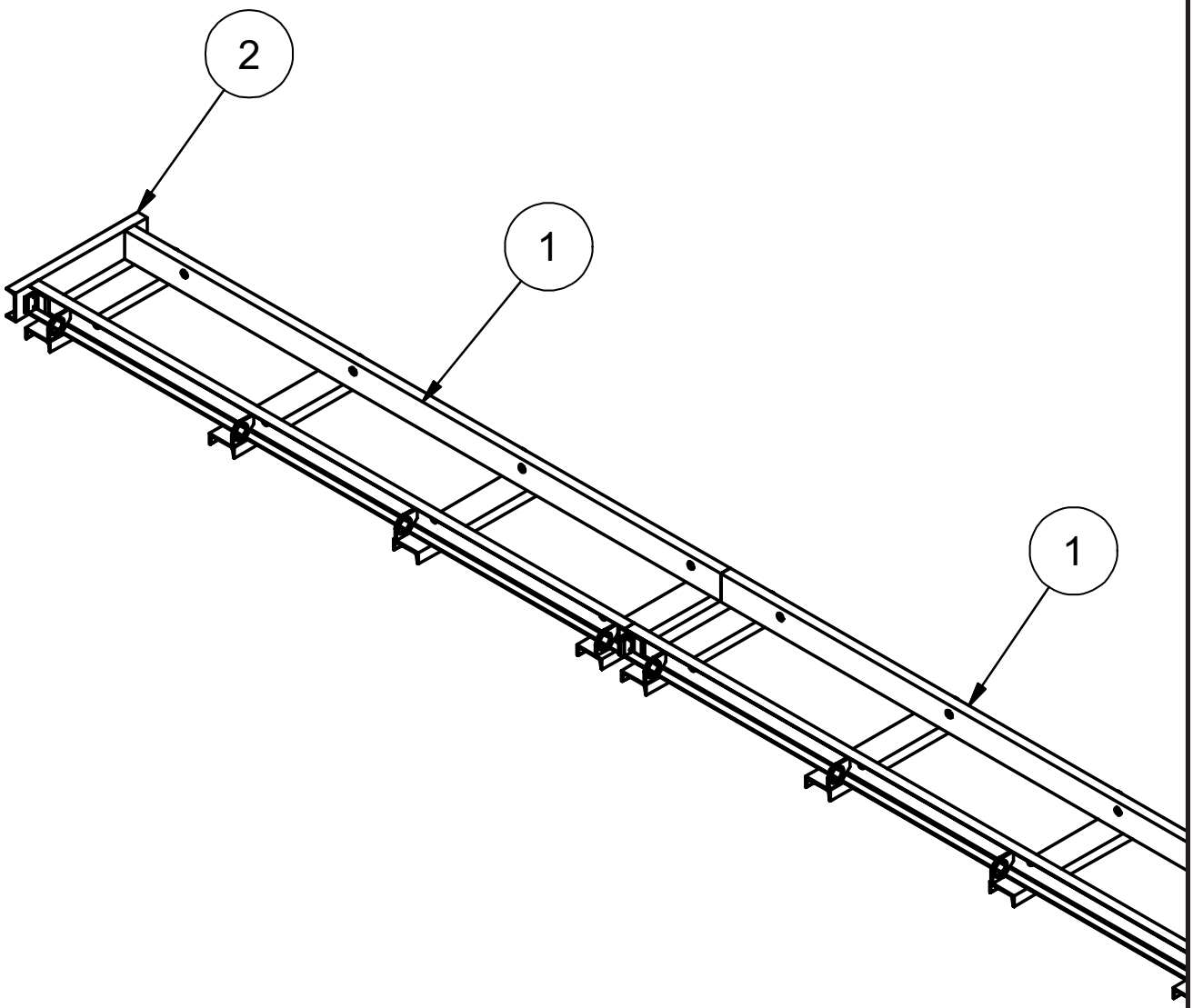
Dog Plate Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	2	2020020	DOG PIN
2	2	U600040	SPRING, COMP .105 X 1.06 X 4.25
3	1	2020010	DOG PLATE HOUSING
	2	U020060	SCREW, SQ .500-13 X 2.00
	2	U210100	WASHER, LOCK .500
	2	U100120	NUT, HEX .500-13
4	2	2020050	LINKAGE ARM
	2	U000815	SCREW, HC .500-13 X 1.00
5	1	2020040	LINKAGE SHIFTER
	1	T500020	FITTING, GREASE .125 STRAIGHT
	2	U000815	SCREW, HC .500-13 X 1.00
	2	U120100	NUT, LOCK .500-13
6	1	2020060	TOP COVER PLATE
	4	U000960	SCREW, HC .500-13 X 4.00
	4	U210100	WASHER, LOCK .500
7	1	2020070	OPERATOR LEVER
	1	U000400	SCREW, HC .375-16 X .750
	1	U100060	NUT, HEX .375-16
	1	U410055	KEY, STR .250 X .250 X 1.00

Track Assembly

McL - 20C



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BORASSY004

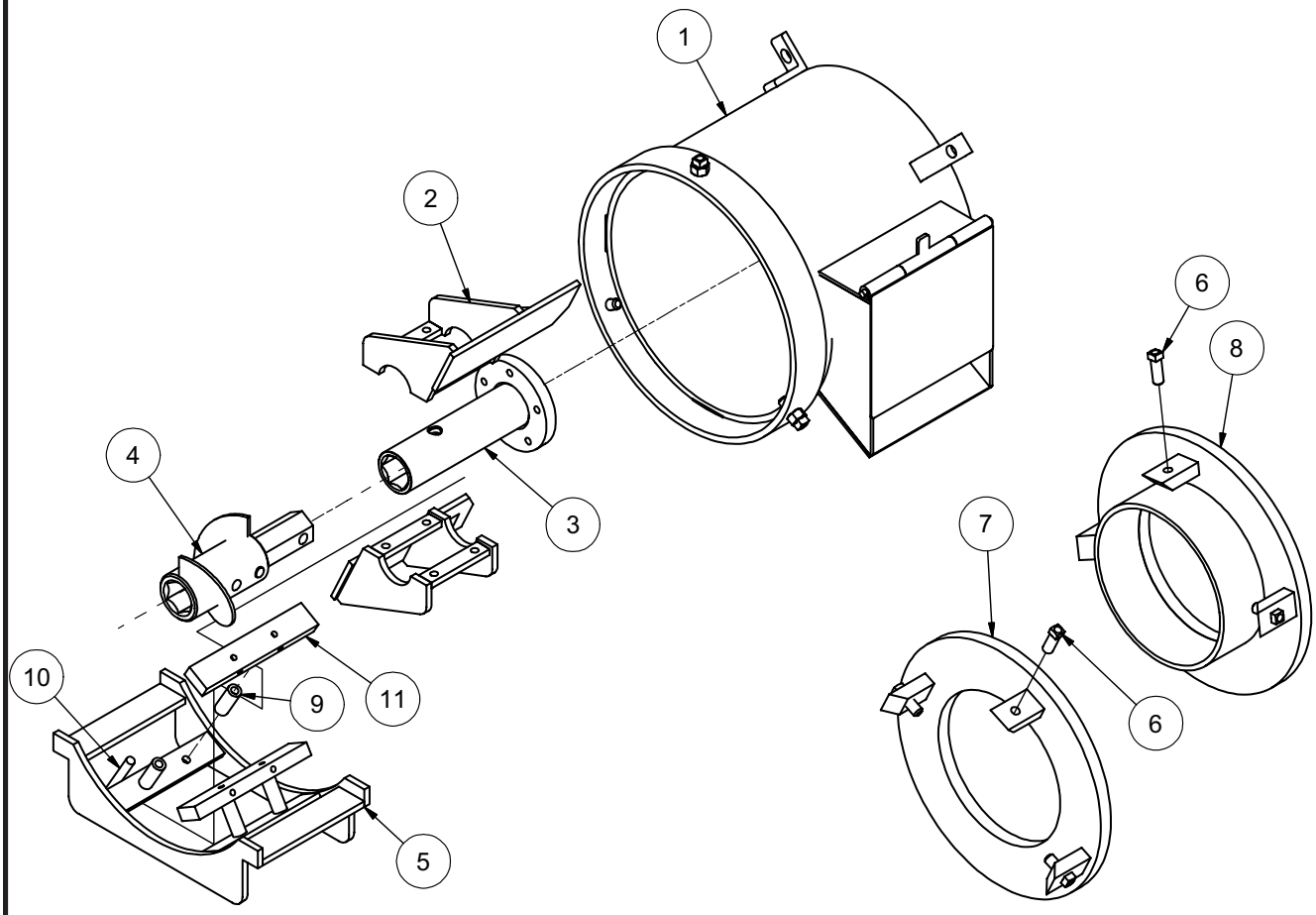
Track Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	3	2040000	TRACK
	8	U000860	SCREW, HC .500-13 X 1.75
	8	U100120	NUT, HEX .500-13
	8	U210100	WASHER, LOCK .500
2	1	2040060	THRUST PLATE
	4	U000860	SCREW, HC .500-13 X 1.75
	4	U100120	NUT, HEX .500-13
	4	U210100	WASHER, LOCK .500

Casing Pusher / Spoil Ejector Assembly

McL - 20C



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BORASSY005

Casing Pusher / Spoil Ejector Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	2050041	CASING PUSHER ASSEMBLY
	4	U001355	SCREW, HC .750 - 10 X 1.25"
	4	U210160	WASHER, LOCK .750
	2	U320015	PIN, COTTER .125 X 1.00
	3	U020120	SCREW, SQ .750 -10 X 2.00
2	1	2050101	PADDLE ASSEMBLY COMPLETE
3	1	A200440	2.25 HEX - CHUCK ASSEMBLY
	5	U000860	SCREW, HC .500 - 13 X 1.750
	5	U210100	WASHER, LOCK .500
	1	U001510	SCREW, HC .750 - 10 X 4.50
	1	U120040	NUT, NY .750-10
4	1	R800545	CHUCK EXTENSION 2.250 TO 2.250
5	1	2050051	SADDLE ASSEMBLY
6	3	U020120	SCREW, SQ .750 - 10 X 2.00"

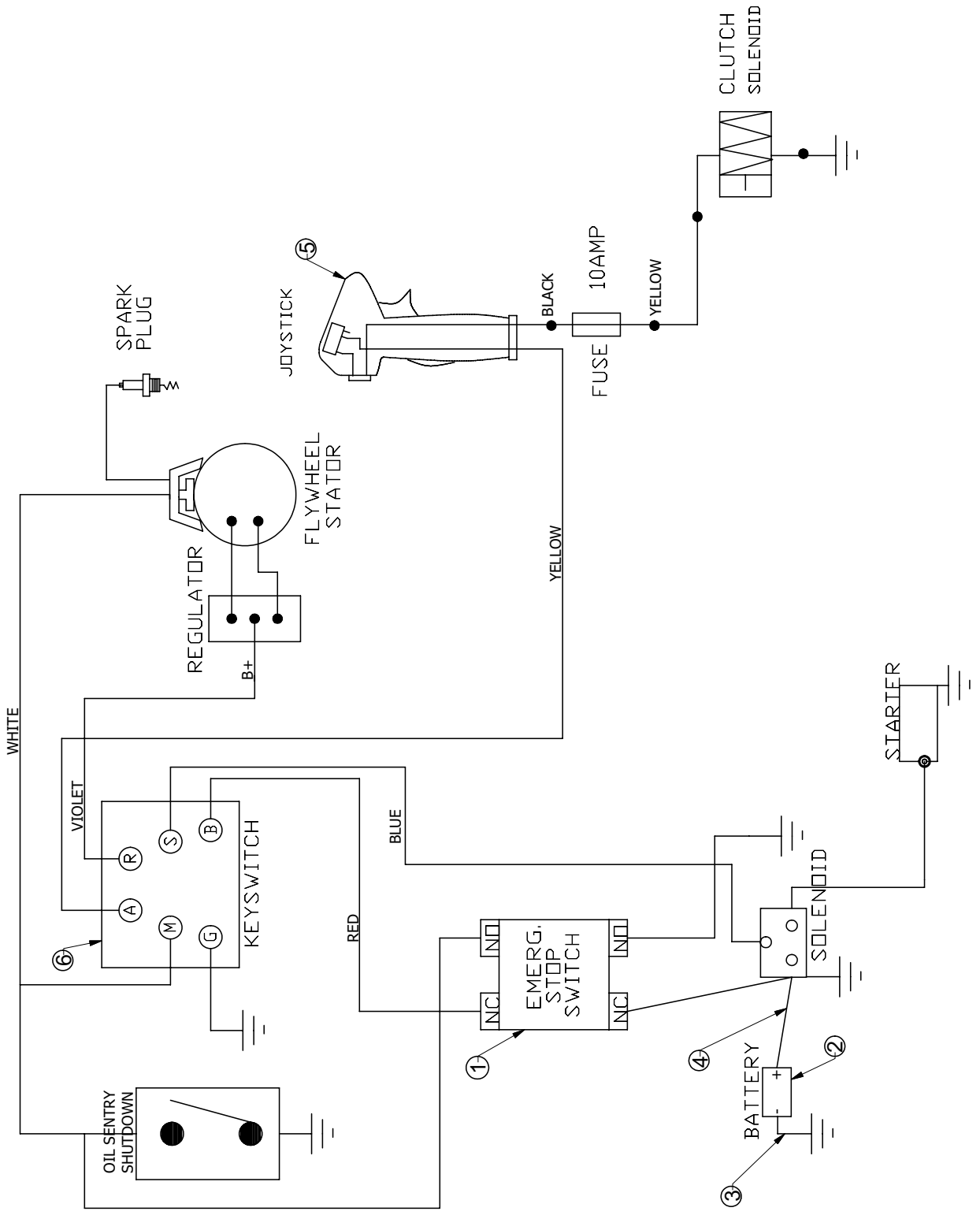
Optional Equipment:
(Available upon request)

7	1	A200040	ADAPTER KIT, 4"
		A200060	ADAPTER KIT, 6"
		A200080	ADAPTER KIT, 8"
		A200100	ADAPTER KIT, 10"
		A200120	ADAPTER KIT, 12"
		A200140	ADAPTER KIT, 14"
		A200160	ADAPTER KIT, 16"
		A200180	ADAPTER KIT, 18"
8	1	A20004P	ADAPTER KIT, 4" PVC
		A20006P	ADAPTER KIT, 6" PVC
		A20008F	ADAPTER KIT, 8" PVC
		A20010P	ADAPTER KIT, 10" PVC
		A20012P	ADAPTER KIT, 12" PVC
9-10	4	2090110	SPACER 4" ADAPTER
		2090120	SPACER 6" ADAPTER
		2090130	SPACER 8" ADAPTER
		2090140	SPACER 10" ADAPTER
		2090150	SPACER 12" ADAPTER
		2090160	SPACER 14" ADAPTER
11	2	2013045	SHOE 16" ADAPTER
			SHOE 18" ADAPTER
*	1	2050149	REPLACEMENT DOOR KIT
	1	2013070	DOOR WELDMENT
	1	2013080	HINGE ROD
	2	U320015	COTTER PIN, .125 X 1.00
*	1	2050160	SEAL SHIELD

* NOT SHOWN

Wiring Diagram

McL - 20C



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BORASSY016

Wiring Diagram

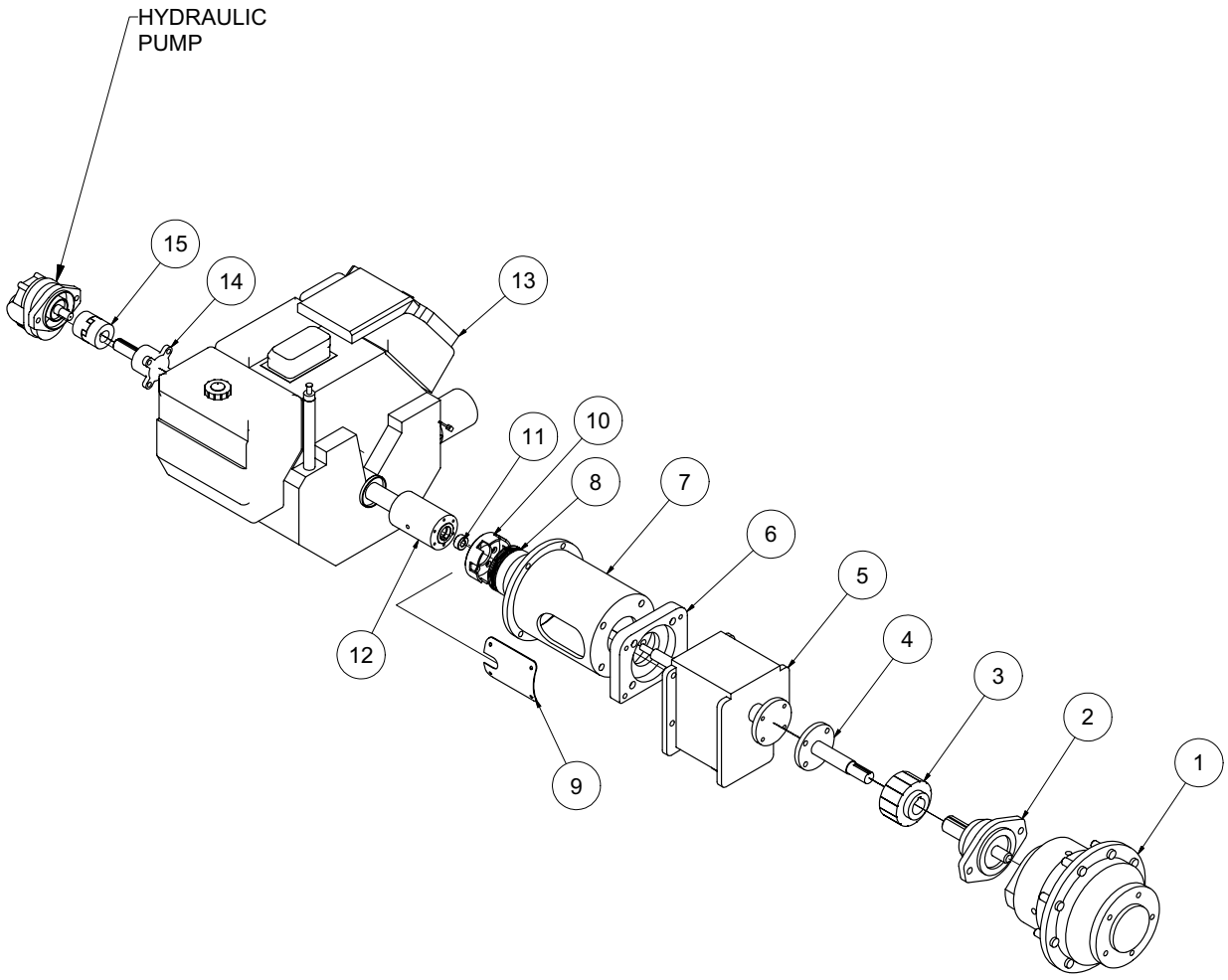
McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	X000020	STOP SWITCH
2	1	X400040	BATTERY
3	1	X300140	CABLE, BATTERY (neg.)
4	1	X300150	CABLE, BATTERY (pos.)
5	1	J700100	PISTOL GRIP - COMPLETE
6	1	X000090	KEY SWITCH
*	1	X000013	STOP SWITCH BUTTON

* NOT SHOWN

Power Train Assembly

McL - 20C



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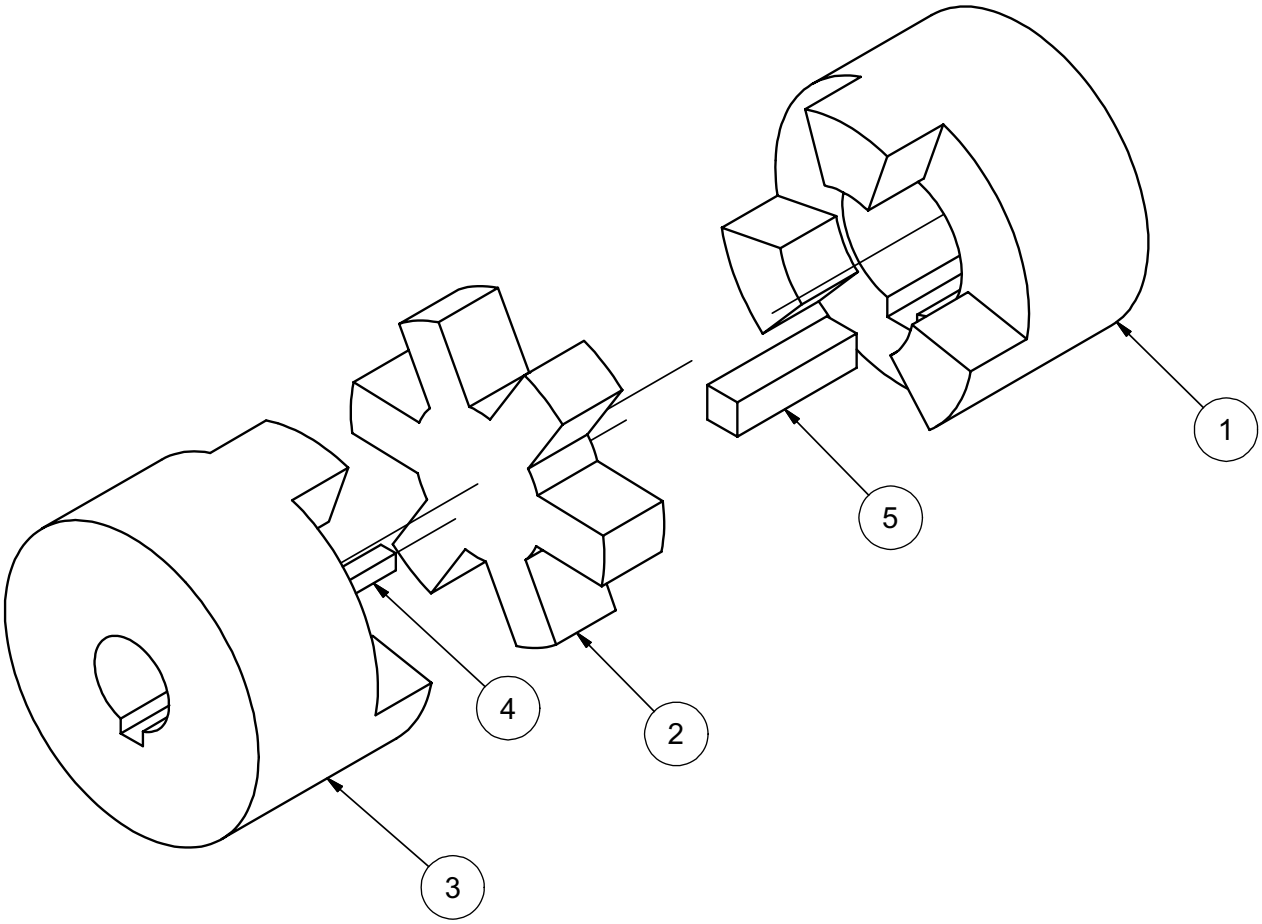
BORASSY006

Power Train Assembly McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	P300000	TORQUE HUB
	9	U100190	NUT, HEX .625-11
	9	U210140	WASHER, LOCK .625
2	1	P330000	INPUT SHAFT
	2	U000820	SCREW, HC .500-13 X .56
	2	U210100	WASHER, LOCK .500
	1	U410092	KEY, STR. .313 X .313 X .56
	1	W200160	O-RING 4.0 X 4.18 X .103
3	1	T260008	COUPLING, ELEMENT- DELRIN CHAIN
4	1	2050120	TRANSMISSION OUTPUT SHAFT
	4	U000760	SCREW, HC .438-14 X 1.25
	4	U210080	WASHER, LOCK .438
	4	U410061	KEY STR. .250 X .250 X .56
5	1	2050155	TRANSMISSION, MODEL #14
	2	U000760	SCREW, HC .438-14 X 1.25
	2	U210080	WASHER, LOCK .438
	2	U000840	SCREW, HC .500-13 X 1.50
	2	U210100	WASHER, LOCK .500
6	1	2050113	TRANS/ BELL HOUSING SPACER
	4	U010080	SCREW, HSH .375-16 X 1.00
7	1	2050112	BELL HOUSING
	4	U000760	SCREW, HC .438-14 X 1.25
	4	U210080	WASHER, LOCK .438
8	1	2050091	CLUTCH, HYD
9	1	2050099	INSPECTION COVER
10	1	2050092	DRIVE CAP
11	1	P240001	CLUTCH SPACER
12	1	2099001	CLUTCH ADAPTER SHAFT
13	1	2060000	ENGINE, KOHLER 15HP
14	1	P400003	STUB SHAFT
15	1	P400000	COUPLING, HALF 1” X 1/4” KEY
	4	U010080	SCREW, HSH .375-16 X 1.000
	4	U210060	WASHER, LOCK .375
	1	U410060	KEY, STR. .250 X .250 1.25
*	1	2050114	SNAP RING
*	2	2050156	TRANSMISSION SPACERS

Hydraulic Pump Coupling Assembly

McL - 20C



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BORASSY006

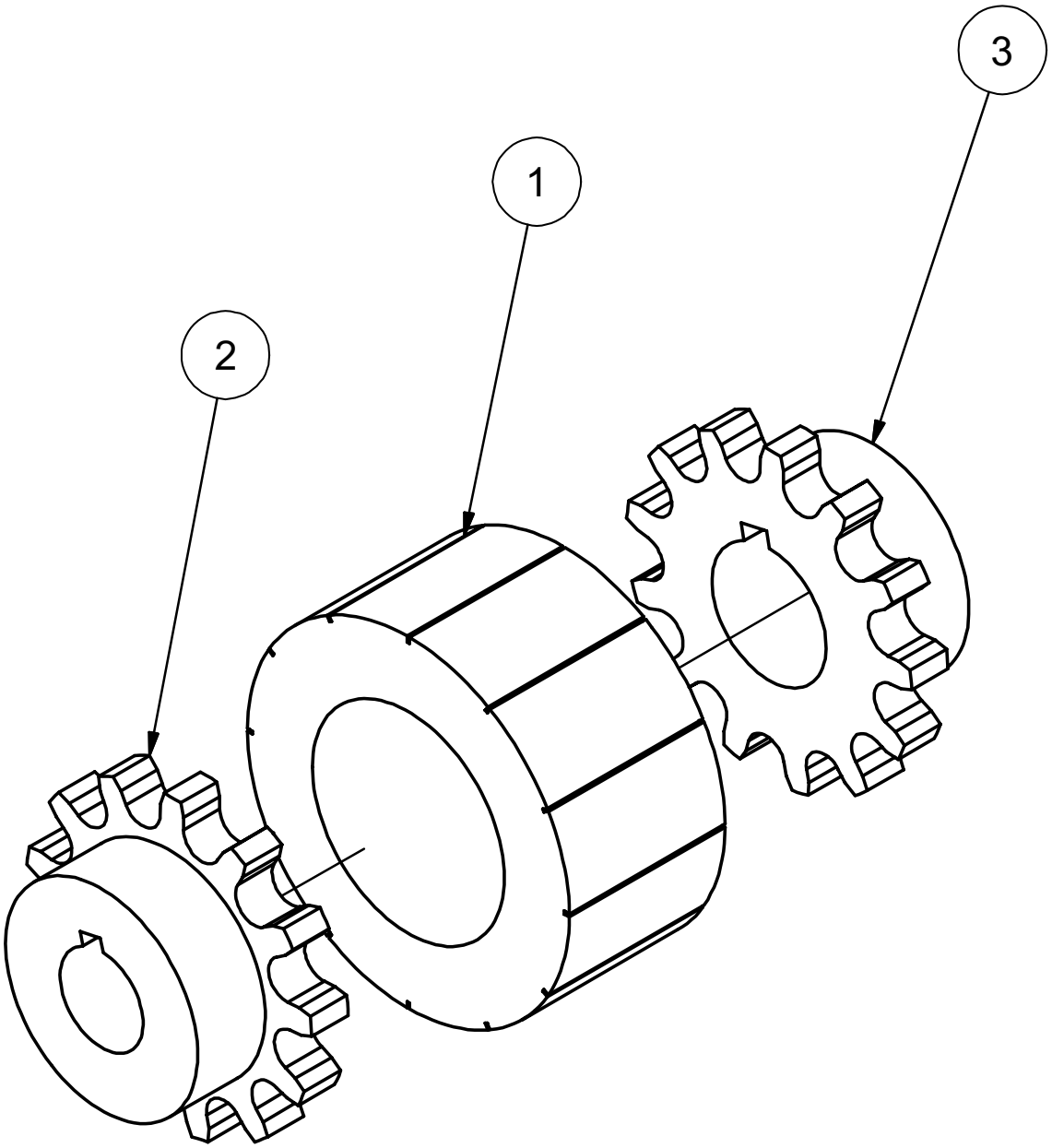
Hydraulic Pump Coupling Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	P400000	COUPLING HALF
2	1	P400002	COUPLING INSERT
3	1	P400001	COUPLING HALF .625 BORE
4	1	U410015	KEY, STR. .125 X .125 X .625
5	1	U410055	KEY, STR. .250 X .250 X 1.00

Transmission Coupling Assembly

McL - 20C



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BORASSY008

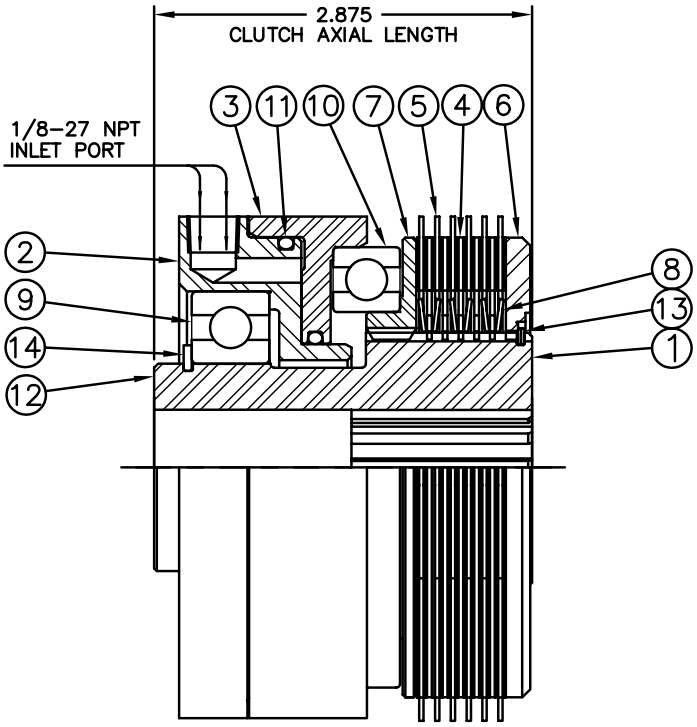
Transmission Coupling Assembly

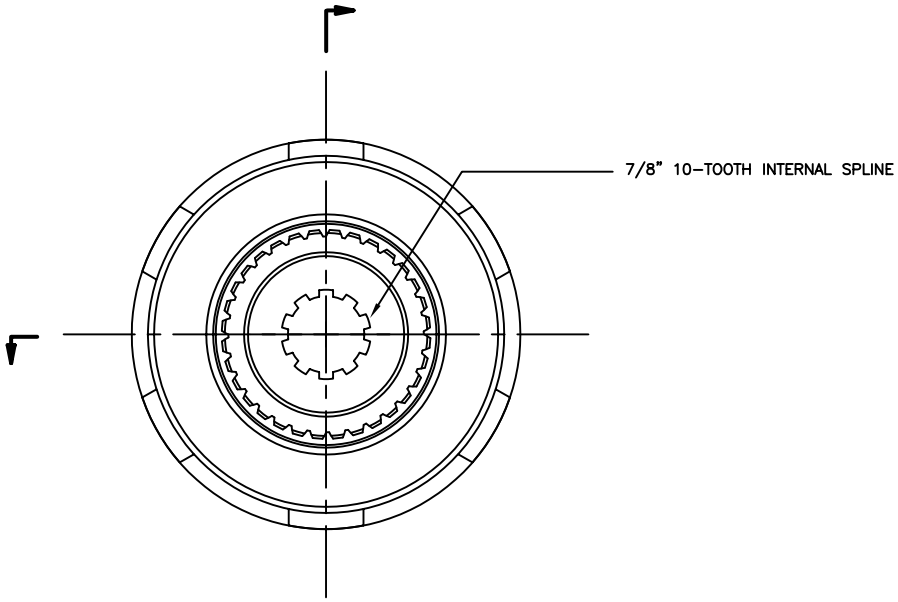
McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	T260008	DELRIN CHAIN
2	1	T260006	COUPLING, 1.00 BORE
	1	U410060	KEY, STR. .250 X .250 X 1.25
3	1	T260007	COUPLING, 1.375 BORE
	1	U410140	KEY, STR .375 X .375 X 2.00

Replacement Disc Kit Assembly

McL - 20C





Replacement Disc Kit Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
	1	2050091	CLUTCH, HYD
1	1	2050091-1	HUB
2	1	2050091-2	CYLINDER ASSEMBLY
3	1	2050091-3	PISTON ASSEMBLY
4	5	2050091-4	SEPARATOR DISC
5	6	2050091-5	FRICTION DISC ASSEMBLY
6	1	2050091-6	BACK PLATE
7	1	2050091-7	PRESSURE PLATE
8	6	2050091-8	BELLEVILLE SPRING
9	1	2050091-9	HUB BEARING
10	1	2050091-10	THRUST BEARING
11	1	2050091-11	O-RING
12	1	2050091-12	O-RING
13	1	2050091-13	RETAINING RING
14	1	2050091-14	RETAINING RING
15	1	2050091-15	INLET PORT CAP

* NOT SHOWN

Clutch Pressure: 100 psi
Use 0-300 psi gauge

CLUTCH, HYD. KITS:

*	1	2050093	KIT INCLUDES: 6 LUG DISCS 5 SPACER PLATES 6 BELLEVILLE SPRINGS 1 CIRCULAR
*	1	2050147	FRONT PLATE
*	1	2050094	KIT INCLUDES: 1 SMALL O-RING 1 LARGE O-RING
*	1	2050095	KIT INCLUDES: 1 SMALL BEARING 1 LARGE BEARING 1 SNAP RING

NOTE: INSTALL BELLEVILLE SPRINGS I.D. TO I.D. AND O.D. TO O.D.

NOTE: FOR SERIAL NO. 20062993536 AND HIGHER. CONSULT MANUFACTURER FOR DISK, SEAL, AND BEARING KIT ASSEMBLES ON EARLIER MODELS.

MAINTENANCE RECORD

McL-20C

DATE	SERVICE PERFORMED	BY

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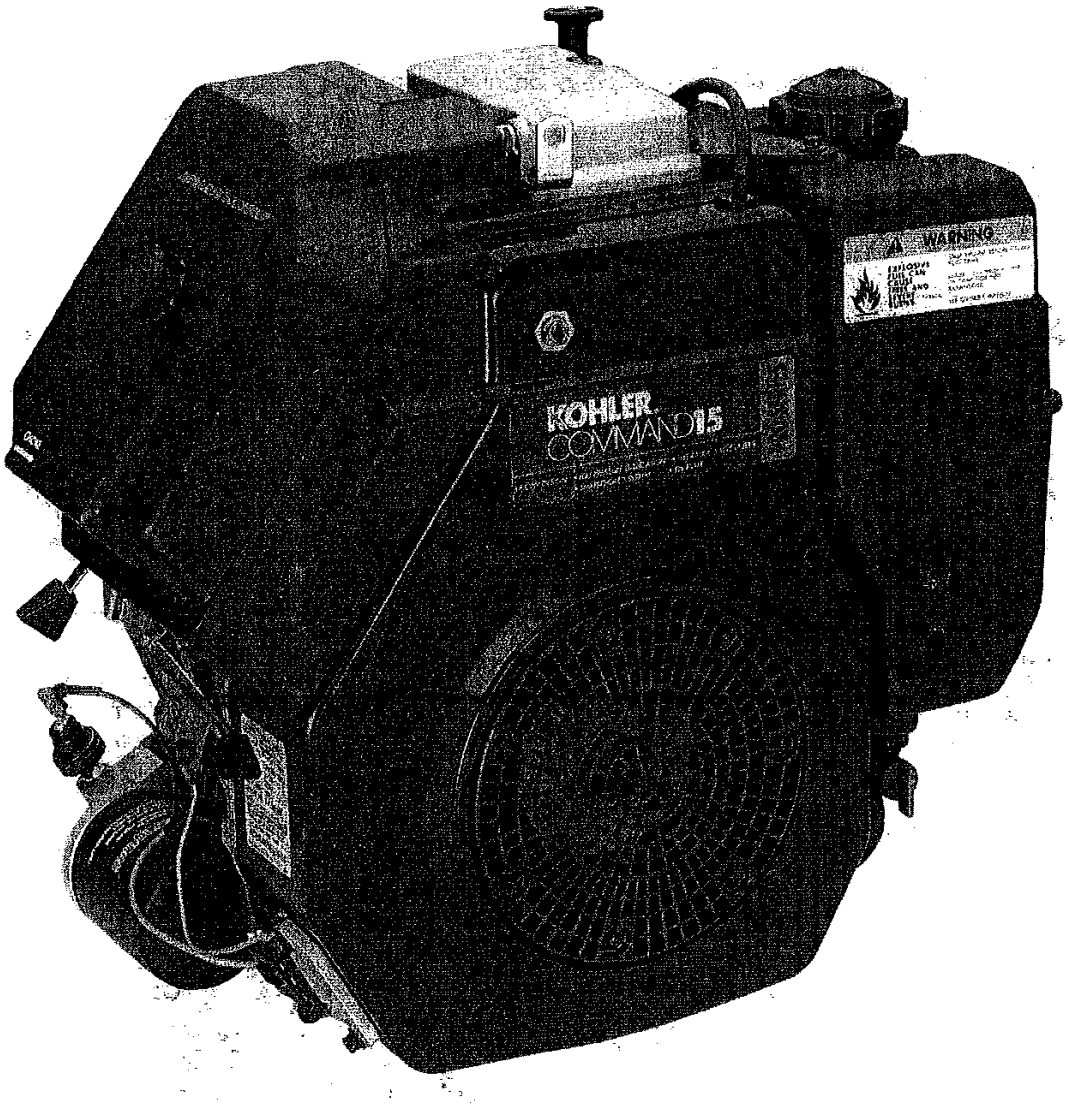
OWNER'S MANUAL

KOHLER® COMMAND CH11-16

HORIZONTAL CRANKSHAFT



KOHLER® ENGINES

Safety Precautions

To ensure safe operations please read the following statements and understand their meaning. Also refer to your equipment owner's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING

Warning is used to indicate the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

CAUTION

Caution is used to indicate the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage if the caution is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

For Your Safety!

These precautions should be followed at all times. Failure to follow these precautions could result in injury to yourself and others.

WARNING

Explosive Fuel can cause fires and severe burns.

Do not fill the fuel tank while the engine is hot or running.

Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

WARNING

Rotating Parts can cause severe injury.

Stay away while engine is in operation.

Rotating Parts!

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.

CAUTION

Electrical Shock can cause injury.

Do not touch wires while engine is running.

Electrical Shock!

Never touch electrical wires or components while the engine is running. They can be sources of electrical shock.

WARNING

Hot Parts can cause severe burns.

Do not touch engine while operating or just after stopping.

Hot Parts!

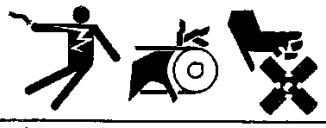
Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running, or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

California Proposition 65 Warning

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Safety Precautions (Cont.)

⚠ WARNING



Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug lead before servicing.

⚠ WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

⚠ WARNING

Explosive Gas can cause fires and severe acid burns.

Charge battery only in a well ventilated area. Keep sources of ignition away.

Accidental Starts!
Disabling engine. Accidental starting can cause severe injury or death. *Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.*

Lethal Exhaust Gases!
Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

Explosive Gas!
Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present.

Congratulations – You have selected a fine four-cycle, single cylinder, air-cooled engine. Kohler designs long life strength and on-the-job durability into each engine...making a Kohler engine dependable...dependability you can count on. Here are some reasons why:

- Efficient overhead valve design and full pressure lubrication provide maximum power, torque, and reliability under all operating conditions.
- Dependable, maintenance free electronic ignition ensures fast, easy starts time after time.
- Kohler engines are easy to service. All routine service areas (like the dipstick and oil fill, oil filter, air cleaner, spark plug, and carburetor) are easily and quickly accessible.
- Parts subject to the most wear and tear (like the cylinder liner and camshaft) are made from precision formulated cast iron. Because the cylinder liner can be rebored, these engines can last even longer.
- Every Kohler engine is backed by a worldwide network of over 10,000 distributors and dealers. Service support is just a phone call away. Call 1-800-544-2444 (U.S. & Canada) for Sales & Service assistance.

To keep your engine in top operating condition, follow the maintenance procedures in this manual.

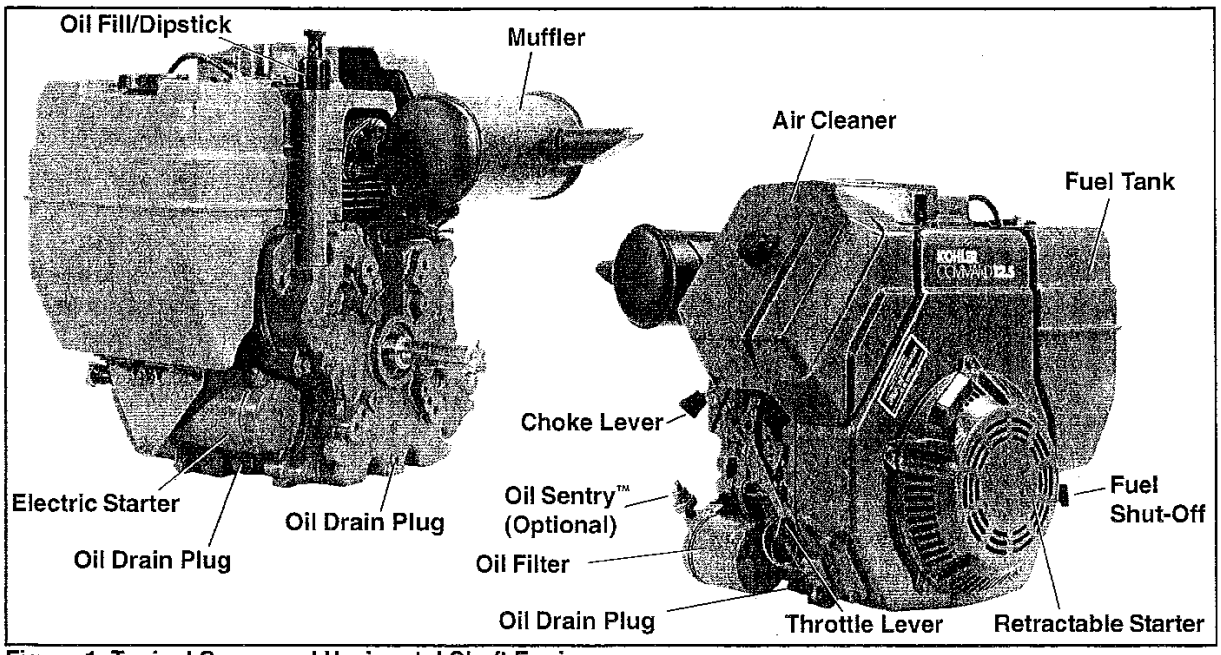


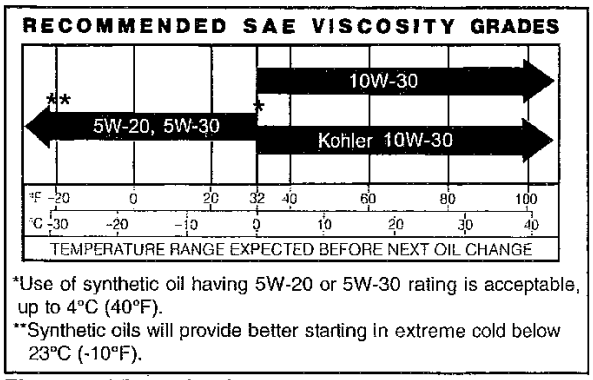
Figure 1. Typical Command Horizontal Shaft Engine.

Oil Recommendations

Using the proper type and weight of oil in the crankcase is extremely important. So is checking oil daily and changing oil regularly. Failure to use the correct oil, or using dirty oil, causes premature engine wear and failure.

Oil Type

Use high quality detergent oil of **API (American Petroleum Institute) service class SG, SH, SJ or higher**. Select the viscosity based on the air temperature at the time of operation as shown in the following table.



*Use of synthetic oil having 5W-20 or 5W-30 rating is acceptable, up to 4°C (40°F).

**Synthetic oils will provide better starting in extreme cold below 23°C (-10°F).

Figure 2. Viscosity Grades Table.

NOTE: Using other than service class SG, SH, SJ or higher oil or extending oil change intervals longer than recommended can cause engine damage.

NOTE: Synthetic oils meeting the listed classifications may be used with oil changes performed at the recommended intervals. However to allow piston rings to properly seat, a new or rebuilt engine should be operated for at least 50 hours using standard petroleum based oil before switching to synthetic oil.

A logo or symbol on oil containers identifies the API service class and SAE viscosity grade. See Figure 3.

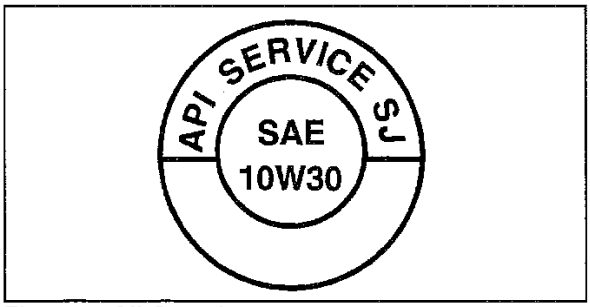


Figure 3. Oil Container Logo.

Refer to Maintenance Instructions beginning on page 8 for detailed oil check, oil change, and oil filter change procedures.

Fuel Recommendations

WARNING: Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

General Recommendations

Purchase gasoline in small quantities and store in clean, approved containers. A container with a capacity of 2 gallons or less with a pouring spout is recommended. Such a container is easier to handle and helps eliminate spillage during refueling.

Do not use gasoline left over from the previous season, to minimize gum deposits in your fuel system and to ensure easy starting.

Do not add oil to the gasoline.

Do not overfill the fuel tank. Leave room for the fuel to expand.

Fuel Type

For best results use only clean, fresh, **unleaded** gasoline with a pump sticker octane rating of 87 or higher. In countries using the Research method, it should be 90 octane minimum.

Unleaded gasoline is recommended as it leaves less combustion chamber deposits. Leaded gasoline may be used in areas where unleaded is not available and exhaust emissions are not regulated. Be aware however, that the cylinder head will require more frequent service.

Gasoline/Alcohol blends

Gasohol (up to 10% ethyl alcohol, 90% unleaded gasoline by volume) is approved as a fuel for Kohler engines. Other gasoline/alcohol blends including E20 and E85 are not to be used and not approved. Any failures resulting from use of these fuels will not be warranted.

Gasoline/Ether blends

Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blends (up to a maximum of 15% MTBE by volume) are approved as a fuel for Kohler engines. Other gasoline/ether blends are not approved.

Engine Identification Numbers

When ordering parts, or in any communication involving an engine, always give the **Model, Specification, and Serial Numbers** of the engine.

The engine identification numbers appear on a decal affixed to the engine shrouding. Include letter suffixes, if there are any.

Record your engine identification numbers on the identification label (Figure 4) for future reference.

Engines without fuel tank.

KOHLER

IMPORTANT ENGINE INFORMATION
THIS ENGINE MEETS U.S. EPA AND CA 2005 AND LATER AND EC STAGE II (SN:4) EMISSION REGS FOR SI SMALL OFF-ROAD ENGINES
FAMILY
TYPE APP
DISPL. (CC)
MODEL NO.
SPEC. NO.
SERIAL NO.
BUILD DATE
OEM PROD. NO.
N11236
EMISSION COMPLIANCE PERIOD:
EPA: CARB:
CERTIFIED ON:
REFER TO OWNER'S MANUAL FOR HP RATING, SAFETY, MAINTENANCE AND ADJUSTMENTS
1-800-544-2444 www.kohlerengines.com
KOHLER CO. KOHLER, WISCONSIN USA

Engines with fuel tank supplied.

KOHLER

IMPORTANT ENGINE INFORMATION
THIS ENGINE MEETS U.S. EPA 2005, CA 2006 EXH/EVP AND EC STAGE II (SN:4) EMISSION REGS FOR SI SMALL OFF-ROAD ENGINES
FAMILY
TYPE APP
DISPL. (CC)
MODEL NO.
SPEC. NO.
SERIAL NO.
BUILD DATE
OEM PROD. NO.
N11236
EMISSION COMPLIANCE PERIOD:
EPA: CARB:
CERTIFIED ON:
REFER TO OWNER'S MANUAL FOR HP RATING, SAFETY, MAINTENANCE AND ADJUSTMENTS
1-800-544-2444 www.kohlerengines.com
KOHLER CO. KOHLER, WISCONSIN USA

Figure 4. Engine Identification Label.

The Emission Compliance Period referred to on the Emission Control or Air Index label indicates the number of operating hours for which the engine has been shown to meet Federal and CARB emission requirements. The following table provides the Engine Compliance Period (in hours) associated with the category descriptor found on the certification label.

Emission Compliance Period (Hours)

EPA	Category C 250 Hours	Category B 500 Hours	Category A 1000 Hours
CARB	Moderate 125 Hours	Intermediate 250 Hours	Extended 500 Hours

Refer to certification label for engine displacement.

Exhaust Emission Control System for models CH11,12.5,13,14,15,16 is EM.

Operating Instructions

Also read the operating instructions of the equipment this engine powers.

Pre-Start Checklist

- Check oil level. Add oil if low. Do not overfill.
- Check fuel level. Add fuel if low.
- Check cooling air intake areas and external surfaces of engine. Make sure they are clean and unobstructed.
- Check that the air cleaner components and all shrouds, equipment covers, and guards are in place and securely fastened.
- Check that any clutches or transmissions are disengaged or placed in neutral. This is especially important on equipment with hydrostatic drive. The shift lever must be exactly in neutral to prevent resistance which could keep the engine from starting.

WARNING: Lethal Exhaust Gases!

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

Cold Weather Starting Hints

1. Be sure to use the proper oil for the temperature expected. See Figure 2 on page 4.
2. Declutch all possible external loads.
3. A warm battery has much more starting capacity than a cold battery.
4. Use fresh winter grade fuel. NOTE: Winter grade gasoline has higher volatility to improve starting. Do not use gasoline left over from summer.

Starting

1. **For a Cold Engine** – Place the throttle control **midway** between the **slow** and **fast** positions. Place the choke control into the **on** position.

   For a Warm Engine (normal operating temperatures) – Place the throttle/choke control **midway** between the **slow** and **fast** positions. Place the choke into the **on** position. See Figure 5.

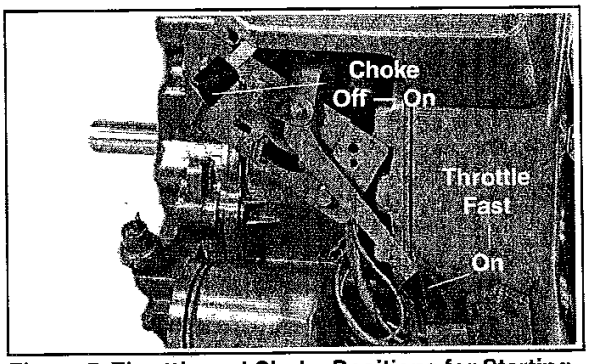


Figure 5. Throttle and Choke Positions for Starting Engine.

2. Start the engine as follows:

   For a Retractable Start Engine – SLOWLY pull the starter handle until just past compression – STOP! Return starter handle, pull firmly with a smooth, steady motion to start. Pull the handle straight out to avoid excessive rope wear from the starter rope guide.

   Extend the starting rope periodically and check its condition. If the rope is frayed, have it replaced immediately by your Kohler Engine Service Dealer.

WARNING: Accidental Starts!

Before extending and checking the retractable starter rope, remove the spark plug lead to prevent the engine from starting accidentally. Make sure the equipment is in neutral.

For an Electric Start Engine – Activate the starter switch. Release the switch as soon as the engine starts.

NOTE: Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60 second cool down period between starting attempts. Failure to follow these guidelines can burn out the starter motor.

NOTE: Upon start-up, a metallic ticking may occur. This is caused by hydraulic lifter leakdown during storage. Run the engine for 5 minutes. The noise will normally cease in the first minute. If noise continues, run the engine at mid-throttle for 20 minutes. If noise persists, take the engine to your local Kohler Service outlet.

NOTE: If the engine develops sufficient speed to disengage the starter but does not keep running (a false start), engine rotation must be allowed to come to a complete stop before attempting to restart the engine. If the starter is engaged while the flywheel is rotating, the starter pinion and flywheel ring gear may clash, resulting in damage to the starter.

If the starter does not turn the engine over, shut off starter immediately. Do not make further attempts to start the engine until the condition is corrected. Do not jump start using another battery (refer to **Battery**). See your Kohler Engine Service Dealer for trouble analysis.

3. **For a Cold Engine –** Gradually return the choke control to the **off** position after the engine starts and warms ups.

   The engine/equipment may be operated during the warm up period, but it may be necessary to leave the choke partially on until the engine warms up.

4. **For a Warm Engine –** Return choke to **off** position as soon as engine starts.

Stopping

1. Remove the load by disengaging all PTO attachments.

2a. **For engines without a shutdown solenoid:** Move the throttle to the **slow** or **low** idle position. Allow the engine to run at idle for 30-60 seconds; then stop the engine.

b. **For engines equipped with a shutdown solenoid:** Position the throttle control somewhere between half and full throttle; then stop the engine.

Battery

A 12 volt battery is normally used. Refer to the operating instructions of the equipment this engine powers for specific battery requirements.

If the battery charge is not sufficient to crank the engine, recharge the battery (see page 12).

Operating

Angle of Operation

This engine will operate continuously at angles up to 25°. Check oil level to assure crankcase oil level is at the "F" mark.

Refer to the operating instructions of the equipment this engine powers. Because of equipment design or application, there may be more stringent restrictions regarding the angle of operation.

NOTE: Do not operate this engine continuously at angles exceeding 25° in any direction. Engine damage could result from insufficient lubrication.

Cooling

NOTE: If debris builds up on the grass screen or other cooling air intake areas, stop the engine immediately and clean. Operating the engine with blocked or dirty air intake and cooling areas can cause extensive damage due to overheating.

WARNING: Hot Parts!

Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running–or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

Engine Speed

NOTE: Do not tamper with the governor setting to increase the maximum engine speed. Overspeed is hazardous and will void the engine warranty.

Maintenance Instructions

Maintenance, repair, or replacement of the emission control devices and systems, which are being done at the customers expense, may be performed by any non-road engine repair establishment or individual. Warranty repairs must be performed by an authorized Kohler service outlet.

WARNING: Accidental Starts!

Disabling engine. Accidental starting can cause severe injury or death. *Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.*

Maintenance Schedule

These required maintenance procedures should be performed at the frequency stated in the table. They should also be included as part of any seasonal tune-up.

Frequency	Maintenance Required
Daily or Before Starting Engine	• Fill fuel tank. • Check oil level. • Check air cleaner for dirty[1], loose, or damaged parts. • Check air intake and cooling areas, clean as necessary[1].
Every 25 Hours	• Service precleaner element[1].
Every 50 Hours	• Check gear reduction unit.
Every 100 Hours	• Replace air cleaner element[1]. • Change oil. • Remove cooling shrouds and clean cooling areas[1].
Every 200 Hours	• Change oil filter. • Check spark plug condition and gap. • Replace fuel filter.
Annually or Every 500 Hours	• Have bendix starter drive serviced[2]. • Have solenoid shift starter disassembled and cleaned[2].

[1]Perform these maintenance procedures more frequently under extremely dusty, dirty conditions.
[2]Only required for Denso starters. Not necessary on Delco starters. Have a Kohler Engine Service Dealer perform this service.

Check Oil Level

The importance of checking and maintaining the proper oil level in the crankcase cannot be overemphasized. Check oil **BEFORE EACH USE** as follows:

1. Make sure the engine is stopped, level, and is cool so the oil has had time to drain into the sump.

2. To keep dirt, grass clippings, etc., out of the engine, clean the area around the oil fill cap/dipstick before removing it.

3. Remove the oil fill cap/dipstick; wipe oil off.

   For engines with a press-on style dipstick: Reinsert the dipstick into the tube and press onto the tube. See Figure 6.

   For engines with a thread-on style dipstick: Reinsert the dipstick into the tube and rest the oil fill cap on the tube. Do not thread the cap onto the tube. See Figure 6.

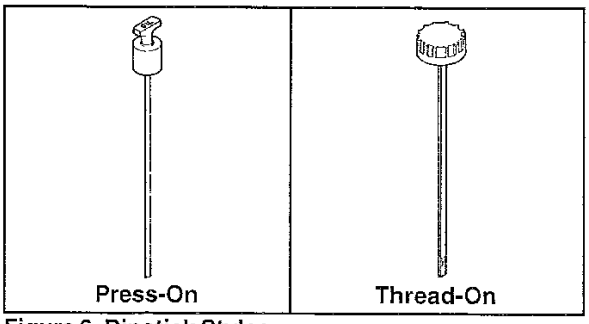


Figure 6. Dipstick Styles.

4. Remove the dipstick and check the oil level.

   The oil level should be up to, but not over, the "F" mark on the dipstick. See Figure 7.

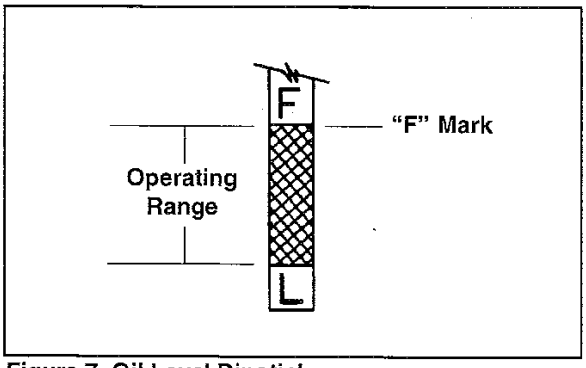


Figure 7. Oil Level Dipstick.

5. If the level is low, add oil of the proper type, up to the "F" mark on the dipstick. (Refer to "Oil Type" on page 4.) Always check the level with the dipstick before adding more oil.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

Oil Sentry™

Some engines are equipped with an optional Oil Sentry™ oil pressure switch. If the oil pressure decreases below an acceptable level, the Oil Sentry™ will either shut off the engine or activate a warning signal, depending on the application.

NOTE: Make sure the oil level is checked **BEFORE EACH USE** and is maintained up to the "F" mark on the dipstick. This includes engines equipped with Oil Sentry™.

Change Oil and Oil Filter

Change Oil

Change oil after every **100 hours** of operation. Refill with service class SG, SH, SJ or higher oil as specified in the Viscosity Grades table (Figure 2) on page 4.

Change the oil while the engine is still warm. The oil will flow more freely and carry away more impurities. Make sure the engine is level when filling, checking, or changing the oil.

Change the oil as follows (see Figure 8):

1. To keep dirt, grass clippings, etc., out of the engine, clean the area around the oil fill cap/ disptick before removing it.

2. Remove the oil drain plug and oil fill cap/dipstick. Be sure to allow ample time for complete drainage.

3. Reinstall the drain plug. Make sure it is tightened to **13.6 N·m (10 ft. lb.)** torque.

4. Fill the crankcase, with new oil, of the proper type, to the "F" mark on the dipstick. Refer to Oil Type on page 4. Always check the level with the dipstick before adding more oil.

5. Reinstall the oil fill cap or plug and tighten securely.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

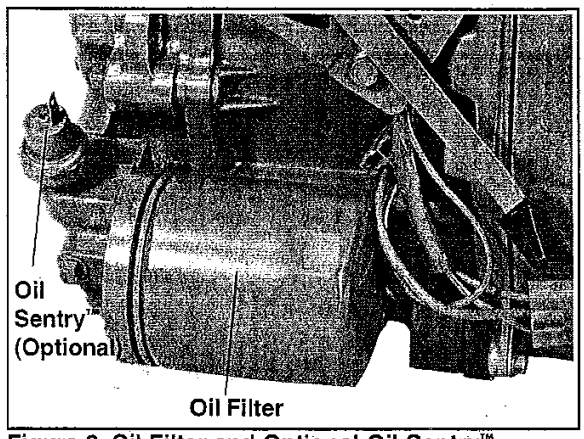


Figure 8. Oil Filter and Optional Oil Sentry™ Switch.

Change Oil Filter

Replace the oil filter **at least every other oil change (every 200 hours of operation)**. Always use a genuine Kohler oil filter. Use chart below to determine part number to order.

Oil Filter Part No.	Length
12 050 01-S	2-1/2"
52 050 02-S	3-3/8"

Replace the oil filter as follows:

1. Drain the oil from the engine crankcase.

2. Allow the oil filter to drain.

3. Before removing the oil filter, clean the area around the oil filter to keep dirt and debris out of the engine. Remove the old filter. Wipe off the surface where the oil filter mounts.

4. Place a new replacement filter in a shallow pan with the open end up. Pour new oil of the proper type in through the threaded center hole. Stop pouring when the oil reaches the bottom of the threads. Allow a minute or two for the oil to be absorbed by the filter material.

5. Apply a thin film of clean oil to the rubber gasket on the new filter.

6. Install the replacement oil filter to the filter adapter. Turn the oil filter clockwise until the rubber gasket contacts the filter adapter, then tighten the filter an additional **3/4 to 1 turn.**

7. Reinstall the drain plug.

8. Fill the crankcase with new oil of the proper type to the "F" mark on the dipstick.

9. Start the engine and check for oil leaks. Correct any leaks before placing the engine into service. Check oil level to be sure it is up to but not over the "F" mark.

Service Precleaner and Air Cleaner Element

This engine is equipped with a replaceable, high density paper air cleaner element. Most engines are also equipped with an oiled, foam precleaner which surrounds the paper element. See Figures 9 and 10.

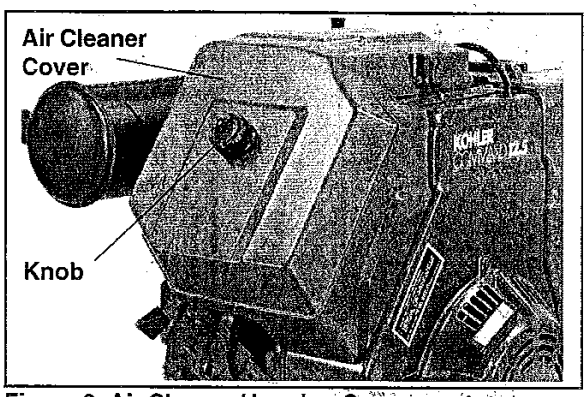


Figure 9. Air Cleaner Housing Components.

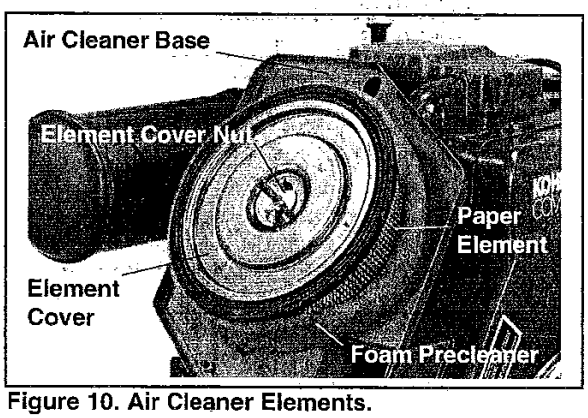


Figure 10. Air Cleaner Elements.

Check the air cleaner **daily or before starting the engine**. Check for a buildup of dirt and debris around the air cleaner system. Keep this area clean. Also check for loose or damaged components. Replace all bent or damaged air cleaner components.

NOTE: Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

Service Precleaner

Wash and reoil the precleaner every **25 hours** of operation, (more often under extremely dusty or dirty conditions).

1. Loosen the air cleaner cover knob and remove the cover.
2. Remove the precleaner from the paper element.
3. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow precleaner to air dry.
4. Saturate the precleaner with new engine oil. Squeeze out all excess oil.
5. Reinstall the precleaner over the paper element.
6. Reinstall the air cleaner cover and tighten the knob securely.
7. When precleaner replacement is necessary order Part No. 52 083 01-S.

Service Paper Element

Every **100 hours** of operation (more often under extremely dusty or dirty conditions), replace the paper element.

1. Loosen the air cleaner cover knob and remove the cover. Remove the wing nut and then remove the air cleaner element with precleaner. Remove the precleaner from the element and service as necessary.
2. Do not wash the paper element or **use pressurized air**, as this will damage the element. Replace a dirty, bent, or damaged element with a genuine Kohler element. Handle new elements carefully; do not use if the sealing surfaces are bent or damaged.
3. When servicing the air cleaner, check the air cleaner base. Make sure it is secured and not bent or damaged. Also check the element cover for damage or improper fit. Replace all damaged air cleaner components.
4. Reinstall all components as described above.
5. When air cleaner element replacement is necessary order Part No. 47 083 01-S.

Clean Air Intake/Cooling Areas

To ensure proper cooling, make sure the grass screen, cooling fins, and other external surfaces of the engine are kept clean **at all times**.

Every **100 hours** of operation (more often under extremely dusty, dirty conditions), remove the blower housing and other cooling shrouds. Clean the cooling fins and external surfaces as necessary. Make sure the cooling shrouds are reinstalled.

NOTE: Operating the engine with a blocked grass screen, dirty or plugged cooling fins, and/or cooling shrouds removed, will cause engine damage due to overheating.

Ignition System

This engine is equipped with a dependable electronic magneto ignition system. Other than periodically checking/replacing the spark plug, no maintenance, timing, or adjustments are necessary or possible with this system.

In the event starting problems should occur which are not corrected by replacing the spark plugs, see your Kohler Engine Service Dealer for trouble analysis.

Check Spark Plug

Every **200 hours** of operation, remove the spark plug, check its condition, and reset the gap or replace with a new plug as necessary. The standard spark plug is a Champion® RC12YC (Kohler Part No. 12 132 02-S). A high-performance spark plug, Champion® Platinum 3071 (used on Pro Series engines, Kohler Part No. 25 132 12-S), is also available. Equivalent alternate brand plugs can also be used.

1. Before removing the spark plug, clean the area around the base of the plug to keep dirt and debris out of the engine.

2. Remove the plug and check its condition. Replace the plug if worn or reuse is questionable.

   NOTE: Do not clean the spark plug in a machine using abrasive grit. Some grit could remain in the spark plug and enter the engine causing extensive wear and damage.

3. Check the gap using a wire feeler gauge. Adjust the gap by carefully bending the ground electrode. See Figure 11. Gap CH11-15 plugs to 1.02 mm (0.040 in.). Gap CH16 plugs to 0.76 mm (0.030 in.).

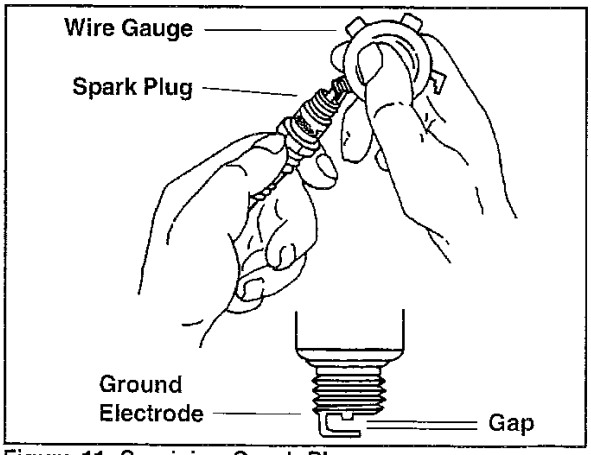


Figure 11. Servicing Spark Plug.

4. Reinstall the spark plug into the cylinder head. Torque the spark plug to **38.0-43.4 N·m (28-32 ft. lb.)**.

Battery Charging

WARNING: Explosive Gas!

Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present.

Fuel Filter

Most engines are equipped with an in-line fuel filter. Periodically inspect the filter and replace with a genuine Kohler filter every **200 operating hours**.

Fuel Line

In compliance with CARB Tier III Emission Regulations, these engines with a **Family** identification number beginning with "6" or greater (see Figure 12), must use Low Permeation SAE 30 R7 rated fuel line; certified to meet CARB requirements. Standard fuel line may not be used. Order replacement hose by part number through a Kohler Engine Service Dealer.

Figure 12. Family Number Location.

Reduction Gear Units

On engines equipped with a reduction gear unit, remove the oil plug on lower part of cover every **50 hours** of operation to check oil level. With the engine level, the oil level of the unit should be up to the bottom of the oil plug hole. To add oil, remove the vented plug at the top of the unit. Use AGMA No. 7 EP oil in the reduction gear unit. Following are a few products that meet this spec:

Mobilgear 634
Pennzoil Super Maxol "S"
Pennzoil Maxol EP Gear Oil
Pennzoil Super Maxol EP Gear Oil
Pennzoil Super Pennztac EP Gear Oil

Carburetor Troubleshooting and Adjustments

NOTE: Carburetor adjustments should be made only after the engine has warmed up.

These engines are equipped with one of two basic types of fixed jet carburetors – Walbro or Nikki.

The carburetor is designed to deliver the correct fuel-to-air mixture to the engine under all operating conditions. On both types of carburetors, the fixed main jet is calibrated at the factory and is not adjustable. On Walbro carburetors, the low idle fuel adjusting needle is set at the factory and normally does not need adjustment. Certified engines may have a fixed idle or limiter cap on the idle fuel adjusting needle. The idle fuel can only be adjusted within the limits allowed by the cap. Nikki carburetors have a sealed idle fuel adjusting needle which is not adjustable.

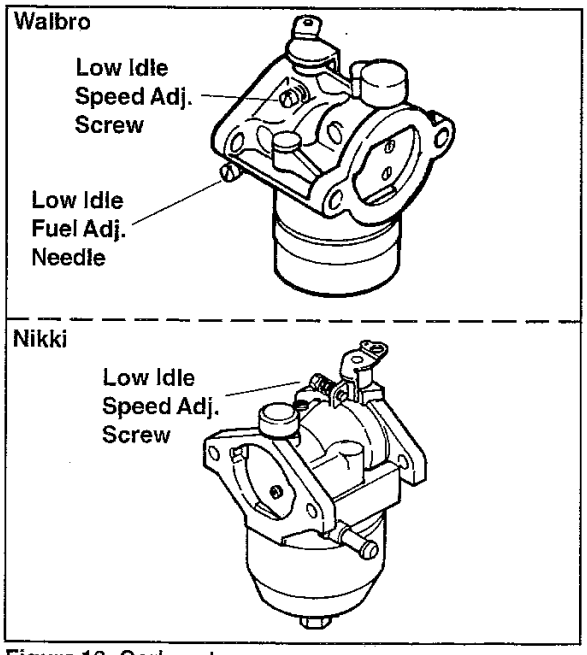


Figure 13. Carburetors.

NOTE: To ensure correct engine operation at altitudes above 1525 meters (5000 ft.), it may be necessary to have an authorized Kohler dealer install a special high-altitude jet kit in the carburetor. If a high-altitude kit has been installed, the engine must be reconverted to the original jet size, before it is operated at lower altitudes, or overheating and engine damage can result.

Troubleshooting

If engine troubles are experienced that appear to be fuel system related, check the following areas before adjusting the carburetor.

- Make sure the fuel tank is filled with clean, fresh gasoline.
- Make sure the fuel tank cap vent is not blocked and that it is operating properly.
- If the fuel tank is equipped with a shut-off valve, make sure it is open.
- If the engine is equipped with an in-line fuel filter, make sure it is clean and unobstructed. Replace the filter if necessary.
- Make sure fuel is reaching the carburetor. This includes checking the fuel lines and fuel pump for restrictions or faulty components, replace as necessary.
- Make sure the air cleaner element is clean and all air cleaner components are fastened securely.

If, after checking the items listed above, the engine is hard to start, runs roughly, or stalls at low idle speed, it may be necessary to adjust or service the carburetor.

Carburetor Adjustment

NOTE: Certified engines may have a fixed idle or limiter cap on the idle fuel adjusting needle. Step 2 can only be performed within the limits allowed by the cap.

1. Start the engine and run at half throttle for 5 to 10 minutes to warm up. The engine must be warm before doing steps 2 and 3.
2. **Low Idle Fuel Needle Setting:** Place the throttle into the **idle** or **slow** position.

   Turn the low idle fuel adjusting needle out (counterclockwise) from the preliminary setting until engine speed decreases (rich). Note the position of the needle.

Now turn the adjusting needle in (clockwise). The engine speed may increase, then it will decrease as the needle is turned in (lean). Note the position of the needle.

Set the adjusting needle midway between the rich and lean settings. See Figure 14.

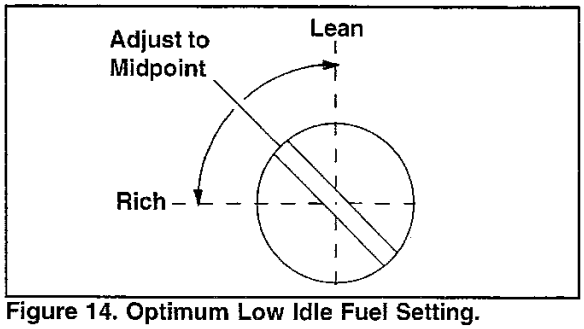


Figure 14. Optimum Low Idle Fuel Setting.

3. **Low Idle Speed Setting:** Place the throttle control into the **idle** or **slow** position. Set the low idle speed to **1200 RPM*** (± 75 RPM) by turning the low idle speed adjusting screw **in or out.** Check the speed using a tachometer.

   *NOTE: The actual low idle speed depends on the application – refer to equipment manufacturer's recommendations. The recommended low idle speed for basic engines is 1200 RPM. To ensure best results when setting the low idle fuel needle, the low idle speed must not exceed 1200 RPM (± 75 RPM).

Troubleshooting

When troubles occur, be sure to check the simple causes which, at first, may seem to obvious to be considered. For example, a starting problem could be caused by an empty fuel tank. Some common causes of engine troubles are listed in the following table.

Do not attempt to service or replace major engine components, or any items that require special timing or adjustment procedures. Have your Kohler Engine Service Dealer do this work.

Possible Cause / Problem	No Fuel	Improper Fuel	Dirt In Fuel Line/System	Dirty Grass Screen	Incorrect Oil Level	Engine Overloaded	Dirty Air Cleaner	Faulty Spark Plug
Will Not Start	•	•	•		•	•	•	•
Hard Starting		•	•		•	•	•	•
Stops Suddenly	•		•	•	•	•	•	
Lacks Power		•	•	•	•	•	•	•
Operates Erratically		•	•	•		•	•	•
Knocks or Pings		•		•		•		•
Skips or Misfires		•	•	•			•	•
Backfires			•			•	•	•
Overheats			•	•	•	•	•	
High Fuel Consumption						•	•	•

Storage

If the engine will be out of service for two months or more, use the following storage procedure:

1. Clean the exterior surfaces of the engine.

2. Change the oil and filter while the engine is still warm from operation. See Change Oil and Oil Filter on page 9.

3. The fuel system must be completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If you choose to use a stabilizer, follow the manufacturers recommendations, and add the correct amount for the capacity of the fuel system. Fill the fuel tank with clean, fresh gasoline. Run the engine for 2-3 minutes to get stabilized fuel into the carburetor.

   To empty the system, run the engine until the fuel tank and system are empty.

4. Remove the spark plug. Add one tablespoon of engine oil into the spark plug hole. Install the plug, but do not connect the plug lead. Crank the engine two or three revolutions.

5. Remove the spark plug. Cover the spark plug hole with your thumb, and turn the engine over until the piston is at the top of its stroke. (Pressure against thumb is greatest.) Reinstall the plug, but do not connect the plug lead.

6. Store the engine in a clean, dry place.

Parts Ordering

The engine Model, Specification, and Serial Numbers are required when ordering replacement parts from your Kohler Engine Service Dealer. These numbers are found on the identification plate which is affixed to the engine shrouding. Include letter suffixes if there are any. See Engine Identification Numbers on page 5.

Always insist on genuine Kohler parts. All genuine Kohler parts meet strict standards for fit, reliability, and performance.

Major Repair

Major repair information is available in Kohler Engine Service Manuals. This type of repair generally requires the services of a trained mechanic and the use of special tools and equipment. Kohler Engine Service Dealers have the facilities, training, and genuine Kohler replacement parts necessary to perform this service.

For the nearest Sales & Service location:

- visit our website www.kohlerengines.com
- call 1-800-544-2444 (U.S. & Canada)
- look in the yellow pages under Engines-Gasoline

Model Designation

Model CH15ST for example: C designates Command engine, H designates horizontal crankshaft, and 15 designates horsepower. A letter suffix designates a specific version as follows:

Suffix	Designates
S	Electric Start
T	Retractable Start
ST	Electric/Retractable Start
GT	Generator Application/Retractable Start
GS	Generator Application/Electric Start
PT	Pump/Retractable Start
RT	Gear Reduction/Retractable Start

Specifications

Model:	CH11	CH12.5	CH13	CH14	CH15/CH16**
Bore: mm (in.)	87 (3.43)	87 (3.43)	87 (3.43)	87 (3.43)	90 (3.55)/90 (3.55)
Stroke: mm (in.)	67 (2.64)	67 (2.64)	67 (2.64)	67 (2.64)	67 (2.64)/67 (2.64)
Displacement: cm^3 (in^3)	398 (24.3)	398 (24.3)	398 (24.3)	398 (24.3)	426 (26.0)/426 (26.0)
Power (@3600 RPM): kW (HP)	8.2 (11*)	9.33 (12.5*)	9.75 (13*)	10.50 (14*)	11.2 (15*)/11.9 (16*)
Max. Peak Torque (@ RPM): ft. lb.	19.7 @2400	20.5 @2500	21.1 @2200	21.3 @2500	24.8 @2400/25.3 @2400
Compression Ratio:	8.5:1	8.5:1	8.5:1	8.5:1	8.5:1/8.5:1
Weight: kg (lb.)	40 (88.3)	40 (88.3)	40 (88.3)	40 (88.3)	40 (88.3)/40 (88.3)
Oil Capacity (w/filter): L (U.S. qt.)	1.9 (2)	1.9 (2)	1.9 (2)	1.9 (2)	1.9 (2)/1.9 (2)
Lubrication:	Full Pressure w/full Flow Filter				

Exhaust Emission Control System for CH11,12.5,13,14,15,16 is EM.

*Horsepower ratings exceed Society of Automotive Engineers Small Engine Test Code J1940. Actual engine horsepower is lower and affected by, but not limited to, accessories (air cleaner, exhaust, charging, cooling, fuel pump, etc.), application, engine speed and ambient operating conditions (temperature, humidity, and altitude). Kohler reserves the right to change product specifications, designs and equipment without notice and without incurring obligation.

**CH16 engine is equipped with SMART-SPARK$_{m}$ computerized ignition system.

LIMITED 2 YEAR COMMAND ENGINE WARRANTY

Kohler Co. warrants to the original consumer that each new COMMAND engine sold by Kohler Co. will be free from manufacturing defects in materials or workmanship in normal service for a period of two (2) years from date of purchase, provided it is operated and maintained in accordance with Kohler Co.'s instructions and manuals.

Our obligation under this warranty is expressly limited, at our option, to the replacement or repair at Kohler Co., Kohler, Wisconsin 53044, or at a service facility designated by us of such parts as inspection shall disclose to have been defective.

EXCLUSIONS:
Mufflers on engines used commercially (non-residential) are warranted for one (1) year from date of purchase, except catalytic mufflers, which are warranted for two (2) years.

This warranty does not apply to defects caused by casualty or unreasonable use, including faulty repairs by others and failure to provide reasonable and necessary maintenance.

The following items are not covered by this warranty:

Engine accessories such as fuel tanks, clutches, transmissions, power-drive assemblies, and batteries, unless supplied or installed by Kohler Co. These are subject to the warranties, if any, of their manufacturers.

KOHLER CO. AND/OR THE SELLER SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND, including but not limited to labor costs or transportation charges in connection with the repair or replacement of defective parts.

IMPLIED OR STATUTORY WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. We make no other express warranty, nor is any one authorized to make any on our behalf.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN WARRANTY SERVICE:
Purchaser must bring the engine to an authorized Kohler service facility. To locate the nearest facility, visit our website, www.kohlerengines.com, and click on SALES AND SERVICES to use the locator function, consult your Yellow Pages or telephone 1-800-544-2444.

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

KOHLER CO.
FEDERAL AND CALIFORNIA EMISSION CONTROL SYSTEMS
LIMITED WARRANTY
SMALL OFF-ROAD ENGINES

The U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and Kohler Co. are pleased to explain the Federal and California Emission Control Systems Warranty on your small off-road equipment engine. In California beginning in 2006, "emissions" means both exhaust and evaporative emissions. For California, engines produced in 2006 and later must be designed, built and equipped to meet the state's stringent anti-smog standards. In other states, 1997 and later model year engines must be designed, built and equipped, to meet the U.S. EPA regulations for small non-road engines. The engine must be free from defects in materials and workmanship which cause it to fail to conform with U.S. EPA standards for the first two years of engine use from the date of sale to the ultimate purchaser. Kohler Co. must warrant the emission control system on the engine for the period of time listed above, provided there has been no abuse, neglect or improper maintenance.

The emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included are the hoses, belts and connectors and other emission related assemblies.

Where a warrantable condition exists, Kohler Co. will repair the engine at no cost, including diagnosis (if the diagnostic work is performed at an authorized dealer), parts and labor.

MANUFACTURER'S WARRANTY COVERAGE
Engines produced in 2006 or later are warranted for two years in California. In other states, 1997 and later model year engines are warranted for two years. If any emission related part on the engine is defective, the part will be repaired or replaced by Kohler Co. free of charge.

OWNER'S WARRANTY RESPONSIBILITIES
(a) The engine owner is responsible for the performance of the required maintenance listed in the owner's manual. Kohler Co. recommends that you retain all receipts covering maintenance on the engine, But Kohler Co. cannot deny warranty solely for the lack of receipts or for your failure to assure that all scheduled maintenance was performed.

(b) Be aware, however, that Kohler Co. may deny warranty coverage if the engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Continued on next page.

(c) For warranty repairs, the engine must be presented to a Kohler Co. service center as soon as a problem exists. Call 1-800-544-2444, or access our web site at: www.kohlerengines.com for the names of the nearest service centers. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding warranty rights and responsibilities, you should contact Kohler Co. at 1-920-457-4441 and ask for an Engine Service representative.

COVERAGE

Kohler Co. warrants to the ultimate purchaser and each subsequent purchaser that the engine will be designed, built and equipped, at the time of sale, to meet all applicable regulations. Kohler Co. also warrants to the initial purchaser and each subsequent purchaser, that the engine is free from defects in materials and workmanship which cause the engine to fail to conform with applicable regulations for a period of two years.

Engines produced in 2006 or later are warranted for two years in California. For 1997 and later model years, EPA requires manufacturers to warrant engines for two years in all other states. These warranty periods will begin on the date the engine is purchased by the initial purchaser. If any emission related part on the engine is defective, the part will be replaced by Kohler Co. at no cost to the owner. Kohler Co. is liable for damages to other engine components caused by the failure of a warranted part still under warranty.

Kohler Co. shall remedy warranty defects at any authorized Kohler Co. engine dealer or warranty station. Warranty repair work done at an authorized dealer or warranty station shall be free of charge to the owner if such work determines that a warranted part is defective.

Listed below are the parts covered by the Federal and California Emission Control Systems Warranty. Some parts listed below may require scheduled maintenance and are warranted up to the first scheduled replacement point for that part. The warranted parts are to the extent they were present in the engine purchased:

- Oxygen sensor (if equipped)
- Intake manifold (if equipped)
- Exhaust manifold (if equipped)
- Catalytic muffler (if equipped)
- Fuel metering valve (if equipped)
- Spark advance module (if equipped)
- Crankcase breather
- Ignition module(s) with high tension lead
- Gaseous fuel regulator (if equipped)
- Electronic control unit (if equipped)
- Carburetor or fuel injection system
- Fuel lines, fuel line fittings and clamps (if equipped)
- Air filter, fuel filter, and spark plugs (only to first scheduled replacement point)

LIMITATIONS

This Emission Control Systems Warranty shall not cover any of the following:

(a) repair or replacement required because of misuse or neglect, improper maintenance, repairs improperly performed or replacements not conforming to Kohler Co. specifications that adversely affect performance and/or durability and alterations or modifications not recommended or approved in writing by Kohler Co.,

(b) replacement of parts and other services and adjustments necessary for required maintenance at and after the first scheduled replacement point,

(c) consequential damages such as loss of time, inconvenience, loss of use of the engine or equipment, etc.,

(d) diagnosis and inspection fees that do not result in eligible warranty service being performed, and

(e) any add-on or modified part, or malfunction of authorized parts due to the use of add-on or modified parts.

MAINTENANCE AND REPAIR REQUIREMENTS

The owner is responsible for the proper use and maintenance of the engine. Kohler Co. recommends that all receipts and records covering the performance of regular maintenance be retained in case questions arise. If the engine is resold during the warranty period, the maintenance records should be transferred to each subsequent owner. Kohler Co. reserves the right to deny warranty coverage if the engine has not been properly maintained; however, Kohler Co. may not deny warranty repairs solely because of the lack of repair maintenance or failure to keep maintenance records.

Normal maintenance, replacement or repair of emission control devices and systems may be performed by any repair establishment or individual; however, **warranty repairs must be performed by a Kohler authorized service center**. Any replacement part or service that is equivalent in performance and durability may be used in non-warranty maintenance or repairs, and shall not reduce the warranty obligations of the engine manufacturer.

KOHLER ENGINES

FOR SALES AND SERVICE INFORMATION
IN U.S. AND CANADA, CALL **1-800-544-2444**

KohlerEngines.com

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

FORM NO.:	12 590 02-A
ISSUED:	11/04
REVISED:	3/07
MAILED:	

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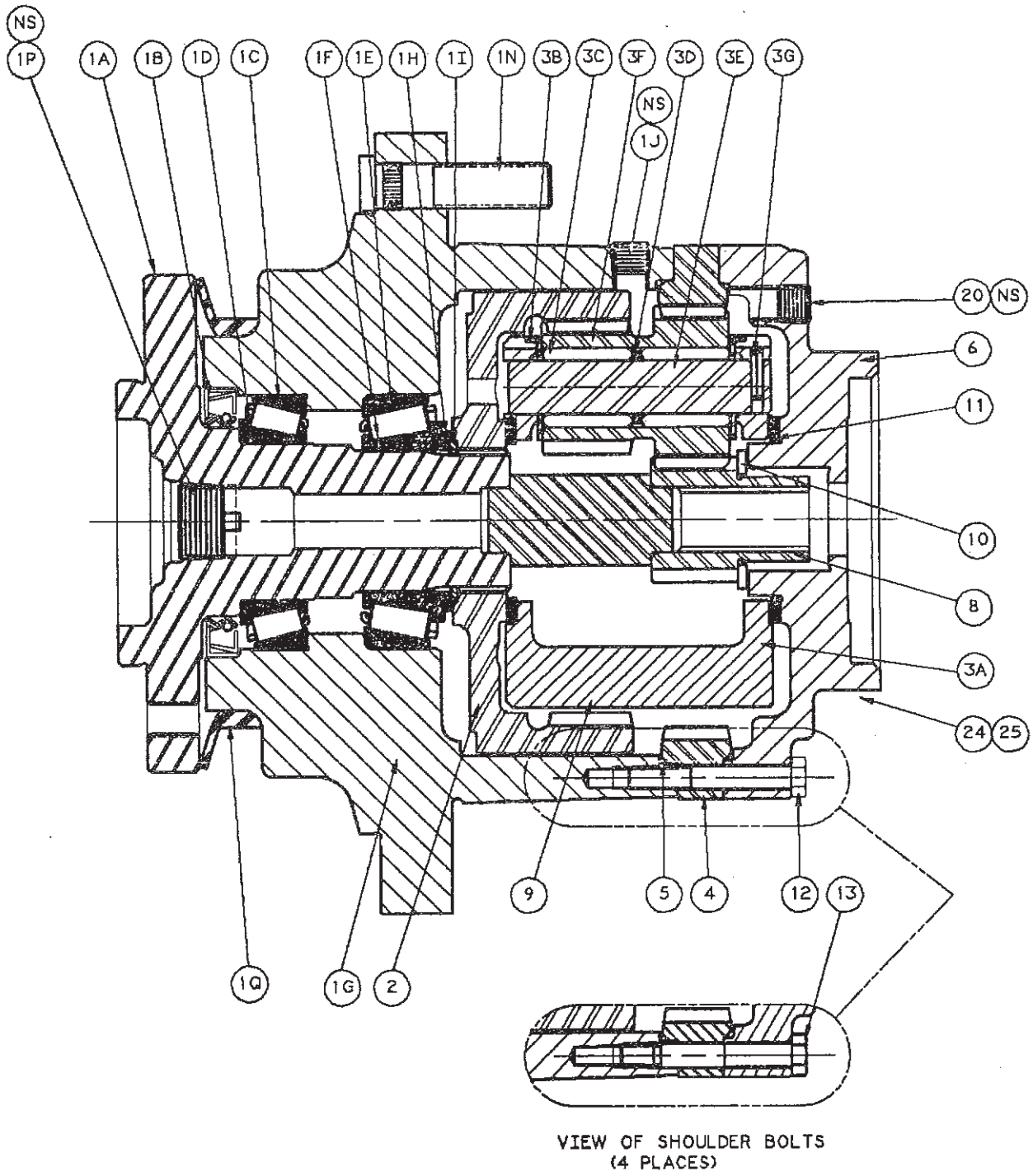
TORQUE HUB

McL - 20C



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BORASSY015

TORQUE HUB

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1A	1	P301002	SPINDLE
1B	1	P300003	SEAL, LIP
1C	1	P300004	BRG, TAPERED CUP
1D	1	P300005	BRG, TAPERED CONE
1E	1	P300006	BRG, TAPERED CUP
1F	1	P300007	BRG, TAPERED CONE
1G	1	P301005	HOUSING
1H	1	P300009	WASHER, THRUST
1I	1	P300010	RETAINING, RING-EXT
1J	2	P300030	PIPE PLUG STD-NPTF
1N	9	P301007	STUD
1P	1	P301006	PIPE PLUG MAGN-NPTF
1Q	1	P301003	SEAL, BOOT
2	1	P300012	GEAR, INTERNAL
3A	1	P300014	CARRIER
3B	6	P300015	WASHER, THRUST-TANGED
3C	96	P300016	BRG, NEEDLE
3D	3	P300017	SPACER, THRUST
3E	3	P300018	SHAFT, PLANET
3F	3	P300019	GEAR, CLUSTER
3G	3	P301004	PIN, ROLL
4	1	P300021	GEAR, RING
5	2	P300022	O-RING
6	1	P300023	COVER, INPUT
8	1	P300024	GEAR, SUN
9	1	P300025	SPACER, INPUT
10	1	P300026	WASHER, THRUST
11	2	P300027	WASHER, THRUST
12	8	P300028	BOLT, HEX UNC
13	4	P300029	BOLT, SHOULDER
20	1	P300030	PIPE PLUG, STD-NPTF
25	4	P300032	SCREW, DRIVE

* NOT SHOWN

DISASSEMBLY
McL-20C

1. Drain oil from unit and discard.

2. Pressure test unit at 8 PSI for 10 minutes. Seal and O-ring check.

3. Mark housing from bolt head down O.D. of cover across ring gear to hub O.D. This is necessary especially if rebuilding on machine.

4. Remove four (4) shoulder bolts and eight (8) grade bolts from cover (items 12 & 13).

5. Remove cover (item #6).

6. Remove thrust washer (item #10) and thrust washer (item #11).

7. Remove input sun gear (item #8).

8. Remove O-ring between cover and ring gear.

9. Remove ring gear (item #4).

10. Remove carrier sub-assembly (item #3A).

11. Remove O-ring (item #11) between ring gear and hub counter bore.

12. Remove thrust washer (item #11) between carrier housing and internal gear.

13. Remove internal gear (item #2).

14. Remove retaining gear (item #1T) from hub/spindle sub-assembly and throw away. This requires retaining ring pliers. NOTE: Do not reuse retaining ring. It might require that the bearing be tapped down to remove the interference of press fit.

15. Remove bearing spacer (thrust washer) (item #1H).

16. Place hub/spindle under a press and push spindle out of hub. NOTE: Both bearing cones are press fit.

17. When spindle comes out of hub, the seal (item #1B) and bearing cone (item #1D) will be attached. A bearing puller must be used to remove cone. Do not reuse bearing cone or seal at this area.

18. Remove bearing cone from hub (item #1F).

19. Remove seal boot (item #1Q).

20. Place hub on table - using a grade '5' bolt, ground to a flat side, tap one cup out. Turn hub over and tap other cup out.

Upon repair, install new cups and cones, seal retaining ring for hub/spindle sub-assembly and new O-rings. NOTE: Take care to time carrier sub-assembly per building procedures. If carrier is mistimed, gear teeth will fail in a short amount of operating hours. Failure mode will be same as torque overload which is bi-directional bending fatigue in the cluster gears.

If disassembling the carrier sub-assembly, simply tape the roll pins into the planet shaft (roll pins will self contain in the planet shaft) tap planet shaft out of carrier housing.

TORQUE HUB ASSEMBLY
McL-20C

CARRIER SUB-ASSEMBLY

1. Grease the inside of small end of one **cluster gear (3F)** and line the inside of small end of **cluster gear (3F)** with 16 **needle rollers (3C)**.

1

2

2. Place **spacer (3D)** on top of **needle rollers (3C)** inside **cluster gear (3F)**.

3

3. Grease the inside of large end of **cluster gear (3F)** and line the inside of large end of **cluster gear (3F)** with 16 **needle rollers (3C)**.

4

4. Stand **carrier housing (3A)** on its side. Starting from the roll-pin-holed side of carrier, insert a **planet shaft (3E)**, roll pin hole last, into one of the planet shaft holes in **carrier housing (3A)**.

5. Grease and place one tanged **thrust washer (3B)** onto the end of **planet shaft (3E)**, inserting tang of the thrust washer into the slot in the side of the carrier housing.

6. Following the thrust washer, oil assembled **cluster gear (3F)** and place it onto **planet shaft (3E)**.

7. Following the planet gear, grease and place one more **thrust washer (3B)** onto **planet shaft (3E)**, inserting tang of the thrust washer into the slot in the side of carrier housing. Now insert **planet shaft (3E)** into the opposite planet shaft hole in **carrier housing (3A)**.

5

6

8. Using an alignment punch, align the roll pin holes in **carrier housing (3A)** and **planet shaft (3E)** and hammer **roll pin (3G)** into the aligned holes.

7

8

9. Repeat steps 1 to 8 to assemble and install the two remaining cluster gears.

10. At this point the carrier sub-assembly is complete.

HUB-SPINDLE SUB-ASSEMBLY

NOTE: Make sure the cup sits square with the counterbore before pressing.

1. Set **hub (1G)** on work surface, wide end up. Using a bearing cup pressing tool, press **bearing cup (1E)** into the counterbore in the wide end of **hub (1G)**. Oil the bearing cup.

NOTE: Make sure the cup sits square with the counterbore before pressing.

2. Using a bearing cup pressing tool, press **bearing cup (1C)** into the counterbore in the small end of **hub (1G)**. Oil the bearing cup.

3. Place **bearing cone (1D)** into the small end of **hub (1G)**. Oil the bearing cone.

4. Using a seal pressing tool, press **seal (1B)**, closed side facing up, into the small end of **hub (1G)**. Oil the seal.

5. Press **studs (1N)** into the holes in flange of **hub (1G)**. Reinstall **seal boot (1Q)** onto the **hub (1G)**. (Ref. drawing pg. 56). Replace seal if damaged or missing.

6. Apply a light coat of “Never-Seize” to **pipe plug (1P)** and install it into the bottom (wide end) of **spindle (1A)**.

7. Place **spindle (1A)** on table, wide end down. Slowly lower **hub (1G)**, small end down, onto **spindle (1A)**, watching **seal (1B)** to make sure it stays in place.

8. Using a bearing cone pressing tool, press **bearing cone (1F)** onto **spindle (1A)** in **hub (1G)**. Oil the bearing cone.

9. Place **spacer (1H)** over the end of **spindle (1A)**.

CAUTION: Beware of sharp edges in the counterbore when you install "O" ring.

7

10. Place **retaining ring (1I)** over **spindle (1A)**.

8

11. Check endplay.

9

12. Apply a light coat of "Never-Seize" to **pipe plug (1J)** and install it into the side of **hub (1G)**.

10

13. At this point the hub-spindle sub-assembly is complete.

12

MAIN ASSEMBLY

1. Lower **internal gear (2)**, small end down, into **hub (1G)**.

2. Grease and place **thrust washer (11)** into **internal gear (2)** and around **spindle (1A)**.

CAUTION: Beware of sharp edges in the counterbore when you install "O" ring.

3. Grease and place **"O" ring (5)** into the counterbore of **hub (1G)**. NOTE: "O" ring can be stretched to fit counterbore (if it is too small), or squeezed together bit by bit (if it is too large) to make "O" ring fit exactly.

4. Set **carrier sub-assembly (3)** on table, large gear ends facing up. Line up the punch marks on the gear teeth to the 12 o'clock position. See Diagram 1.

5. Place **ring gear (4)** onto **carrier sub-assembly (3)** to keep the punch marks in position.

1

2

3

4

5

6. Holding onto ring gear, lower **carrier sub-assembly (3)** into **hub (1G)**.

7. Now lift **ring gear (4)** off of **hub (1G)** and line up the bolt holes in hub and ring gear, then replace ring gear into hub.

8. Place **thrust spacer (9)** down into middle of **carrier (3)**.

9. Place **input gear (8)**, larger splined end down, on top of **thrust spacer (9)** in the middle of **carrier (3)**.

10. Place **thrust washer (10)** down around **input gear (8)**.

CAUTION: Beware of sharp edges in the counterbore when you install "O" ring.

6

11. Place **cover (6)** on work surface, interior side up. Grease and place **"O" ring (5)** into the counterbore around rim of **cover (6)**.
NOTE: "O" rings may be stretched to fit counterbore. If an "O" ring has been stretched too much, simply squeeze the "O" ring together bit by bit as you place it around the counterbore. It can be made to fit exactly.

8

9

11

12. Grease and place **thrust washer (11)** around edge of raised circular center of **cover (6)**.

12

13. Lower **cover (6)**, interior side down, onto **ring gear (4)**, aligning the bolt holes in cover and ring gear. See you assembly print for pipe plug timing.

14. Place **shoulder bolts (13)** into their holes in **cover (6)** and tighten by hand.

13

15. Place **bolts (12)** into their holes in **cover (6)** and tighten.

14

16. Apply 23-27 ft.-lbs. of torque to each **shoulder bolt (13)**.

15

17. Apply 23-27 ft.-lbs. of torque to each **bolt (12)**.

16

18. Apply a light coat of “Never-Seize” to **pipe plug (20)** and install it into the pipe plug hole in **cover (6)**.

18

19. Roll test the unit in both clockwise and counterclockwise directions. Perform the same number of turns in each direction as the ratio of the unit. This number is the same as the last two digits in the model number found on the ID tag of the unit. For example, if the model number of this unit is S1B1003369, then roll the unit 69 times in each direction.

19

20. Lead test the unit at a pressure of 5 PSI for 2-3 minutes.

20

21. At this point the main assembly is complete.

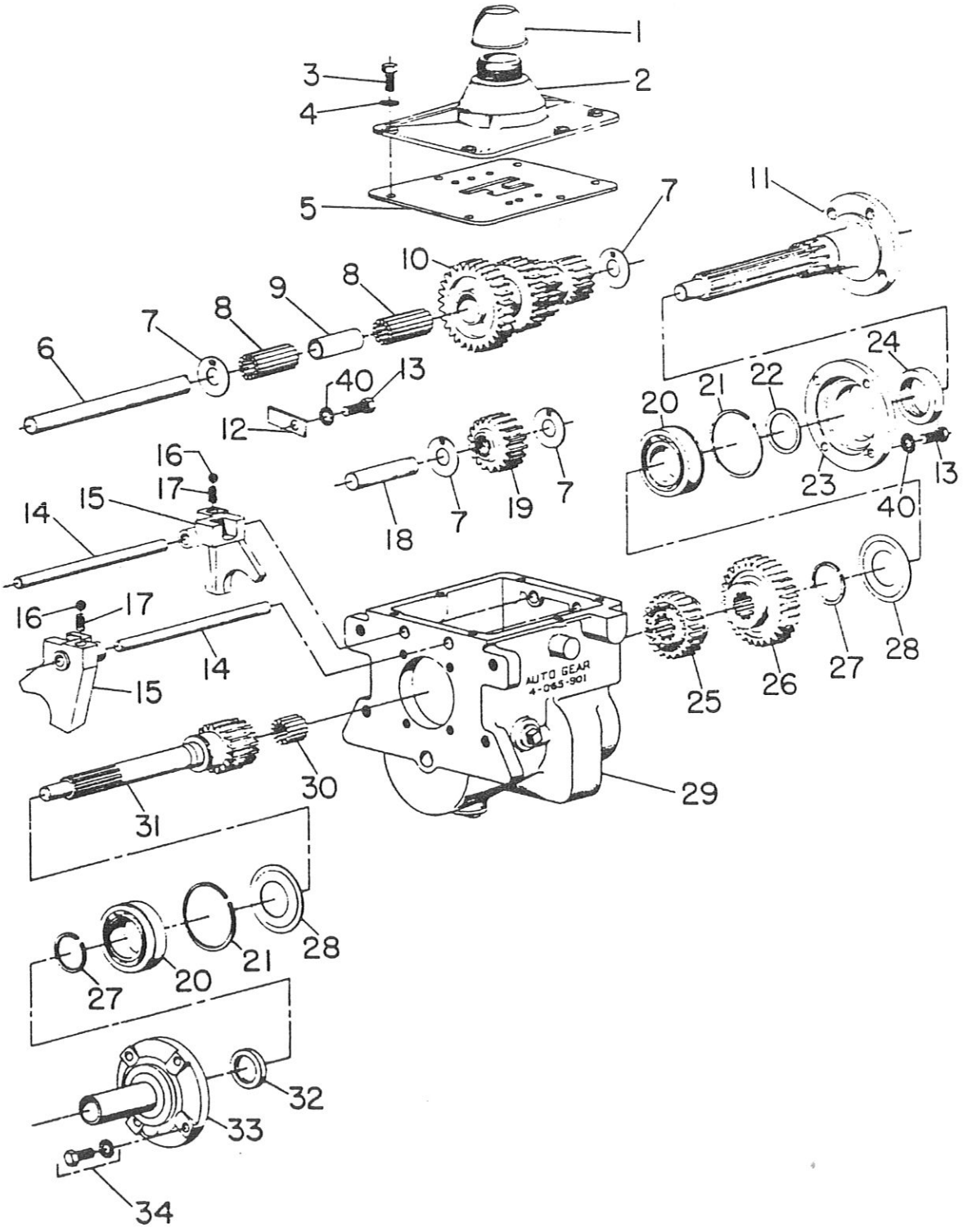
MAINTENANCE RECORD

McL-20C

DATE	SERVICE PERFORMED	BY

Transmission Parts

McL - 20C



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BORASSY013

Transmission Parts

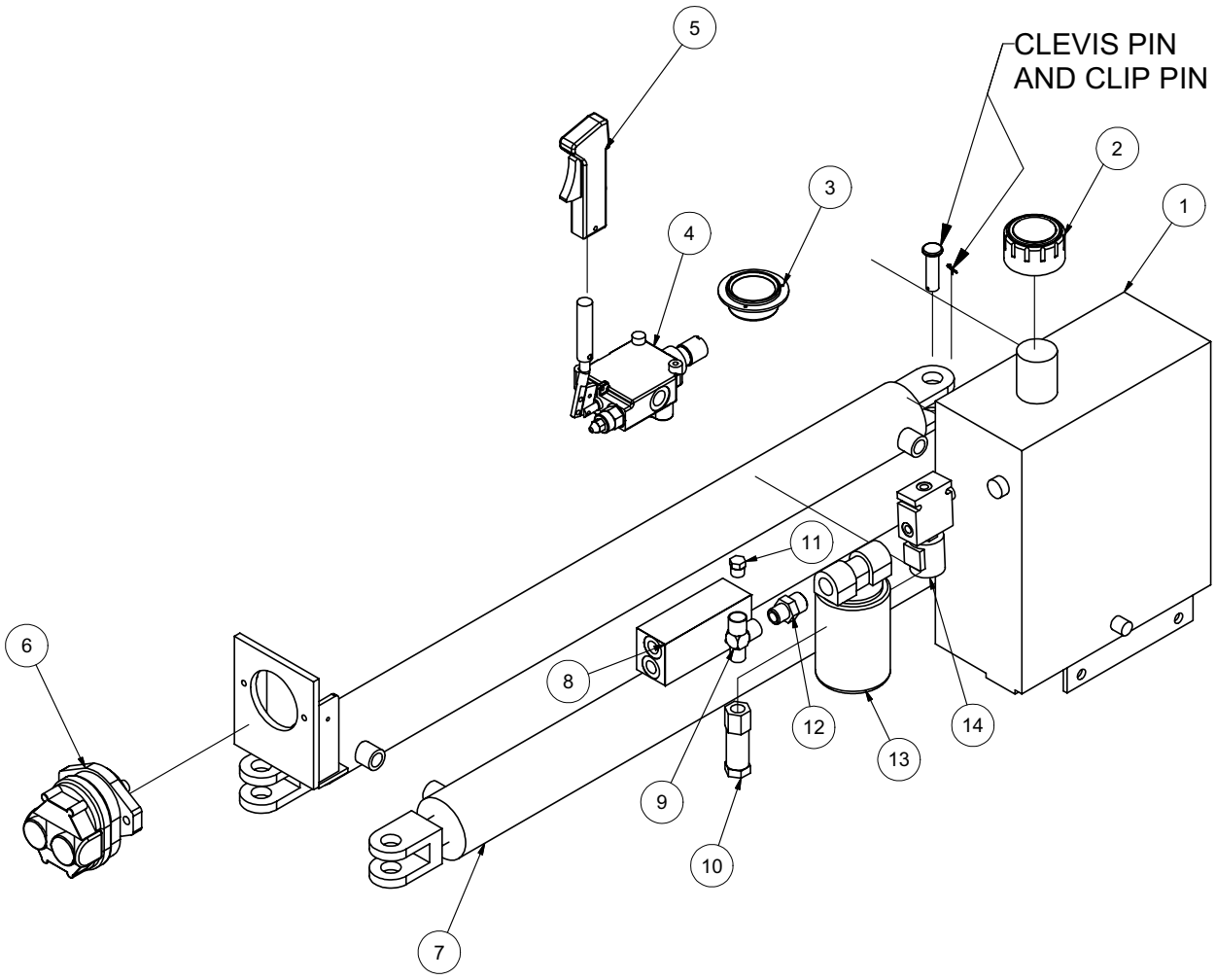
McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	2400186	SHIFT COVER CAP
2	1	2400187	SHIFT COVER
3	6	2400188	SCREW, HHCS .312-18 X .875
4	6	2400189	LOCKWASHER, .312 EXT. TOOTHED
5	1	2400190	INTERLOCK PLATE
6	1	2400191	COUNTERSHAFT
7	4	2400192	THRUST WASHER
8	2	2400193	COUNTERSHAFT BEARING
9	1	2400194	COUNTERSHAFT SPACER
10	1	2400195	COUNTERSHAFT CLUSTER GEAR
11	1	2400196	MAINSHAFT
12	1	2400197	LOCKPLATE
13	5	U000400	SCREW, HCS .375-16 X .750
14	2	2400199	SHIFT RAIL
15	2	2400200	SHIFT FORK
16	2	2400201	DETENT BALL
17	2	2400202	DETENT SPRING
18	1	2400203	REVERSE IDLER SHAFT
19	1	2400204	REVERSE IDLER GEAR
20	2	2400205	BEARING
21	2	2400206	BEARING/CASE SNAPRING
22	1	2400207	BEARING SPACER
23	1	2400208	MAINSHAFT RETAINER
24	1	2400209	MAINSHAFT OILSEAL
25	1	2400210	2nd & 3rd SLIDING GEAR
26	1	2400211	1st & REVERSE SLIDING GEAR
27	AS REQ'D	2400212	BEARING/SHAFT SNAPRING .087
	AS REQ'D	2400213	BEARING/SHAFT SNAPRING .090
	AS REQ'D	2400214	BEARING/SHAFT SNAPRING .093
	AS REQ'D	2400215	BEARING/SHAFT SNAPRING .097
28	1	2400216	BEARING SLINGER
29	1	2050136	CASE
30	14	2400218	MAIN DRIVE ROLLER
31	1	2050137	MAIN DRIVE GEAR
32	1	2400220	MAIN DRIVE OILSEAL
33	1	2400221	MAIN DRIVE RETAINER
34	4	2400222	MAIN DRIVE FASTENERS
35*	1	2050132	SHIFT LEVER KIT

* NOT SHOWN

Hydraulic Parts Assembly

McL - 20C



091709-E

BORASSY007

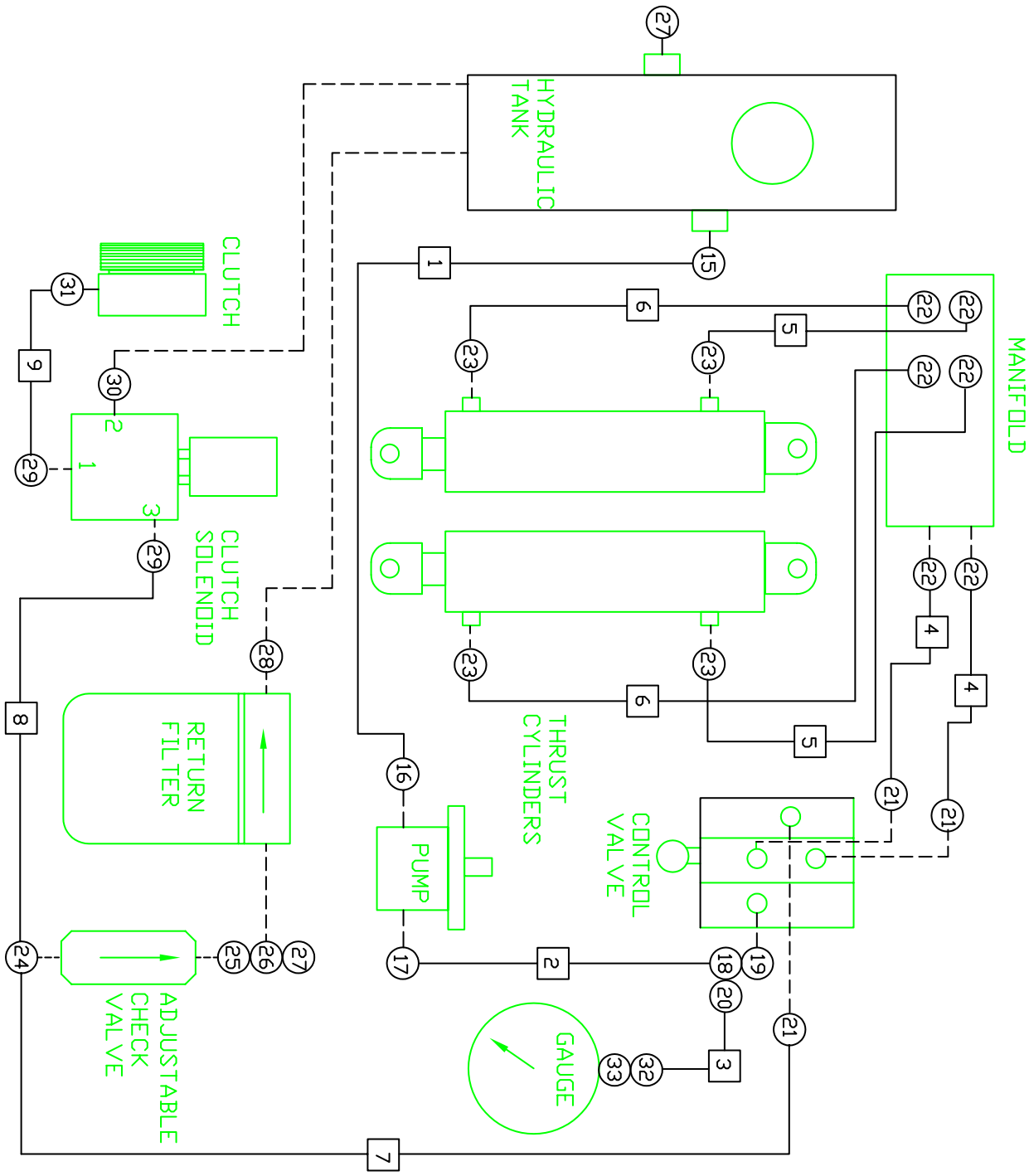
Hydraulic Parts Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	2050028	HYDRAULIC TANK
	2	U000860	SCREW, HC .500-13 X 1.75
	2	U210100	WASHER, LOCK .500
	2	U000400	SCREW, HC .375-16 X .750
	2	U210060	WASHER, LOCK .375
2	1	2050068	HYDRAULIC TANK CAP
3	1	HD00092	PRESSURE GAUGE
4	1	2050170	CONTROL VALVE (DOES NOT INCLUDE PISTOL GRIP)
	3	U000140	SCREW, HC .250-20 X 2.50
	6	U210020	WASHER, LOCK .250
5	1	J700100	PISTOL GRIP - COMPLETE
6	1	2050145	HYDRAULIC PUMP
7	2	2050165	HYDRAULIC CYLINDER
8	1	2400127	HYDRAULIC MANIFOLD
9	1	T402159	TEE, 1/2MP - 1/2MP - 1/2FP
10	1	T000320	VALVE, CHECK
11	1	T405062	PLUG, 1/2"NPT
12	2	T404030	UNION, 12MP - 8MP
13	1	T700080	FILTER ASSEMBLY
14	1	2400371	SOLENOID CONTROL VALVE

Hydraulic Hoses & Fittings

McL - 20C



092109-E

BORASSY012

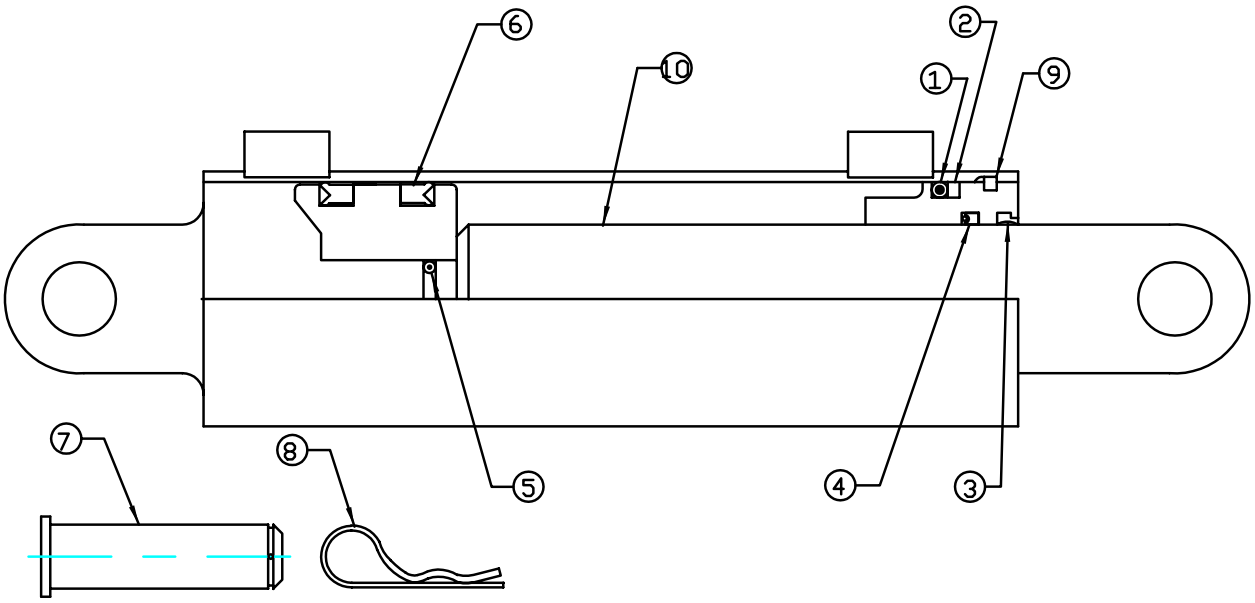
Hydraulic Hoses & Fittings

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	TH00053	HOSE ASSEMBLY, TANK - PUMP
2	1	TH00054	HOSE ASSEMBLY, PUMP - VALVE
3	1	TH00059	HOSE ASSEMBLY, VALVE - GAUGE
4	2	TH00055	HOSE ASSEMBLY, VALVE MANIFOLD
5	2	TH00052	HOSE ASSEMBLY, MANIFOLD - CYLINDER (BASE)
6	2	TH00051	HOSE ASSEMBLY, MANIFOLD - CYLINDER (ROD)
7	1	TH00057	HOSE ASSEMBLY, VALVE - ADJ. CHECK VALVE
8	1	TH00058	HOSE ASSEMBLY, ADJ. CHECK VALVE - SOLENOID
9	1	TH00050	HOSE ASSEMBLY, SOLENOID - CLUTCH
15	1	T400070	UNION, 8MP-12MJ
16	1	T401670	ELBOW, 90 12MB-12MJ (LONG)
17	1	T401300	ELBOW, 90 10MB-8MJ
18	1	T402150	TEE, 8FJ-8MJ-8MJ
19	1	T401320	ELBOW, 90 12MB-8MJ
20	1	T400700	REDUCER, 8FJ-4MJ
21	3	T400160	UNION, 10MB-8MJ
22	6	T400140	UNION, 8MB-8MJ
23	4	T401140	ELBOW, 90 8MP-8MJ
24	1	2050109	HTDRAULIC FITTING ASSY.
25	1	T402156	TEE, 8MP-8FP-8FP
26	1	T404030	UNION, 12MP-8MP
27	2	T405060	PLUG, 8MP
28	1	T400800	UNION, 12MP-12MP
29	2	T400550	UNION, 6MB-4MJ
30	1	T400028	UNION, 6MP-6MJ w/ #6 SAE O-RING
31	1	T400010	UNION, 2MP-4MJ
32	1	T400020	UNION, 4MP-4MJ
33	1	T401015	ELBOW, 45 4FP-4MP

Hydraulic Cylinder Assembly

McL - 20C



Hydraulic Cylinder Assembly

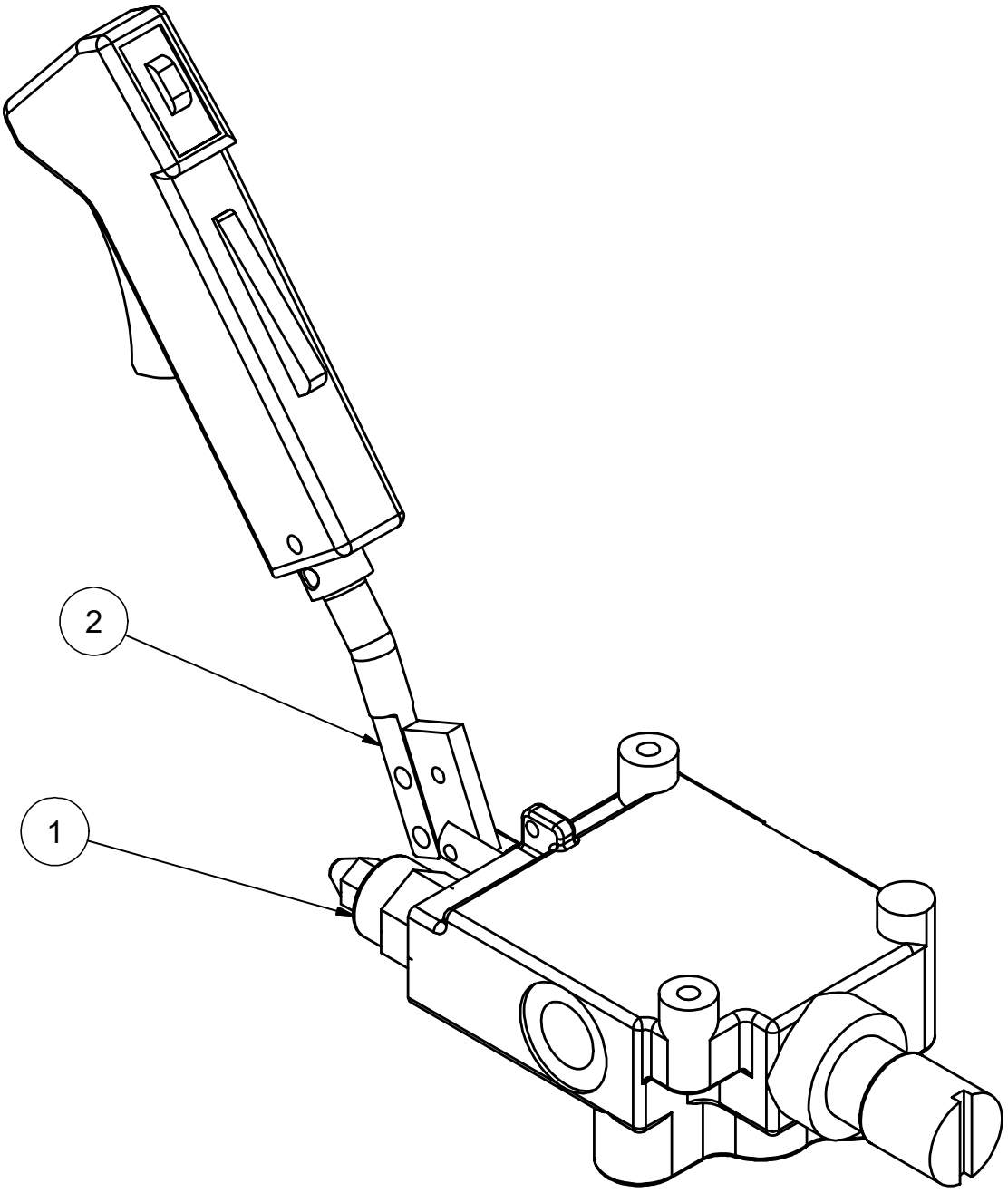
McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
	2	2050165	HYDRAULIC CYLINDER
	1*	2000010	SEAL KIT, CYLINDER (INCLUDES)
1	1	2000010-1	O-RING
2	1	2000010-2	BACK-UP
3	1	2000010-3	WIPER
4	1	2000010-4	U-CUP LOADED
5	1	2000010-5	O-RING
6	2	2000010-6	U-CLIP
7	2*	T840080	CLEVIS PIN
8	2*	G820050	CLIP PIN
9	1*	2050065	RETAINING RING HEAD CAP
10	1*	T810040	ROD ASSEMBLY

* PER CYLINDER

Control Valve Assembly

McL - 20C



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BORASSY011

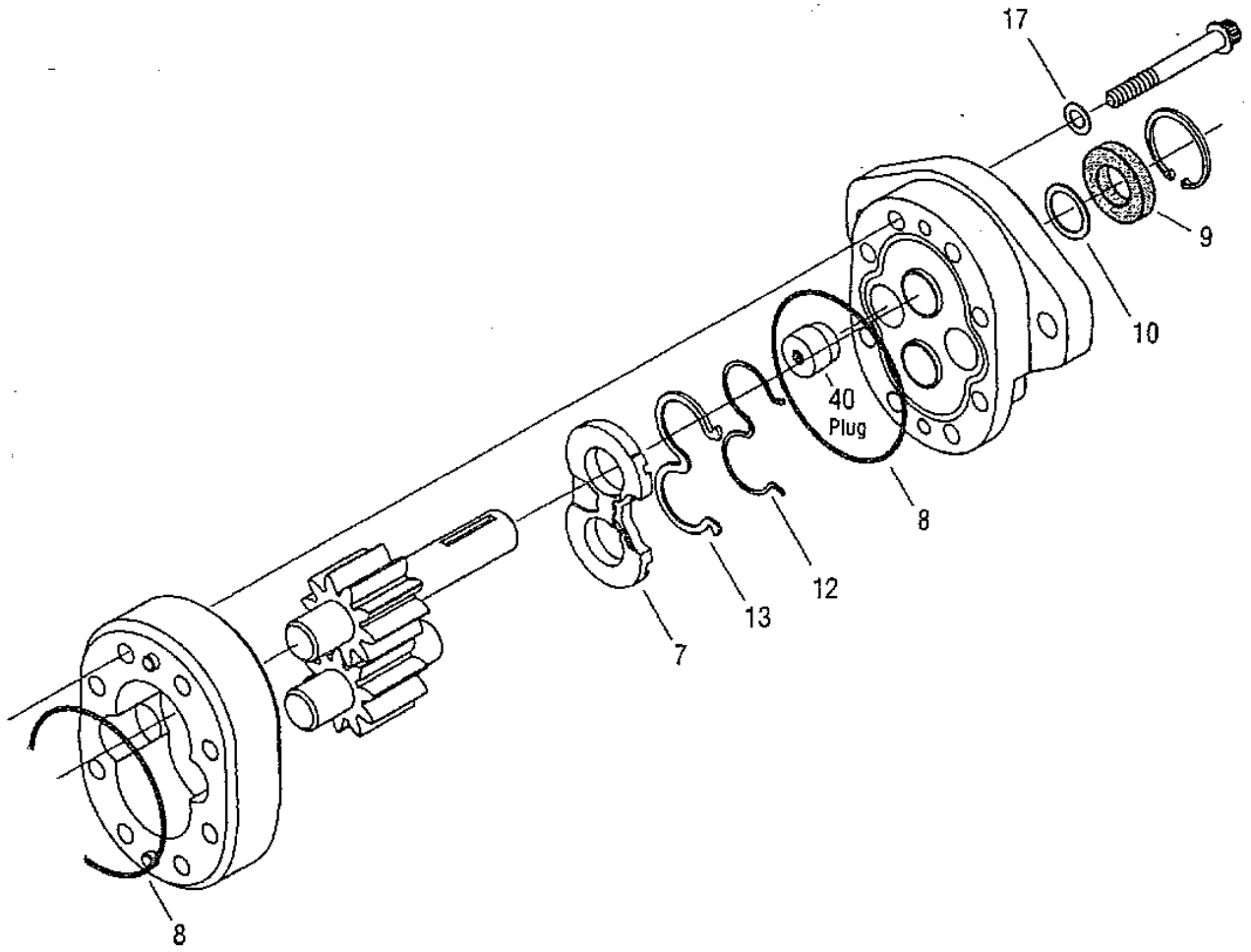
Control Valve Assembly

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
1	1	2050067	RELIEF VALVE CARTRIDGE
2	1	2050175	VALVE HANDLE

Hydraulic Pump Seal Kit

McL - 20C



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BORASSY014

Hydraulic Pump Seal Kit

McL - 20C

ITEM	QTY	PART NO.	DESCRIPTION
	1	2050146	SEAL KIT
7	1	2050146-7	WEAR PLATE
8	2	2050146-8	O-RING
9	1	2050146-9	SHAFT SEAL
10	1	2050146-10	WASHER
12	1	2050146-12	BACKUP GASKET
13	1	2050146-13	SEAL
17	4	2050146-17	WASHER
40	1	2050146-40	PLUG
	1	2000227	SEAL KIT
*	2		LOADED SEALS
*	1		SHAFT SEALS
*	1		SQUARE CUT RING (STATIC SEAL)
*	2		LOAD SEAL SPACER

* NOT SHOWN

COLD WEATHER OPERATION
McL-20C

Cold weater effects the operation and performance of the boring machine.

Cold hydraulic fluid causes sluggish machine performance and can contribute to the premature failure of some machine components.

Before starting to bore, the machine and hydraulic fluid must be at operating temperature (i.e. the machine must be warmed-up before boring.)

Warm-up Procedure:

1. Start the machine and let it run at idle for 1-2 minutes.
2. Slowly increase the engine rpm to about 1/2 to 3/4 full throttle.
3. Allow the engine to run at this higher speed for 4-5 minutes.
4. Extend and retract the thrust cylinders to warm up the hydraulic fluid.
5. Occasionally running the machine over relief will help to reduce the warm-up time.

Only after the machine is warmed-up should you begin to bore.

Hydraulic Clutch Operation:

SLUGGISH OR DELAYED APPLY TIME FOR THE CLUTCH CAN CAUSE PREMATURE FAILURE.

The apply time for the clutch (the time it takes to build full pressure) is critical to the operation of the machine. Normal clutch apply time is less than 2 seconds. If the apply time is greater than 2 seconds, wait until oil temperature increases before boring.

Cycle the clutch during warm-up, waiting 10 seconds between engagements. WHEN APPLYING THE CLUTCH DURING THE WARM-UP PERIOD, THE TRANSMISSION MUST BE IN NEUTRAL. Do not cycle the clutch during warm-up while coupled to loaded augers.

Boring with an extended clutch apply time will cause premature failure of the clutch.

Hydraulic Fluid:

Use the alternate hydraulic fluid for the following:
To reduce warm-up time before boring.
When consistently boring in cold weather.

Standard hydraulic fluid: Iso grade #46 with anti-wear additives.
76 Unax AW#46, or equivalent

Alternate hydraulic fluid: Iso grade #32 Wide Temperature Range oil with anti-wear additives.
76 Unax AW-WR#32, or equivalent

Consult McLaughlin Mfg. Co. for more information.

NOTES
McL-20C

REPAIR INSTRUCTIONS
McL-20C

WARNING:
Moving parts. Keep all guards in place. Shut down engine before service or maintenance. Being caught in machinery may cause serious injury.

WARNING:
Crushing weight can cause serious injury. Place machine on solid surface to prevent rollover or falling.

WARNING:
High pressure. Leaking hydraulic fluid under pressure can penetrate and cause serious injury. Check for leaks with cardboard. Relieve pressure before working on any system.

WARNING:
Do not modify this machine. Use only authorized McLaughlin repair parts. Failure to comply can result in serious injury. Service this equipment according with maintenance instructions in this manual.

HYDRAULIC PUMP COUPLING REPLACEMENT

DISASSEMBLY

1. Remove the pump guard.

2. Remove the tow (2) bolts and lockwashers that attach the pump to the pump mount.

3. Slide the pump and coupling half out of the pump mount.

4. Remove old rubber insert.

IF ONLY REPLACING THE INSERT REFER TO NO. 11

5. Loosen the set screw in the coupling half.

6. Slide coupling off shaft.

7. Use same method for other coupling half.

1

3

5

REASSEMBLY

8. Slide coupling half onto the pump shaft until it is all the way to the back.

9. Replace and tighten the set screw.

10. Slide the other coupling half onto engine shaft, but do not tighten.

11. Replace rubber insert.

12. Replace pump and tighten two (2) bolts and lockwashers.

13. Slide other coupling half into rubber insert and tighten set screw. (Note gap)

14. Replace pump guard.

8

13

TRANSMISSION COUPLING REPLACEMENT

DISASSEMBLY

2

1. Disconnect the battery.

2. Remove the coupling guard.

3. Drive out the master link pin in the chain.

4. Remove the chain.

IF ONLY REPLACING THE CHAIN REFER TO NO. 13

3

5. Loosen the set screws in the sprocket hubs. (Removal of the screw is not necessary).

6. Remove the nine (9) nuts that bolt the planetary to the front plate.

7. Slide the planetary forward until coupling half clears.

8. Remove the coupling halves.

5

REASSEMBLY

9. Slide the coupling halves onto the shafts. Make sure the sprocket is flush with the end of the shaft.

10. Slide the planetary backward into its pilot.

11. Tighten the nine (9) nuts that bolt the planetary to the front plate.

12. Tighten the set screws in the sprocket hubs.

7

13. Replace the chain.

14. Insert the master link pin in the chain.

15. Replace the coupling guard.

16. Connect the battery.

9

HYDRAULIC CLUTCH REPLACEMENT

DISASSEMBLY

Step 1: Transmission Coupling Removal

1. Follow the TRANSMISSION COUPLING REPLACEMENT (Disassembly) instructions.

Step 2: Clutch Removal

2. Once the transmission coupling has been removed, further breakdown of the power train can be done.

3. Remove the six (6) bolts that hold the transmission in place. Remove transmission.

4. Remove bell housing inspection plate.

5. Disconnect the hydraulic hose at the clutch. Use a male cap to block the hose. (NOT SUFFICIENTLY BLOCKING THE HOSE COULD RESULT IN A LOSS OF HYDRAULIC FLUID).

6. Remove the bell housing.

7. Remove the clutch by pulling it straight out of the drive shell.

IF TOTALLY REPLACING THE CLUTCH REFER TO NO. 33

3

4

5

6

7

Step 3: Clutch Disassembly

Refer to the following steps for clutch disassembly:
Steps 8-10 Disk Kit Replacement
Steps 8-13 Seal Kit Replacement
Steps 8-15 Bearing Kit Replacement

8. Remove and discard the snap ring holding the disks together. (NOTE: THE DISKS ARE UNDER PRESSURE. THE DISKS MUST BE COMPRESSED BEFORE THE SNAP RING CAN BE REMOVED. EYE PROTECTION MUST BE WORN FOR SAFETY).

9. Once the snap ring is off, remove the front plate. Remove and discard the following: six (6) belleville springs, five (5) seperator disks, and six (6) friction disks. (DO NOT DISCARD THE FRONT PLATE OR PRESSURE PLATE).

10. Clean the front plate and pressure plate if necessary. (MAKE SURE THAT BOTH PLATES ARE COMPLETELY DRY BEFORE REASSEMBLING).

11. Support cylinder assembly, on bearing side, and push down on hub. Remove and discard snap ring. (EYE PROTECTION MUST BE WORN FOR SAFETY).

12. Support clutch on pressure plate. Push down on hub to remove from cylinder assembly.

13. Use low air pressure to separate cylinder assembly from piston assembly and pressure plate. Remove and discard o-rings. At this point, inspect bearings for wear. If bearings are acceptable, refer to step 23.

8

14. Remove the two (2) bearing removal plugs in cylinder face. Use two (2) 1/4” diameter rods to tap bearing out of cylinder counterbore. (NOTE: DO NOT STRIKE THE COUNTERBORE WITH THE RODS).

12

13

15. Remove the two (2) bearing removal plugs in piston face. Use two (2) 1/4” diameter rods to tap bearing out of piston counterbore. (NOTE: DO NOT STRIKE THE COUNTERBORE WITH THE RODS).

14

ASSEMBLY

Step 4: Clutch Assembly

Refer to the following steps for clutch assembly:
Steps 25-27 Disk Kit Assembly
Steps 19-28 Seal Kit Assembly
Steps 16-28 Bearing Kit Assembly

16. Install bearing removal plugs in the cylinder and piston face. Apply a light coat of “Locktite” removable thread locker #242 (or equivalent) to the inner and outer races of the bearings. (NOTE: APPLY A FEW DROPS OF REMOVABLE THREAD SEALANT TO THE PLUGS. TIGHTEN PLUGS TO “JUST BELOW” THE CYLINDER AND PISTON FACES).

17. Press a new sealed bearing into cylinder by pressing on the outer race of the bearing.

18. Press a new sealed bearing onto the pressure plate by pressing on the inner race of the bearing.

19. Apply a light oil to all o-ring surfaces and grooves before assembling the clutch. Install o-rings into the proper o-ring grooves.

20. Align the anti-rotation pin in the piston with the blind hole in the cylinder. Carefully press the piston onto the cylinder. As the piston o-ring begins to slide onto the cylinder, it may be necessary to guide the o-ring into the o-ring groove.

21. Assemble the pressure plate and bearing assembly into the cylinder and piston assembly by pressing on the pressure plate.

22. Assemble the hub into the cylinder assembly by supporting hub on the splined end. Place the cylinder assembly on the hub and press the bearing onto the hub. (NOTE: PRESS ON THE INNER RACE OF THE BEARING). As the bearing is being pressed onto the hub, it is necessary to align the internal spine of the pressure plate with the external spline of the hub.

23. Install the retaining ring. (EYE PROTECTION MUST BE WORN FOR SAFETY).

24. Seat the bearing against the retaining ring by supporting pressure plate and pressing on the hub.

25. The reassembly order of the disk kit is as follows:

1st - friction disk
2nd - belleville spring (O.D. facing pressure plate)*
3rd - spacer plate

This order is repeated until all disks, springs and spacer plates are in place.
*Note: Belleville Springs must be installed I.D. to I.D. for proper clutch operation.

26. Install front plate and reinsert snap ring. (EYE PROTECTION MUST BE WORN FOR SAFETY). (NOTE: DISKS MUST BE COMPRESSED IN ORDER TO HAVE ACCESS TO THE SNAP RING GROOVE).

27. Rotate disks by hand to insure proper seating. The disks should be evenly spaced.

28. Rotate the hub in the cylinder to insure that the bearings are free.

ASSEMBLY

Step 5: Installing the hydraulic clutch fitting. (These instructions are for use only if the fitting is being changed or replaced).

29. Remove the hydraulic clutch fitting from the old clutch.

30. Clean off any remaining sealant into the clutch and tighten.

31. Apply a drop of removable thread sealant to the pipe thread of the fitting. (NOTE: THE FITTING MUST BE CLEAN AND DRY BEFORE ANY SEALANT CAN BE APPLIED).

32. Install the fitting with the sealant into the clutch and tighten.

Step 6: Installing the clutch

33. Line up the clutch disks with the slots in the drive shell. The disks must be aligned one-at-a-time. (EXTRA CARE MUST BE TAKEN WHEN INSTALLING THE CLUTCH INTO THE DRIVE SHELL. ANY SUDDEN MOVEMENT, SIDE-TO-SIDE OR UP AND DOWN, CAN CAUSE THE TEETH OF THE DISKS TO BREAK OFF. DO NOT FORCE THE DISKS INTO THE DRIVE SHELL).

34. Once all four (4) disks are fully in the drive shell, slide the bell housing into its pilot on the engine, and tighten bolts.

35. Connect the hydraulic hose to the clutch.

36. Replace the bell housing inspection plate.

37. Slide transmission input shaft into clutch. Replace and tighten six (6) bolts for the transmission.

Step 7: Reinstalling the transmission coupling

38. Follow the Transmission Coupling Replacement (Assembly) instructions.

Step 8: Machine Test (Before Starting Engine)

39. Check movement of transmission lever and engagement of all transmission gears.

Step 9: Machine Test

40. Start Engine
41. Check movement of transmission lever and engagement of all transmission gears.
42. Check clutch pressure with 0-300 psi gauge. (Pressure setting: 95 psi)
43. Check control valve pressure setting with 0-5000 psi gauge. (Pressure setting: 3000 psi)

WARRANTY/RETURN GOODS POLICY
McL-20C

McLAUGHLIN LIMITED WARRANTY

The Manufacturer warrants its products to be free from defects in material and workmanship for a period of twelve months from the date of shipment from the factory. The Manufacturer shall not be responsible for any damage resulting to or caused by its products by reason of installation, improper storage, unauthorized service, alteration of the products, neglect, or abuse, or use of the product in a manner inconsistent with its design. This warranty does not extend to any component parts not manufactured by Manufacturer; however, Manufacturer's warranty herein shall not limit any warranties made by manufacturers of component parts which may extend to Buyer.

Claims or defects in material and workmanship shall be made in writing to Manufacturer within ten days of discovery of defect. Manufacturer may either send a service representative or have the product returned to its factory at Buyer's expense for inspection. Upon notification of defect, Manufacturer will issue a return good authorization number to Buyer. The return goods authorization number must accompany the product returned. If judged by the Manufacturer to be defective in material or workmanship, the product will be replaced or repaired at the option of Manufacturer, free from all charges except authorized transportation. Buyer shall be responsible for all maintenance services consisting of lubrication and cleaning of equipment, replacing expendable parts, making minor adjustments and performing operating checks, all in accordance with procedures outlined in Manufacturer's maintenance literature.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, AND NO REPRESENTATIONS, GUARANTEES, OR WARRANTIES, EXPRESS OF IMPLIED, (INCLUDING BUT NOT LIMITED TO, A WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE,) ARE MADE BY THE MANUFACTURER IN CONNECTION WITH THE MANUFACTURE OR SALE OF ITS PRODUCTS. NO EMPLOYEE, DISTRIBUTOR OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY ON BEHALF OF MANUFACTURER.

THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES. THE LIABILITY OF MANUFACTURER WHETHER IN CONTRACT, TORT, UNDER ANY WARRANTY, OR OTHERWISE SHALL NOT EXTEND BEYOND ITS OBLIGATION TO REPAIR OR REPLACE, AT ITS OPTION, ANY PRODUCT OR PART FOUND BY MANUFACTURER TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. MANUFACTURER SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

FOR SERVICE OR ASSISTANCE, SEE THE AUTHORIZED McLAUGHLIN DEALER IN YOUR AREA.

GENERAL RETURNS FOR MERCHANDISE

1. All material returned to McLaughlin Mfg. Company must have a return authorization number. This number can be obtained by calling the dealer from whom the material was originally purchased.
2. All returned material must be shipped PREPAID.
3. Material without a material authorization number or returned collect will be refused at our dock.
4. All material ordered incorrectly or new material returned for no valid reason will be subject to a 20% restocking charge.
5. In the case of warranty claims, a letter explaining the problem or requesting repair must accompany the material.
6. On warranty consideration, all material shipped by McLaughlin will be invoiced until the defective material is returned for inspection. After inspection, credit will be issued for all parts deemed defective.
7. All return authorized numbers expire 30 days after issue. After this time, warranty claims and material returns are void, and merchandise must be paid in full.
8. McLaughlin must be notified and authorize all warranty work performed by your service personnel. This authorization must be obtained PRIOR to any work being performed for proper warranty consideration. Credit will not be issued for unauthorized service work performed.

NOTES

McL-20C