McLAUGHLIN BORING SYSTEMS
MIGHTY MOLE

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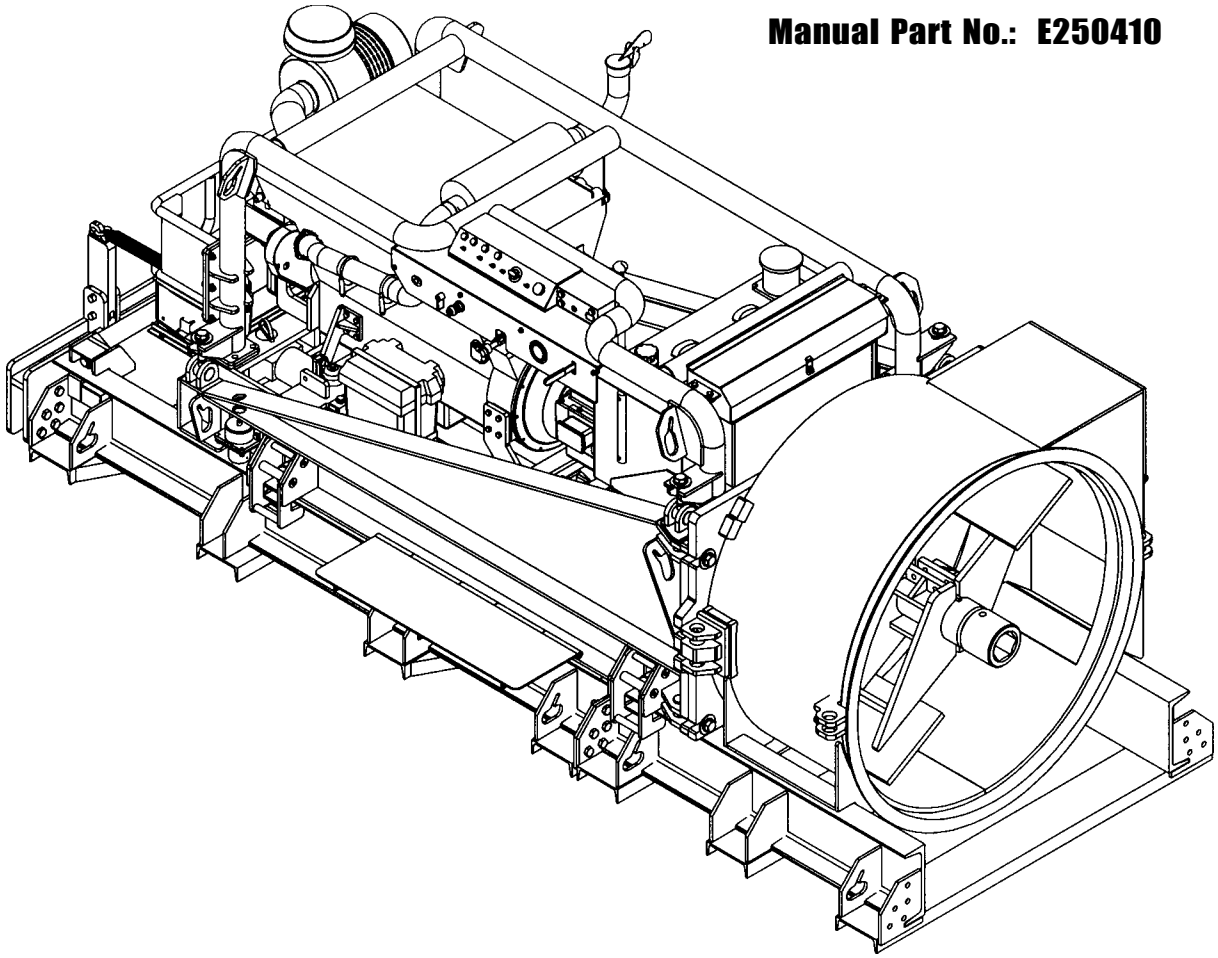
# COMPONENTS AND REPAIR MANUAL

## MODEL McL-48/54 EARTH BORING MACHINE
### PART NO. 4810000

**Machine Serial No.:**
**48/5406060608 - Present**

**Manual Part No.: E250410**



Machine Serial #_____

Purchased &
Serviced Thru: _____

Purchase Date: _____



Revision Date: 01/18/08

**WARNING:** Battery posts, terminals and releated accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling.**

**WARNING:** The engine exhaust from this product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

# TABLE OF CONTENTS
## McL 48/54

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## McL 48/54

# MACHINE SPECIFICATIONS
## McL 48/54

## SPECIFICATIONS OF MCL-48/54
## EARTH BORING MACHINE

| **Boring Range:** | **ENGLISH** | **METRIC** |
|---|---|---|
| Cased Bore | 16”-54” | 41 cm-138 cm |

**Engine:** Air cooled, in-line 6 cylinder diesel, turbo charged
12 VDC electric system
162 hp ISO max. (121 kW) @ 2,500 RPM
139 hp continuous (104 kW) @ 2,500 RPM

**Transmission:** 5 forward speeds, 1 reverse

**Clutch:** Hydraulic clutch with Operator Presence Control Switch

**Final Drive:** Planetary reduction, 4” hex chuck (10 cm)

**Auger Torque:** 170,000 ft/lbs. peak(230,000 Nm) in 1st gear

**Forward Thrust**: 950,000 lbs. (4228 kN) max @ 5,000 psi (345 bar) with infinitely adjustable thrust speed

**Dog Plate:** Hydraulically activated with dog pin indicators and fast feed

**Hydraulic Parameters:** 5,000 psi (345 bar) max. system, pressure comp. pump with load sense, 48 gpm (182) lpm @ 2,500 RPM, hydraulic tank capacity 58 gallons (219 L), oil level sight gauge, temp. and cleanout ports.

**Hydraulic Filtration:**
1. Suction strainer - 100 mesh
2. In-take return filter - 12 micron replaceable element
3. 10 micron spin-on return filter

**Fuel Tank:** 15 gallon (57 L) capacity with sight gauge

## Dimensions

**Machine:** 74” (188 cm) wide x 12’6” (3.8 m) long x 64” (163 cm) high

**Jacking Station:** 9,750 lbs. (4,422 kg)

**Carriage:** 4,200 lbs. (1,905 kg)

**Casing Pusher:** 1,300 lbs. (590 kg)

**Track:** 66” (168 cm) wide x 9’ (274 cm) long x 14.5” (37 cm) high - 1,500 lbs.(680 kg)

**5’ Track Extension:** 800 lbs. (365 kg)

**Machine Centerline:** 32.5” (83 cm)

**Push Plate:** 440 lbs. (200 kg)

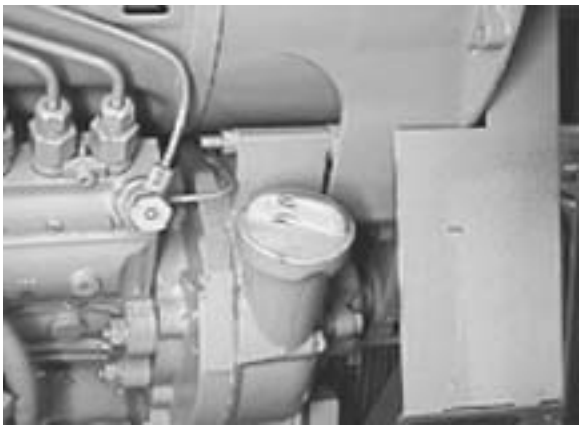
# SYSTEM OPERATION SPECIFICATIONS
## McL 48/54

| | |
|---|---|
| **Engine** | |
| 1. Speed | Idle: 1050-1150 Max.: 2400-2500 |
| 2. Oil | SAE 5W-30 or refer to Engine Manual |
| 3. Fuel | Commercially available diesel fuel with less than 0.5% sulphur content. Refer to Engine Manual. |
| 4. Fuel Tank Capacity | ~ 15 Gallons (56 l.) |
| **Gearbox** | 80-90 wt. gear oil with EP additives |
| Capacity | ~ 2 Gallons (8 l.) |
| **Transmission** | Synthetic 50 wt. transmission fluid |
| Capacity | 1.5 Gallons (5.9 l) |
| **Hydraulic System** | |
| 1 Hydraulic Pump | Pressure Compensated w/ Load Sense<br>Compensator Setting: ~ 5000 psi<br>Stand-by Setting: ~ 250-300 psi |
| 2. Hydraulic Control Valve<br>Main Thrust Sysem | Electric-proportional w/ Manual operation<br>Relief Valve Setting: ~ 5100 + psi |
| 3. Hydraulic Track Brake<br>(Secondary System) | Setting: ~ 800 psi |
| 4. Hydraulic Dog Pins<br>(Secondary System) | Setting: ~ 800 psi |
| 5. Hydraulic Clutch<br>(Secondary System) | Setting: 225 psi |
| 6. Hydraulic Fluid: | 76 Unax AW #46 or equivalent<br><br>ISO grade 46, hydraulic fluid with anti-wear additives. Contains additives that provide oxidation resistance, rust and corrosion protection, foaming resistance and have water separating characteristics. Consult McLaughlin Group, Inc. for recommendations on cold weather operation. |
| 7. Hydraulic Tank Capacity | ~ 60 Gallons (225 l.) |
| **Electrical System** | |
| 1. Battery | 12V DC w/ 700 CCA Max. |
| 2. Hydraulic Control Valve<br>Main Thrust System | 12V DC w/ Valve Driver Card and Potentiometer<br>.6 Amps to shift valve, 1.8 Amps to shift fully |
| 3. Preheat System | 12 V DC w/ manual delay |
| 4. Fuses | 12V DC, Inline and panel, SFE and ATO styles |
| 5. Cartridge Valves | 12V DC at 1-3 Amps |

*Specifications subject to change without notice or obligations.

# FILTERS AND FILL POINTS
## McL 48/54

1



**1. Engine Oil Fill** - Use only manufacturer's approved oils (Reference section 5.1 Engine Operation).

2

**2. Dip Stick** - Check daily with engine warm. Fill as needed to the upper dash mark on the

**3. Oil Filter** - Use only manufacturer approved engine filter. Reference section 5.1 Engine Operations for specifications and maintenance.

3, 4

**4. Fuel Filter** - Use only manufacturer's approved replacement filters. (Reference section 5.1 Engine Operation for maintenence schedule).

5

**5. Fuel Level** - Fill as needed with branded grades of diesel fuel with a sulfur content below 0.5% (Reference section 5.1co Engine Operation for approved fuel specifications).

# FILTERS AND FILL POINTS
## McL 48/54

**6. Hydraulic Oil Level** - Fill to 1 1/2" below top of tank (with cylinders retracted). Change oil after first 1000 hours of use, then annually.

6

**7. Hydraulic Oil Filter** - Replace all filters with every engine oil change or if required by filter indicator, whichever comes first. Clean or replace in-tank suction strainer annually when oil is changed.

7

**8. Gearbox Oil Fill** - Fill to check point. Change after first 50 hours of use, then every 1000 hours or annually.

8

**9. Transmission Oil Fill** - Fill to check point with #50 synthetic transmission fluid. Change after first 50 hours of use, then every 1000 hours or annually.

9

**10. Engine Air Cleaner** - Check air cleaner element condition using the filter indicator. Clean or replace element when indicator is in the "red zone." Clean or replace when required by the filter indicator or annually, which ever comes first. Reference pages 5.1.23 & 5.1.24 of the Engine Operation section for more information.

# DECAL PLACEMENT

## McL 48/54




J000210 - WARNING
LOCATE UTILITIES

J000020 - WARNING
AVOID DEATH

J000080 - WARNING
DO NOT GO FORWARD

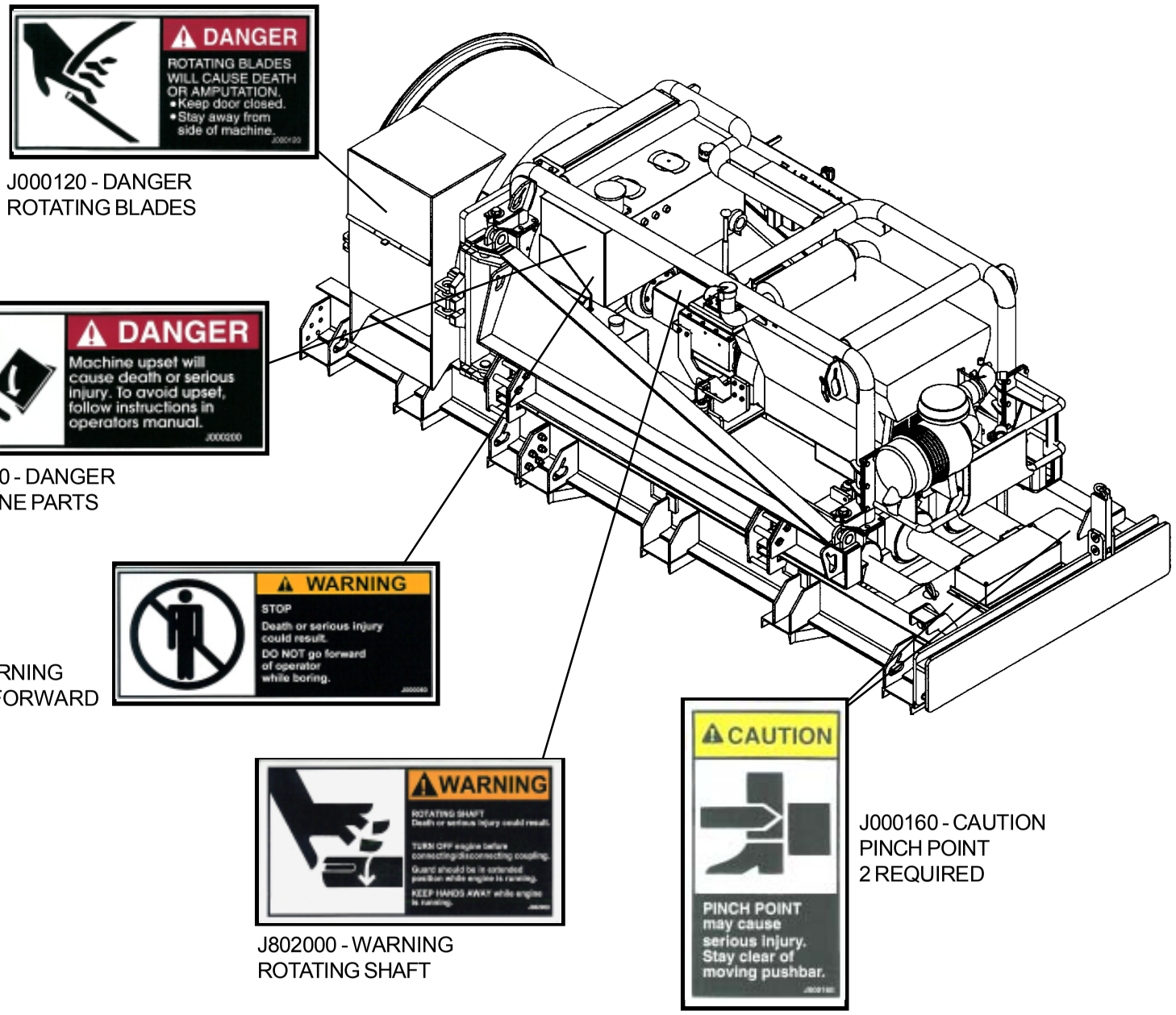
J800030 - INSTRUCTION
OPERATOR'S MANUAL

PLACE ON MANUAL BOX

J000100 - DANGER
ENTANGLEMENT HAZARD

**DECAL APPLICATION:**
REMOVE OIL AND DIRT FROM SURFACE.
MAKE SURE SURFACE IS SMOOTH.

# DECAL PLACEMENT
## McL 48/54




J000120 - DANGER
ROTATING BLADES

J000200 - DANGER
MACHINE PARTS

J000080 - WARNING
DO NOT GO FORWARD

J802000 - WARNING
ROTATING SHAFT

J000160 - CAUTION
PINCH POINT
2 REQUIRED

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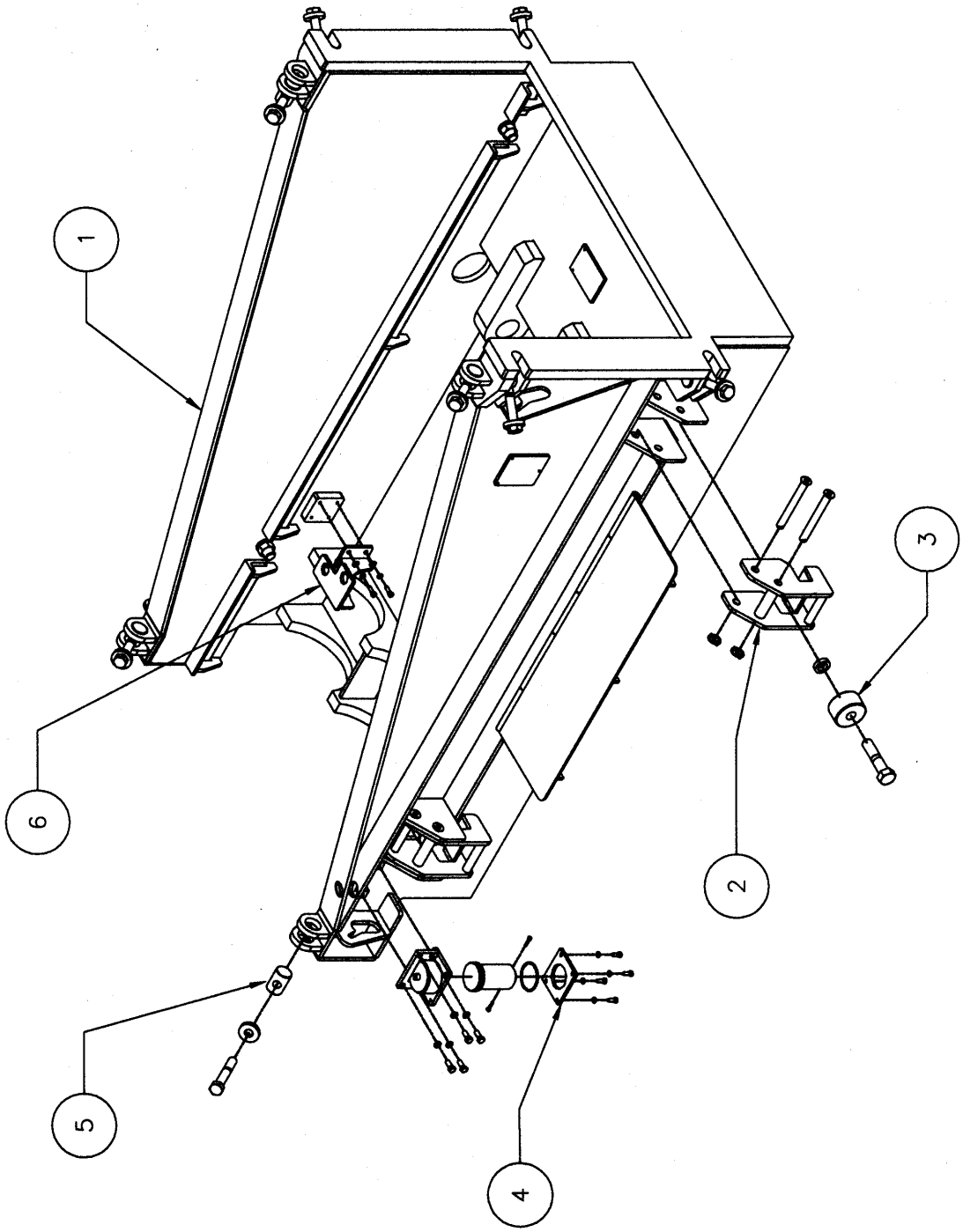
# JACKING STATION ASSEMBLY
## McL 48/54

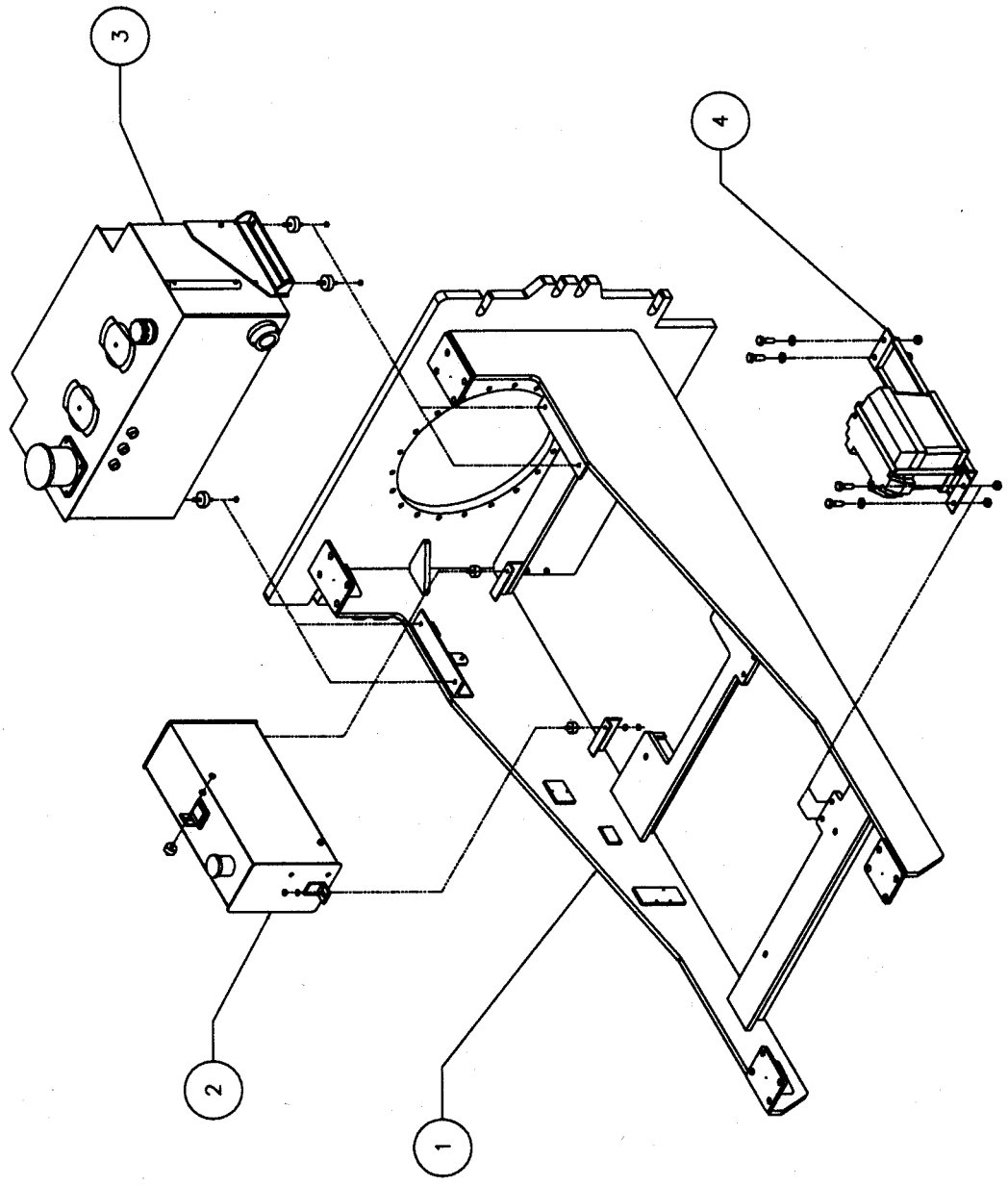


# JACKING STATION ASSEMBLY
## McL 48/54

| ITEM# | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810101 | Jacking Station |
| 2 | 4 | 4810130 | Hold Down |
| | 8 | 4800147 | Hold Down Pin |
| | 8 | U340065 | .25" Linch Pin |
| 3 | 4 | W000100 | Cam Roller |
| | 4 | 4800178 | Cam Roller Spacer |
| | 4 | U001581 | Screw, HC 1.25-7 X 5.50 |
| | 4 | U210071 | Nut, Lock NY 1.25-7 |
| 4 | 1 | 4801110 | Track Brake Assembly |
| | 1 | 4801111 | Track Brake Cylinder |
| | 1 | 4801113 | Mounting Block |
| | 4 | U210100 | Washer, Lock .500 |
| | 4 | U000820 | Screw, HC .500-13 X 1.25 |
| | 1 | 4801112 | Piston |
| | 2 | U000080 | Screw, HC .250-20 X 1.25 |
| | 1 | W200215 | O-Ring #236 |
| | 1 | 4801114 | Stop Plate |
| | 4 | U210060 | Washer, Lock .375 |
| | 4 | U000420 | Screw, HC .375-16 X 1.00 |
| 5 | 4 | 4800149 | Carriage Pin |
| | 4 | 4810129 | Anchor Pin |
| | 8 | 4810134 | 1/2' Heavy Duty Washer |
| | 8 | U001583** | Screw, HC 1-8 X 6.50 G8 |
| 6 | 1 | 4810135 | Quick Disconnect Mount |
| | 4 | U000440 | Screw, HC .375-16 X 1.25 G8 |
| | 4 | U200600 | Washer, Flat .375 |
| | 4 | U210060 | Washer, Lock .375 |

** - Use exact grade specified - DO NOT change from original equipment.

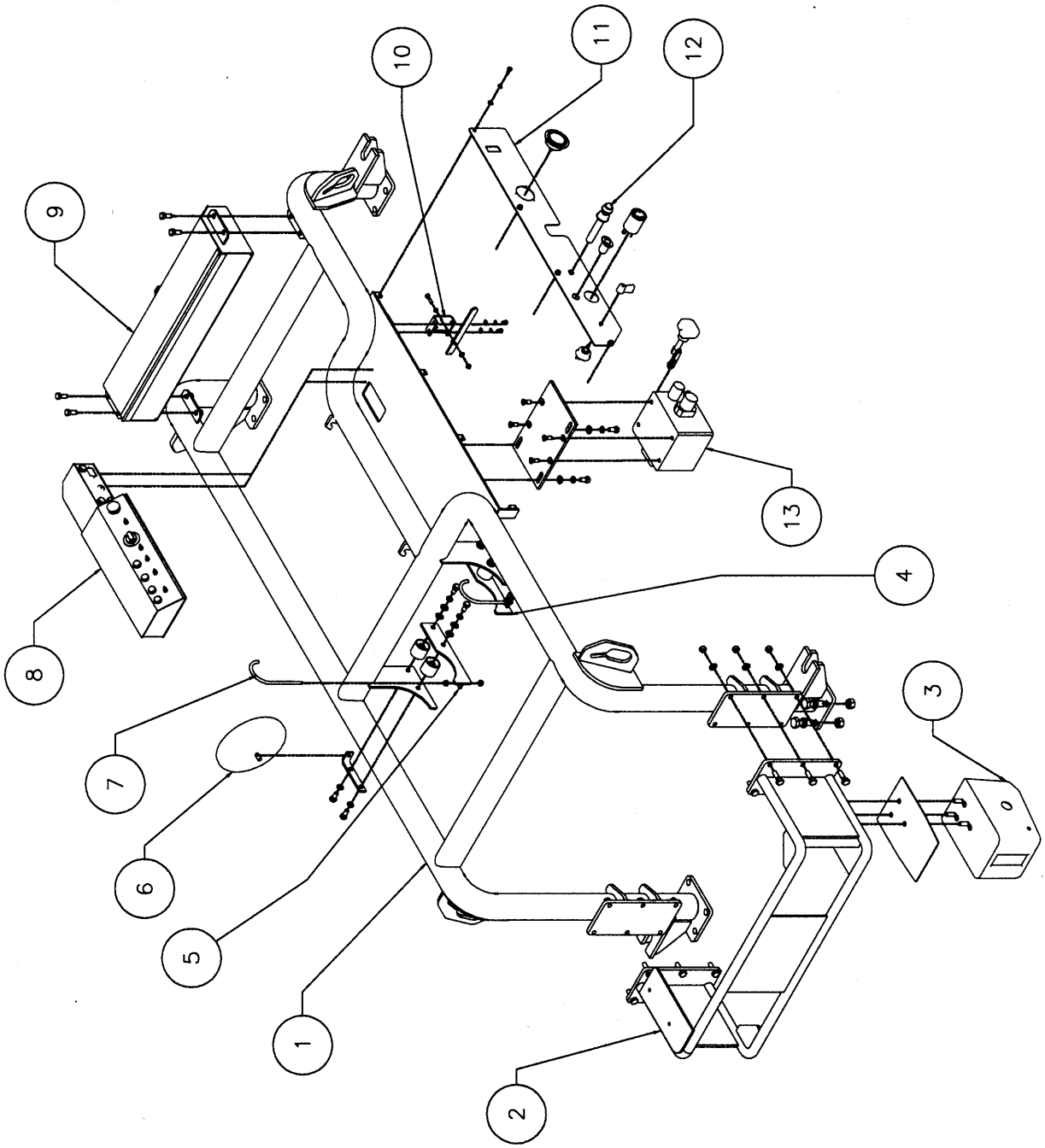
# CARRIAGE ASSEMBLY
## McL 48/54



# CARRIAGE ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810201 | Carriage |
| 2 | 1 | 4810261 | Fuel Tank |
| | 3 | 4800277 | Fuel Tank Mount |
| | 5 | U160010 | Nut, Jam .375-16 |
| | 5 | U200060 | Washer, Flat .375 |
| 3 | 1 | 4810700 | Hydraulic Tank |
| | 4 | 4800762 | Hydraulic Tank Mount |
| | 8 | U120200 | Nut, Whiz Lock .375-16 |
| 4 | 1 | 4810270 | Battery Bracket |
| | 4 | U001200 | Screw, HC .625-11 X 2.00 |
| | 4 | U100180 | Nut, Hex .625-11 |
| | 4 | U200140 | Washer, Flat .625 |
| | 1 | 4810277 | Battery Hold Down |
| | 2 | U000180 | Screw, HC .312-18 X .75 |
| | 2 | U210040 | Washer, Lock .312 |
| | 2 | U200060 | Washer, Flat .375 |
| | 1 | X400030 | Battery Enclosure |
| | 1 | X400020 | Battery Automotive |

# ROLL BAR ASSEMBLY
## McL 48/54



# ROLL BAR ASSEMBLY
## McL 48/54

| ITEM# | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810230 | Roll Cage |
| | 16 | U001420 | Screw, HC .750-10 X 2.50 |
| | 16 | U210160 | Washer, Lock .750 |
| | 16 | U100200 | Nut, Hex .750-10 |
| 2 | 1 | 4810232 | Pump Roll Cage |
| | 12 | U000860 | Screw, HC .500-13 X 1.75 |
| | 12 | U200100 | Washer, Flat .500 |
| | 12 | U100120 | Nut, Hex .500-13 |
| 3 | 1 | 4800847 | Winch |
| | 1 | 480084703 | Freewheel-Engage Dial |
| | 1 | 4810256 | Winch Seal Plate |
| | 3 | U000840 | Screw, HC .500-13 X 1.50 |
| | 3 | U210100 | Washer, Lock .500 |
| | 3 | U100120 | Nut, Hex .500-13 |
| 4 | 1 | 4800298 | Left Side Muffler Bracket |
| | 2 | 4800290 | Muffler Isolator |
| | 4 | U000817 | Screw, HC .500-13 X 1.00 G8 |
| | 6 | U200100 | Washer, Flat .500 |
| | 4 | U210100 | Washer, Lock .500 |
| 5 | 1 | 4800297 | Right Side Muffler Bracket |
| | 2 | 4800290 | Muffler Isolator |
| | 4 | U000817 | Screw, HC .500-13 X 1.00 G8 |
| | 6 | U200100 | Washer, Flat .500 |
| | 4 | U210100 | Washer, Lock .500 |
| 6 | 1 | 4800299 | Mirror |
| | 1 | 4800288 | Mirror Bracket |
| 7 | 2 | 4800295 | Muffler Hook |
| | 4 | U120200 | Nut, Whiz, Lock |
| 8 | 1 | 4801215 | Operator Console |
| | 4 | U000040 | Screw, HC .250-20 X .750 |
| | 4 | U210020 | Washer, Lock .250 |
| | 4 | U200020 | Washer, Flat .250 |
| 9 | 1 | 4800280 | Toolbox |
| | 4 | U000820 | Screw, HC .500-13 X 1.25 |
| | 4 | U210100 | Washer, .500 |
| | 4 | U100120 | Nut, Hex .500-1 |

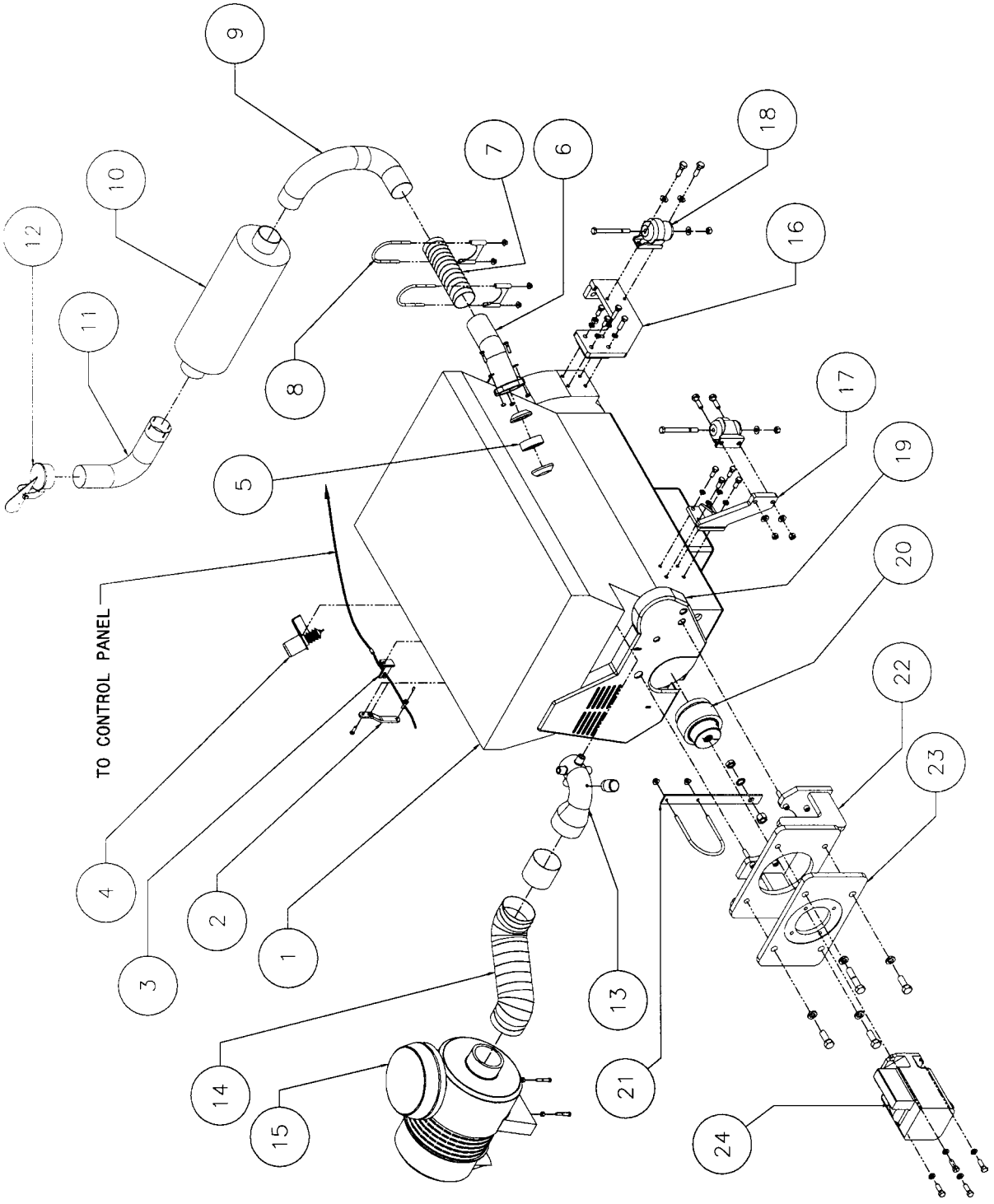
| ITEM# | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 10 | 1 | 4801300 | Drag Brake Handle Assembly |
| | 1 | 4801301 | Drag Brake Handle Bracket |
| | 2 | U200040 | Washer, Flat .312 |
| | 2 | U210040 | Washer, Lock .312 |
| | 2 | U000160 | Screw, HC .312-18 X .500 |
| | 1 | 4801333 | Lever |
| | 1 | 2050057 | Lever Grip |
| | 1 | U000220 | Screw, HC .312-18 X 1.25 |
| | 1 | U210040 | Washer, Lock .312 |
| | 1 | U200040 | Washer, Flat .312 |
| | 1 | U210041 | Nut, NyLock .312-18 |
| 11 | 1 | 4810255 | Console Cover Plate |
| | 4 | U000040 | Screw, HC .250-20 X .750 |
| | 4 | U200020 | Washer, Flat .250 |
| | 4 | U210020 | Washer, Lock .250 |
| | 1 | 4800784 | Thrust Pressure Gauge, 5000 psi |
| | 1 | T720012 | Clutch Pressure Gauge, 600 psi |
| | 1 | 4800829 | Power Outlet |
| | 1 | X000400 | Tachometer, Operator Switch |
| | 1 | 480084702 | Winch Operating Switch Knob |
| | 1 | 480024701 | Winch Operating Switch |
| 12 | 1 | 3600116 | Throttle Control |
| | 1 | 3600115 | Throttle Cable |
| | 1 | 3600131 | Throttle Cable Bulkhead Adapter |
| 13 | 1 | 4800778 | Control Valve |
| | 4 | U030110 | Screw, SFH .437—14 X 1.25 |
| | 1 | 4810710 | Valve Handle |
| | 1 | 3610211 | Valve Adapter Plate |
| | 3 | U000817 | Screw, HC .500-13 X 1.00 G8 |
| | 3 | U210100 | Washer, Lock .500 |
| | 3 | U200100 | Washer, Flat .50 |

### Optional Equipment
(Available upon request)

| | | | |
|---|---|---|---|
| 1 | 1 | 4810281 | Vandal Shield, Control Panel |

# POWERTRAIN ASSEMBLY
## McL 48/54

# HYDRAULIC PUMP DETAIL



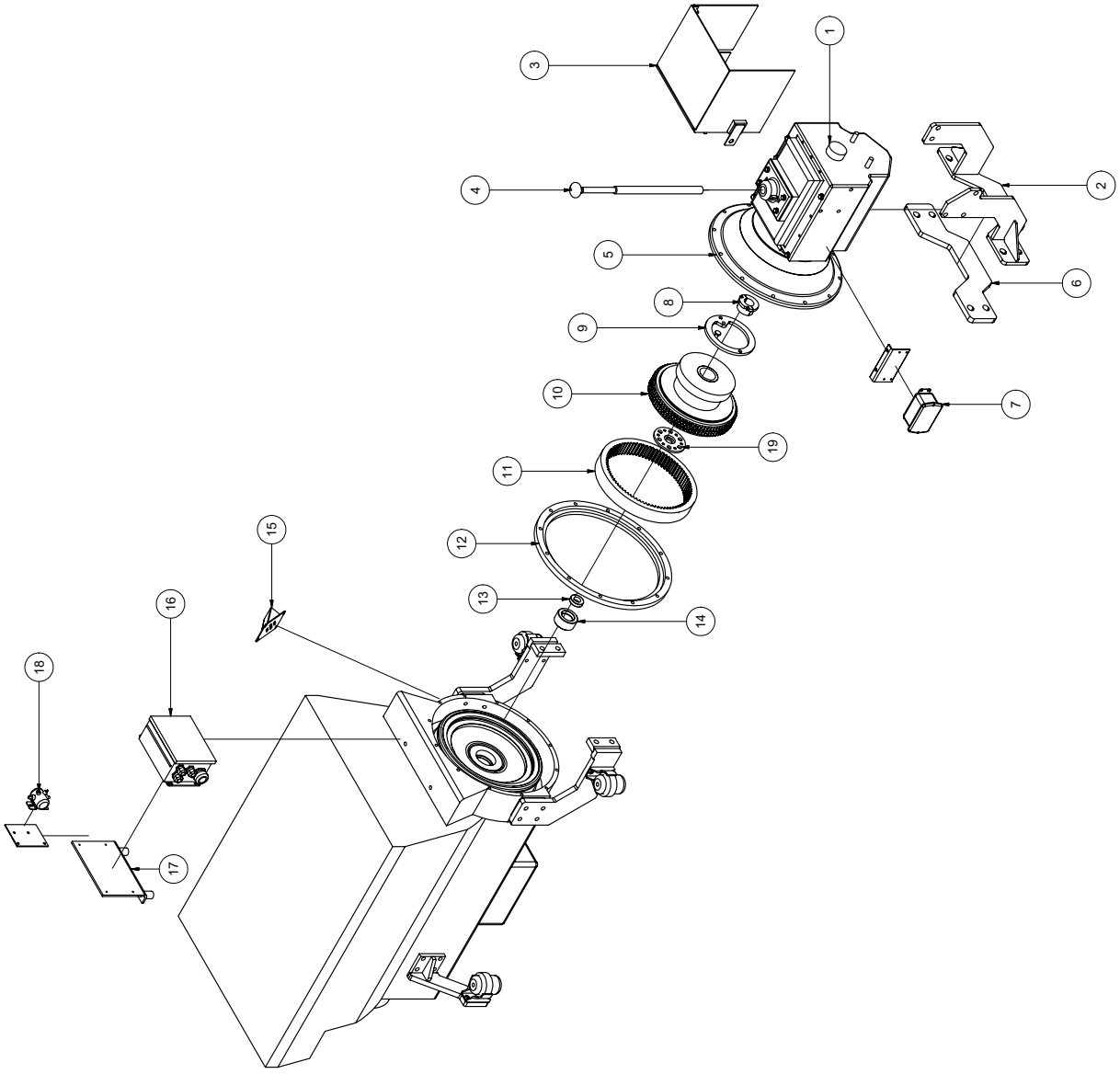
# POWERTRAIN ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800303 | 913 6 Cylinder Deutz Engine |
| 2 | 1 | 4800324 | Throttle Cable Arm |
| | 1 | U001590 | Screw, HC 8mm X 1.25 X 15mm |
| | 1 | 4801108 | Cabble Lock |
| | 1 | U024010 | Screw, Set .250-20 X .500 |
| 3 | 1 | 4800328 | Bracket, Cable Bulkhead |
| | 1 | 3600131 | Bulkhead Adapter Kit |
| | 1 | 3600115 | Throttle Cable |
| 4 | 1 | 4800365 | Shut Down Solenoid |
| 5 | 1 | 4800379 | Exhaust Seal Rings |
| 6 | 1 | 4800364 | Exhaust Manifold Elbow |
| | 3 | U000802 | Screw, HC .438-14 X 2.250 |
| | 3 | U210080 | Washer, Lock .438 |
| | 3 | U100100 | Nut, Hex .438 |
| 7 | 1 | 4800384 | Exhuast Flexible Hose |
| 8 | 2 | 4800341 | Muffler Exhaust Bracket |
| | 2 | U120205 | Nut, Whiz, Lock .312-18 |
| 9 | 1 | 4800368 | Exhaust Muffler Side |
| 10 | 1 | 4800381 | Muffler |
| 11 | 1 | 4810308 | Muffler Exhaust Elbow |
| 12 | 1 | 4800378 | Raincap |
| 13 | 1 | 4800382 | Air Cleaner Elbow |
| | 1 | 4200041 | Air Filter Indicator |
| 14 | 1 | 4800383 | Air Cleaner Flexible Hose |
| | 1 | 4800369 | Air Cleaner Adapter |
| 15 | 1 | 4800338 | Air Cleaner |
| | | 480033801 | Air Cleaner Cap |
| | | 480033802 | Air Cleaner Outer Filter Element |
| | | 480033803 | Air Cleaner Inner Filter Element |
| 16 | 1 | 48100310 | R.S. Engine Mount Weldment |
| | 1 | 48100311 | L.S. Engine Mount Weldment |
| | 4 | U001646 | Screw, HC 12mm X 1.75 X 30 |
| | 4 | U001642 | Screw, HC 12mm X 1.75 X 45 |
| | 8 | U210223 | Washer, Lock 12mm |
| 17 | 1 | 4800212 | R.S. Rear Engine Mount |
| | 1 | 4800215 | L.S. Rear Engine Mount |
| | 8 | U001642 | Screw, HC 12mm X 1.75 X 30 |
| | 8 | U210223 | Washer, Lock 12mm |
| 18 | 4 | 4800352 | Engine Isolators |
| | 4 | U001020 | Screw, HC .500-13 X 5.50 |
| | 8 | U000806 | Screw, HC .500-13 X .75 |
| | 12 | U200100 | Washer, Flat .500 |
| | 12 | U120120 | Nut, Lock .500-13 |
| 19 | 1 | 4800351 | Front Guard Cover Assembly |
| | | Duetz P/N | |
| | | 030-3808 | Hex Spacer |
| | | 030-3807 | Tube Spacer |
| | | 030-3809 | Support Bracket |
| | | 223-9180 | Halter Bracket |
| | | 030-3795 | Belt Guard |
| | | 336-3948 | Washer |
| | | 111-2322 | HHCS Iso-4017 M8 X 20 A4C |
| | | 111-1244 | HHCS Iso-4014 M8 X 200 A4C |
| 20 | 1 | 4800360 | Hydraulic Pump Coupling |
| 21 | 1 | 4800361 | Support Bar for Intake Hose |
| | 1 | U100140 | Nut, Load .500-13 |
| | 1 | U220040 | Washer, Star .750 |
| | 1 | U160020 | Nut, Jam .750-13 |
| | 1 | 4800380 | Large Hose Bracket |
| | 2 | U120200 | Nut, Whiz, Lock .375-16 |
| 22 | 1 | 4800701 | Mounting Plate |
| | 4 | 111-2322 | HHCS ISO-M8 X 20 A4C |
| 23 | 1 | 4800702 | Pilot Plate |
| | 1 | U001485 | Screw, HC .750-10 X 3.50 G8 |
| | 3 | U001420 | Screw, HC .750-10 X 2.50 |
| | 4 | U210160 | Washer, Lock .750 |
| 24 | 1 | 4800769 | Hydraulic Pump |
| | 4 | U210100 | Washer, Lock .500 |
| | 4 | U000900 | Screw, HC .500-13 X 2.50 |

# HYDRAULIC PUMP DETAIL

# POWERTRAIN ASSEMBLY TRANSMISSION DETAIL

## McL 48/54

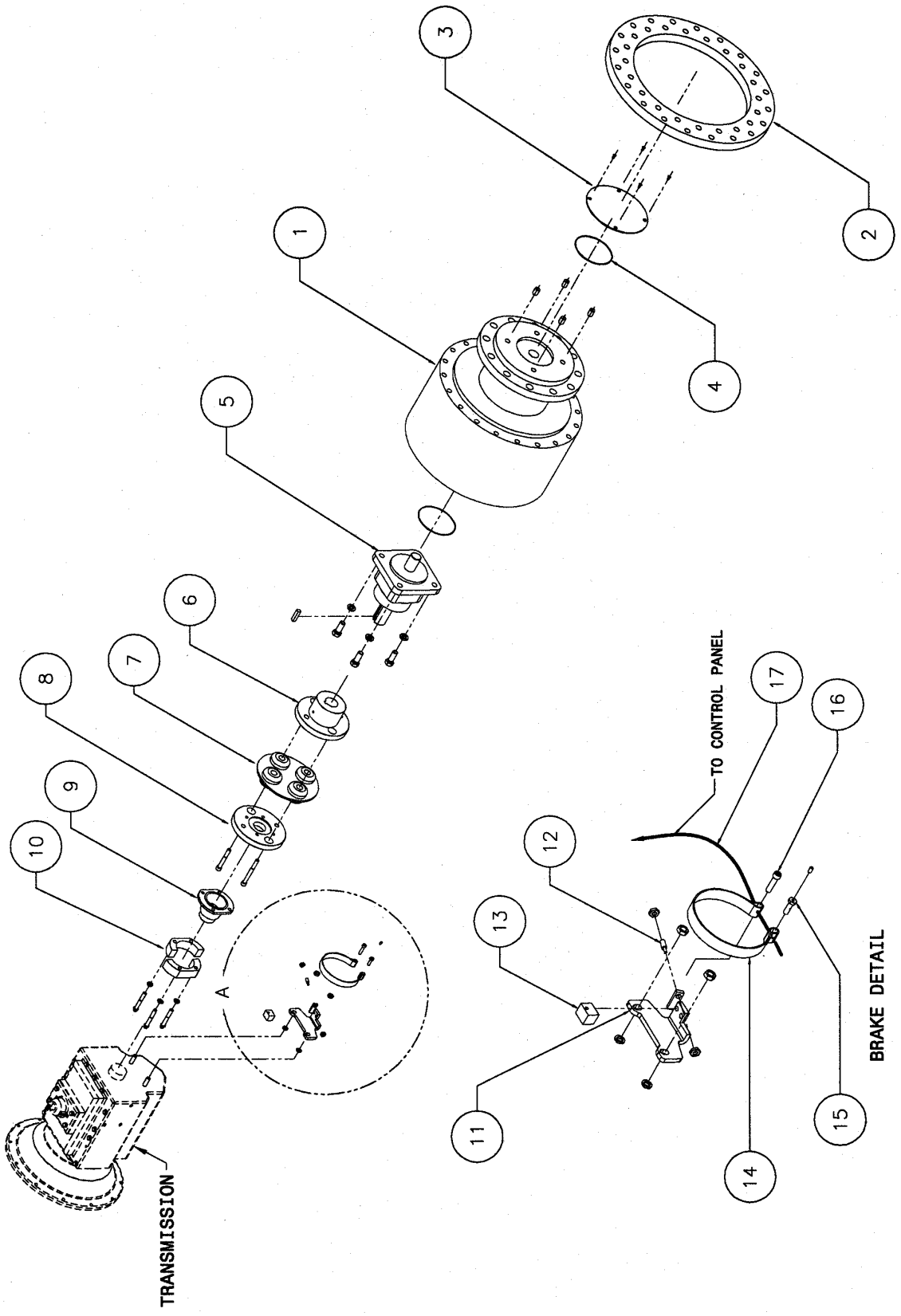


# POWERTRAIN ASSEMBLY TRANSMISSION DETAIL
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800346 | Transmission |
| 2 | 1 | 4810312 | Transmission Support Weldment |
| | 4 | U001360 | Screw, HC .750-10 X 1.50 |
| | 4 | U210160 | Washer, Lock .750 |
| | 5 | U001642 | Screw, HC 12mm X 1.75 X 30mm |
| | 5 | U210223 | Washer, Lock 12mm |
| 3 | 1 | 4810346 | Coupling Guard |
| | 3 | U000440 | Screw, HC .375-16 X 1.25 |
| | 3 | U200600 | Washer, Flat .375 |
| 4 | 1 | 480034601 | Transmission Shaft Rod |
| | 1 | 480034602 | Transmission Shaft Knob |
| 5 | 1 | 4800369 | Bell Housing |
| | 2 | 4810355 | Bell Housing Side Cover (Not Shown) |
| | 1 | 4000335 | Cover Plate, Bottom (Not Shown) |
| | 12 | U001620 | Screw, HC 10mm X 1.50 X 25mm |
| | 12 | U210220 | Washer, Lock 10mm |
| 6 | 1 | 4810322 | Eng/Trans Support Spacer |
| 7 | 1 | 4800844 | Enclosure, Clutch Relay |
| | 4 | 8030438 | Screw, PH 10-24 X .750 |
| | 1 | 4800336 | Bracket, Enclosure, Clutch Solenoid |
| 8 | 1 | 4810385 | Clutch Sleeve |
| 9 | 1 | 4810379 | Ant-Rotation Bracket |
| 10 | 1 | 4810399 | Hydraulic Clutch - Model 211 |
| 11 | 1 | 4810398 | Clutch Drive Shell |
| 12 | 1 | 4810382 | Bell Housing Spacer |
| 13 | 1 | 4800387 | Bearing |
| 14 | 1 | 4810384 | Bearing Carrier |
| 15 | 1 | 4801345 | Engine Vent |
| 16 | 1 | 4800841 | Junction Box |
| | 2 | U000060 | Screw, HC .250-20 X 1.00 |
| | 2 | U000020 | Screw, HC .250-20 X .500 |
| | 4 | U210020 | Washer, Lock .250 |
| 17 | 1 | 4800371 | Mount Plate |
| | 2 | U210240 | Screw, HC M10 X 30mm |
| | 2 | U210220 | Washer, Lock 10mm |
| 18 | 1 | X000047 | V-Belt Solenoid |
| | 1 | 4801309 | Bracket, V-Belt Solenoid |
| | 2 | U000040 | Screw, HC .250-20 X .750 |
| | 2 | U200020 | Washer, Flat .25 |
| 19 | 1 | 4810389 | Clutch Capture Spacer |
| | 6 | U030050 | Screw, SFH .3125-18 x .750 |

# POWERTRAIN ASSEMBLY
## McL 48/54

# GEARBOX DETAIL



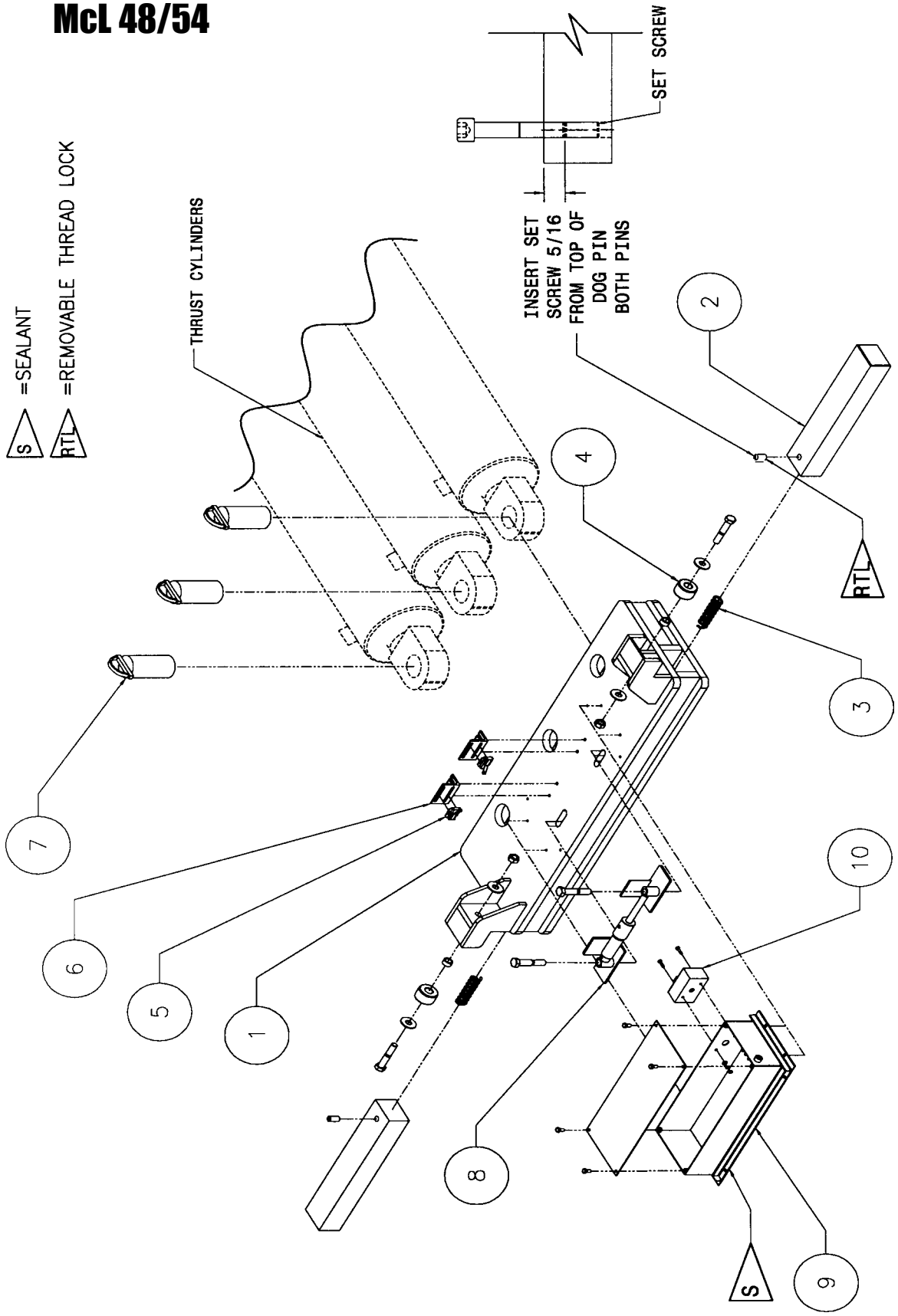
# POWERTRAIN ASSEMBLY GEARBOX DETAIL
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800302 | Gearbox |
| | 4 | 4800307 | Gearbox Seal Plate Threaded Insert |
| 2 | 1 | 4800103 | Gearbox Adapter Ring |
| | 40 | U001440 | Screw, HC .750-10 x 2.00 (Not Shown) |
| | 40 | U210160 | Washer, Lock .750 (Not Shown) |
| 3 | 1 | 4800306 | Gearbox Seal Plate |
| | 4 | U030010 | Screw, SFH .250-20 X .563 |
| 4 | 2 | W200195 | O-Ring |
| 5 | 1 | 4800348 | Shaft, Input Adapter |
| | 4 | U001380 | Screw, HC .750-10 X 2.00 |
| | 4 | U210160 | Washer, Lock .750 |
| | 1 | U420041 | Key |
| 6 | 1 | 4810334 | Coupling Round Flange |
| | 2 | U240030 | Screw, Set .375-16 x 1.50 |
| 7 | 1 | 4810331 | Center Member |
| 8 | 1 | 4810332 | Coupling Adapter Plate |
| | 2 | U010250 | Screw, HSH .500-13 X 3.75 |
| | 2 | U010261 | Screw, HSH .500-13 X 4.75 |
| | 2 | U100140 | Nut, Hex .500-13 |
| 9 | 1 | 4810333 | Companion Flange |
| 10 | 1 | 4800395 | Drag Brake Disk |
| | 4 | U210110 | Washer, H-C .500 |
| | 4 | U070030 | Screw, CB, 12Pt. .500-13 X 3.25 |
| 11 | 1 | 4810338 | Drag Brake Mount |
| | 2 | U200100 | Washer, Flat .500 |
| | 2 | U120015 | Nut, Nyloc.500-20 |
| 12 | 2 | 3600131 | Bulkhead Adapter Kit |
| | | | Contains: 1 Field Hub |
| | | | 2 Nut, Jam |
| 13 | 1 | 4810336 | Drag Brake Mounting Block |
| 14 | 1 | 4801306 | Brake Band |
| 15 | 1 | 4801303 | Brake Band Cable Lock |
| | | U024010 | Screw, Set .250-20 X .500 KN Cup |
| 16 | 1 | U022155 | Screw, Shoulder .375 x 1.00 |
| 17 | 1 | 3600115 | Throttle Cable |

**Optional Equipment**
(Available upon request)

| | | | |
|---|---|---|---|
| 1 | 1 | 4810360 | Vandal Shield, Powertrain |

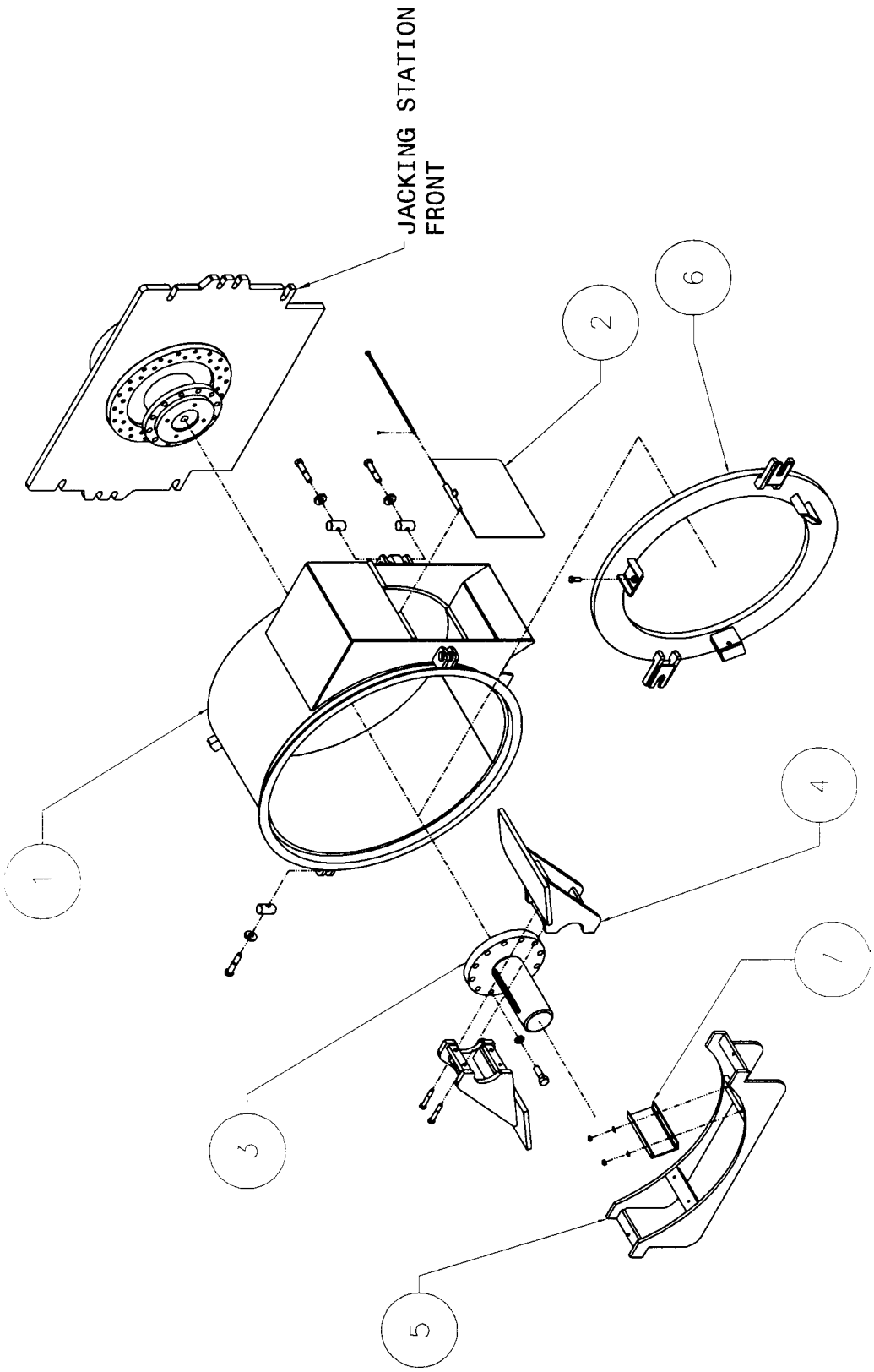
# DOG PLATE ASSEMBLY
## McL 48/54



# DOG PLATE ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800435 | Dog Plate |
| 2 | 2 | 4800410 | Dog Pin |
| 3 | 2 | U600060 | Dog Pin Compression Spring |
| 4 | 2 | W000070 | Dog Plate Roller |
| | 2 | 4800418 | Roller Spacer |
| | 2 | U001505 | Screw, HC .750-10 X 4.00 |
| | 4 | U200160 | Washer, Flat, Large .750 |
| | 2 | U100200 | Nut, HC .750-10 |
| 5 | 2 | 4800808 | Dog Plate Switch |
| 6 | 2 | 4800437 | Switch Mount |
| | 4 | U000060 | Screw, HC .250-20X1.00 |
| | 4 | U100020 | Nut, Hex .250-20 |
| | 4 | U200020 | Washer, Flat .250 |
| 7 | 3 | 4800430 | Cylinder Pin |
| 8 | 1 | 4801710 | Dog Pin Cylinder |
| | 2 | U001505 | Screw, HC .750-10 X 4.00 |
| 9 | 1 | 4810401 | Cylinder Cover Box |
| | 1 | 4800425 | Top Cover |
| | 8 | U000400 | Screw, HC .375-16 X .750 |
| | 8 | U210060 | Washer, Lock .375 |
| | 4 | U000400 | Screw, HC .375-16 X .750 |
| | 4 | U200060 | Washer, Flat .375 |
| 10 | 1 | 4800412 | Outlet Box |
| | 1 | 4800413 | Outlet Cover |
| | 1 | 4800414 | Outlet Grommet |
| | 2 | U000060 | Screw, HC .250-20 X 1.00 |
| | 2 | U210020 | Washer, Lock .250 |
| | 2 | U200020 | Washer, Flat .250 |
| | 2 | U120100 | Nut, Lock .250-20 |

# 54” CASING PUSHER/SPOIL EJECTOR
## McL 48/54



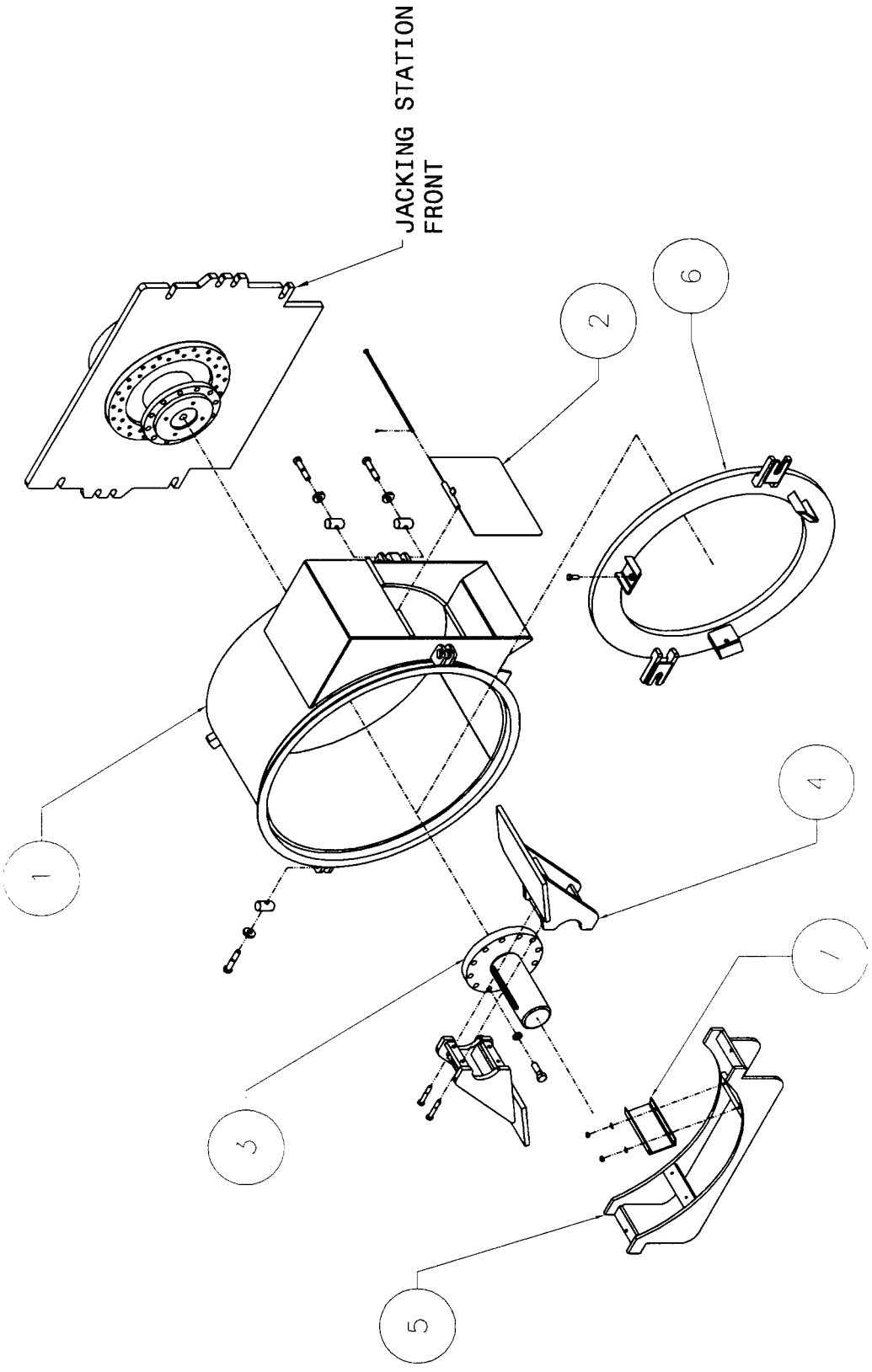
# 54” CASING PUSHER/SPOIL EJECTOR
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810501 | 54" Casing Pusher, Complete |
| | 4 | 4810129 | Anchor Pins |
| | 4 | 4810134 | Tie Down |
| | 4 | U001570 | Screw, HC 1-8 X 5.00 G5 |
| 2 | 1 | 4800514 | Spoil Door |
| | 1 | 4800550 | Hinge Rod |
| | 1 | U320015 | Pin, Cotter .125 X 1.00 |
| 3 | 1 | 4800515 | 4" Hex Chuck |
| | 12 | U001584 | Screw, HC 1.125-12 X 3.50 |
| | 12 | U210210 | Washer, Lock 1.125 |
| 4 | 1 | 4800526 | 54" Paddle Assembly |
| 5 | 1 | 4800520 | Saddle |

**Optional Equipment**
(Available upon request)

| | | |
|---|---|---|
| 6 | A800180 | Adapter Kit, 18" |
| | A800200 | Adapter Kit, 20" |
| | A800240 | Adapter Kit, 24" |
| | A800300 | Adapter Kit, 30" |
| | A800360 | Adapter Kit, 36" |
| | A800420 | Adapter Kit, 42" |
| | A800480 | Adapter Kit, 48" |
| | U020120 | Screw, SQ .750-10 x 3.50 (3 Req'd) |
| 7 | A80020S | Shoe, 20" Adapter |
| | A80024S | Shoe, 24" Adapter |
| | A80030S | Shoe, 30" Adapter |
| | A80036S | Shoe, 36" Adapter |
| | A80042S | Shoe, 42" Adapter |
| | A80048S | Shoe, 48" Adapter |
| | U000880 | Screw, HC .500-13 X 2.00 (4 Req'd) |
| | U210100 | Washer, Lock .500 (4 Req'd) |
| | U100120 | Nut, Hex .500-13 (4 Req'd) |

# 48” CASING PUSHER/SPOIL EJECTOR
## McL 48/54



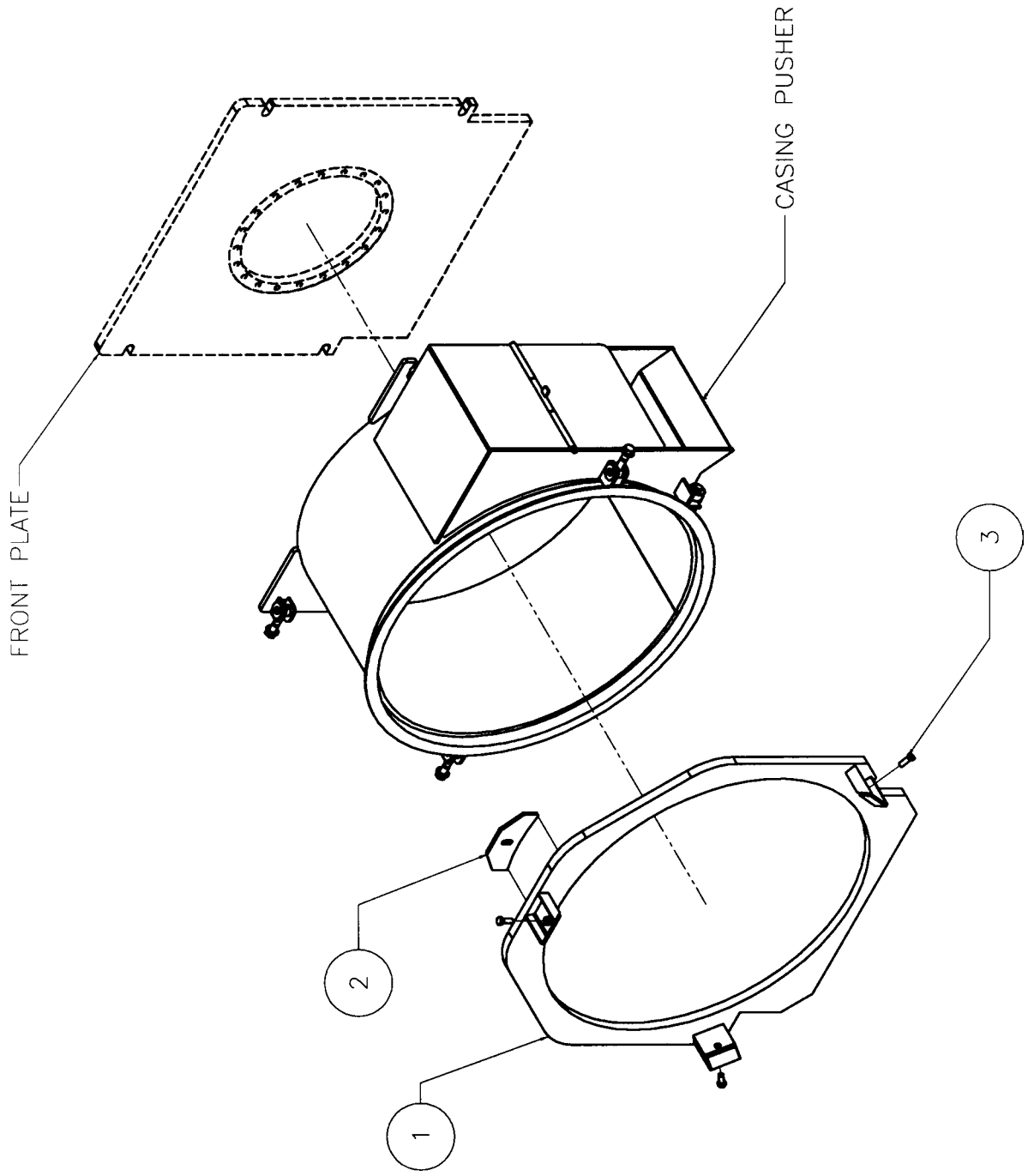
# 48” CASING PUSHER/SPOIL EJECTOR
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810521 | 48" Casing Pusher, Complete |
| | 4 | 4810129 | Anchor Pins |
| | 4 | 4810134 | Tie Down |
| | 4 | U001570 | Screw, HC 1-8 X 5.00 G5 |
| 2 | 1 | 4800514 | Spoil Door |
| | 1 | 4800550 | Hinge Rod |
| | 1 | U320015 | Pin, Cotter .125 X 1.00 |
| 3 | 1 | 4800515 | 4" Hex Chuck |
| | 12 | U001584 | Screw, HC 1.125-12 X 3.50 |
| | 12 | U210210 | Washer, Lock 1.125 |
| 4 | 1 | 4800526 | 54" Paddle Assembly |
| 5 | 1 | 4800520 | Saddle |

**Optional Equipment**
(Available upon request)

| | | |
|---|---|---|
| 6 | A700180 | Adapter Kit, 18" |
| | A700200 | Adapter Kit, 20" |
| | A700240 | Adapter Kit, 24" |
| | A700300 | Adapter Kit, 30" |
| | A700360 | Adapter Kit, 36" |
| | A470020 | Adapter Kit, 42" |
| | U020120 | Screw, SQ .750-10 x 3.50 (3 Req'd) |
| 7 | A70020S | Shoe, 20" Adapter |
| | A70024S | Shoe, 24" Adapter |
| | A70030S | Shoe, 30" Adapter |
| | A70036S | Shoe, 36" Adapter |
| | A70042S | Shoe, 42" Adapter |
| | U000880 | Screw, HC .500-13 X 2.00 (4 Req'd) |
| | U210100 | Washer, Lock .500 (4 Req'd) |
| | U100120 | Nut, Hex .500-13 (4 Req'd) |

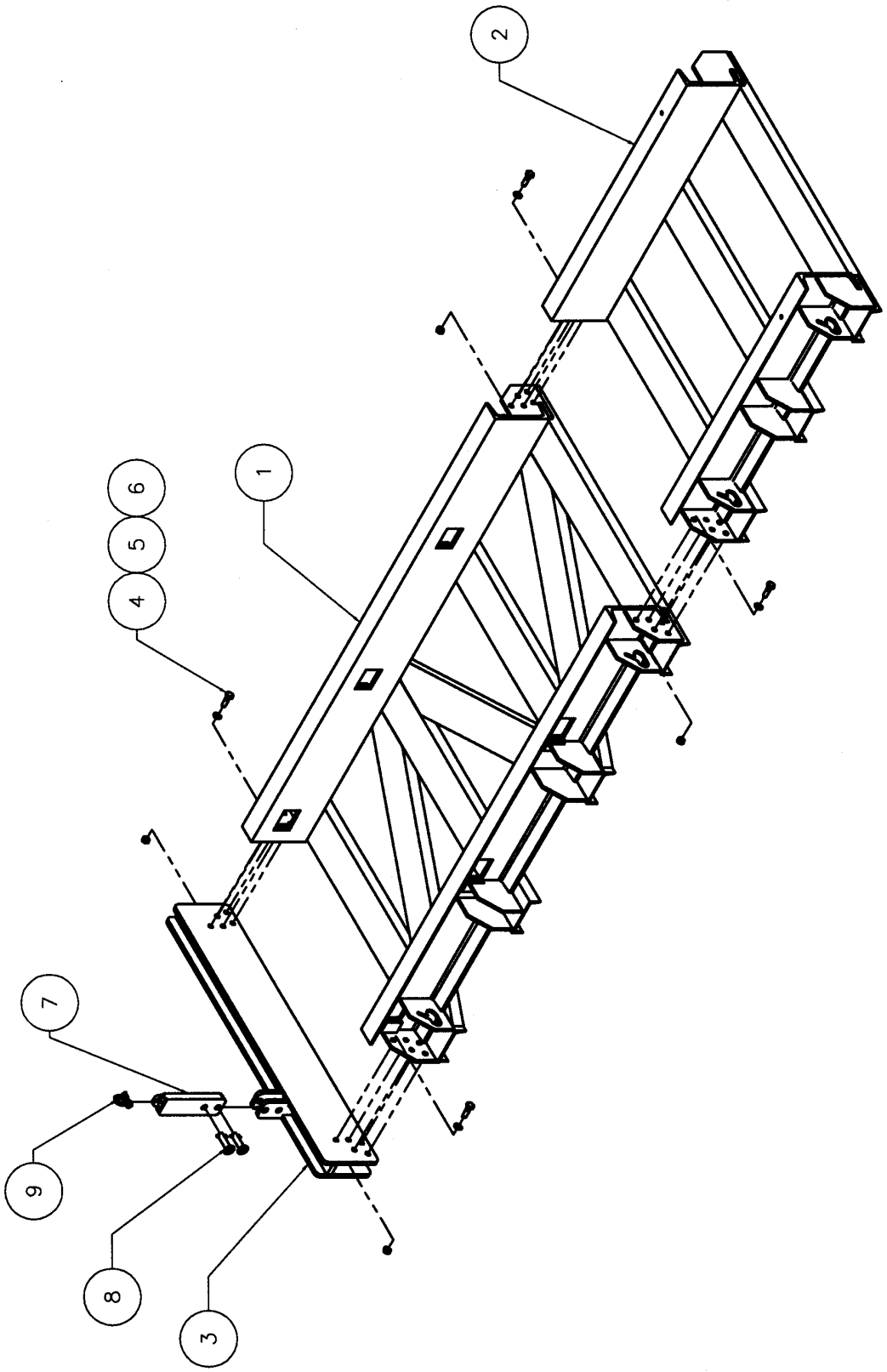
# 60” ADAPTER
## McL 48/54



# 60” ADAPTER
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800555 | 60" Adapter |
| 2 | 1 | 4800557 | Bracket, Back Support |
| 3 | 3 | U020120 | Screw, SQ .75-10 X 2.00 |

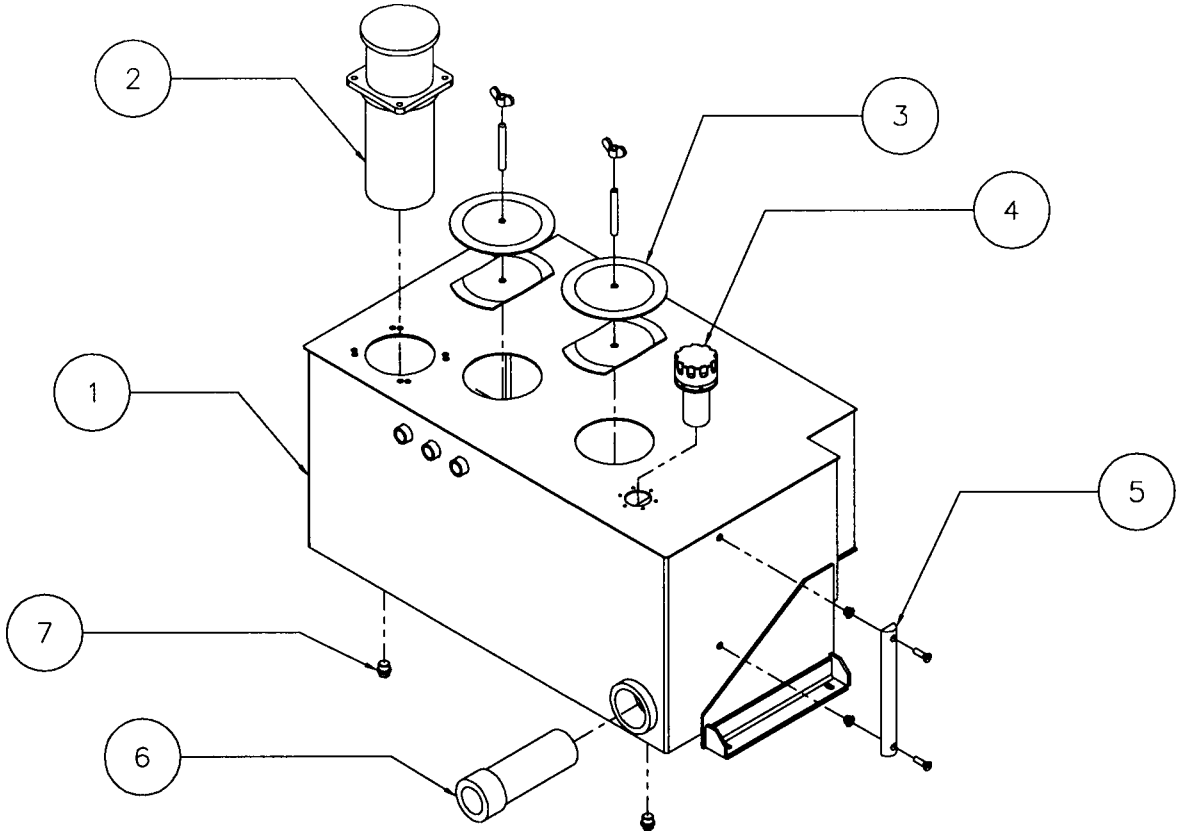
# MASTER TRACK ASSEMBLY
## McL 48/54



# MASTER TRACK ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 3 | 4800632 | Track |
| 2 | 1 | 4800631 | Extension Track |
| 3 | 1 | 4800620 | Push Plate |
| 4 | 40 | U001420 | Screw, HC .75-10 X 2.50 |
| 5 | 40 | U210160 | Washer, Lock .750 |
| 6 | 40 | U100200 | Nut, Hex .750-10 |
| 7 | 1 | 4800645 | Anchor Bar |
| 8 | 2 | 4800648 | Anchor Bar Pin |
|  | 2 | U320020 | Pin, Cotter .125 X 1.50 |
| 9 | 1 | 4800650 | Anchor Bar Shackle |

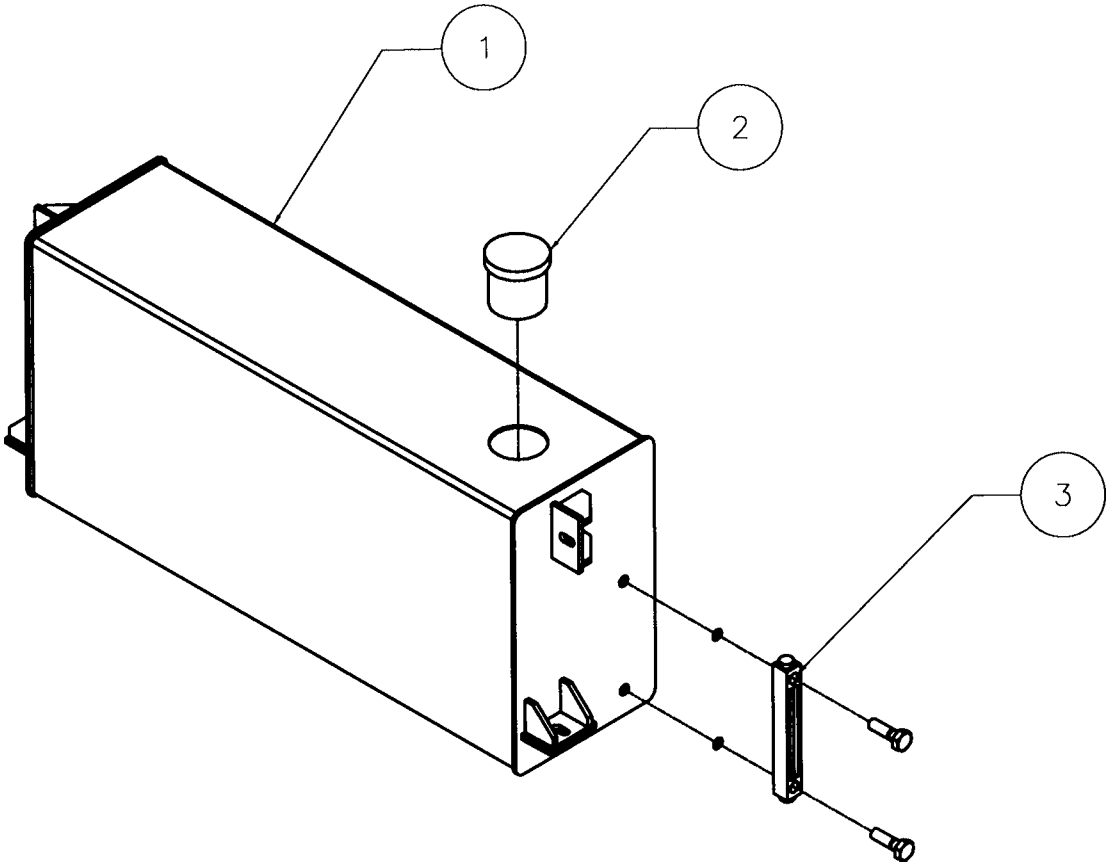
# HYDRAULIC TANK ASSEMBLY
## McL 48/54




# HYDRAULIC TANK ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810701 | Hydraulic Tank |
| 2 | 1 | 4800723 | Return Filter Assembly |
| | 1 | 4801708 | (Filter Element Only) |
| 3 | 2 | 4800758 | Clean-Out Cover Kit |
| 4 | 1 | 4800759 | Fill Assembly Kit |
| 5 | 1 | T720060 | Sight Gauge Kit |
| 6 | 1 | 4800761 | Suction Strainer |
| 7 | 2 | T405060 | Drain Plug |

# FUEL TANK ASSEMBLY
## McL 48/54

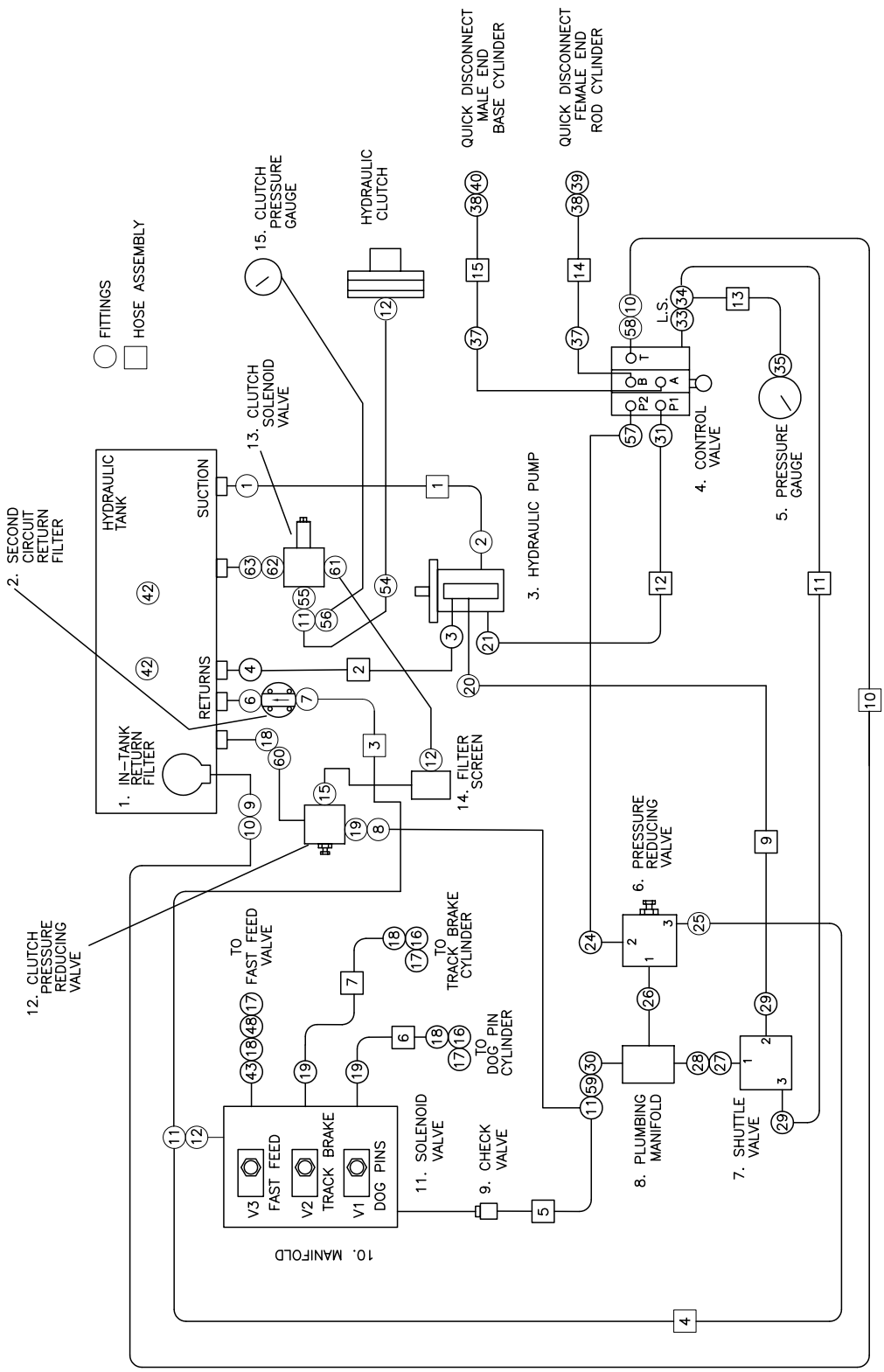



# FUEL TANK ASSEMBLY
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4810261 | Fuel Tank |
| 2 | 1 | 4800278 | Lockable Fuel Cap Kit |
| 3 | 1 | 8010006 | Sight Gauge, 6" Kit |

# HYDRAULIC SYSTEM
## McL 48/54

# CARRIAGE




**See page 4.1.2 for fittings and components callout**

| | FITTING DESCRIPTION | PART NO. |
|---|---|---|
| 1 | ELBOW, 45 32MP-32MJ | T401565 |
| 2 | KIT #32 SPLIT FLANGE COMPLETE | T410450 |
| 3 | ELBOW, 90 10MB-12MJ | T401581 |
| 4 | ELBOW, 90 12MP-12MJ | T401180 |
| 5 | UNION, 12MP-6MJ | T400085 |
| 6 | UNION, 12MP-12MP | T400800 |
| 7 | UNION, 12MP-6MJ | T400085 |
| 8 | ELBOW, 90 6FJ-6MJ | T401228 |
| 9 | UNION, 24MB-24MJ | T400580 |
| 10 | ELBOW, 90 24FJ-24MJ | T401730 |
| 11 | TEE, 6FJ-6MJ-6MJ | T402153 |
| 12 | ELBOW, 90 6MB-6MJ | T401250 |
| 13 | - | |
| 14 | - | |
| 15 | UNION, 6MB-6MB | T400038 |
| 16 | QUICK DISC., FEMALE 6FP | T412009 |
| 17 | DUST CAP, QUICK DISC., 6FP | T412010 |
| 18 | UNION, 6MP-6MJ | T400028 |
| 19 | UNION, 6MB-6MJ | T400037 |
| 20 | UNION, 4MB-4MJ | T400570 |
| 21 | ADAPTER, SPLIT FLANGE 16FB | 4800767 |
| 22 | UNION, 8MB-8MJ | T400140 |
| 23 | UNION, 16MB-16MF | T400545 |
| 24 | ELBOW, 90 6MB-8MJ | T401260 |
| 25 | ELBOW, 90 6MB-6MJ | T401250 |
| 26 | UNION, 6MB-6MB | T400038 |
| 27 | UNION, 8MB-10MJ | T400400 |
| 28 | UNION, 10FJ-6MJ | T403130 |
| 29 | UNION, 8MB-4MJ | T400134 |
| 30 | ELBOW, 90 10MB-8MJ | T401300 |
| 31 | UNION, 16MB-16MF | T400545 |
| 32 | - | |
| 33 | UNION, 4MB-4MJ | T400570 |
| 34 | TEE, 4FJ-4MJ-4MJ | T402010 |
| 35 | UNION, 4FP-4MJ | T400110 |
| 36 | - | |
| 37 | UNION, 16MB-16MF | T400545 |
| 38 | UNION, 16MF-16MP | T400546 |
| 39 | QUICK DISC., MALE 16FP | 4800775 |
| 40 | QUICK DISC., FEMALE 16FP | 4800776 |
| 41 | - | |
| 42 | PLUG, 8MP | T405062 |
| 43 | O-RING #6 SAE | W200015 |
| 44 | - | |
| 45 | ELBOW, 90 6FJ-6MJ | T401228 |
| 46 | UNION, 6FJ-6FP | T400083 |
| 47 | UNION, 6MP-6MP | T400803 |
| 48 | QUICK DISC., MALE 6FP | T412008 |
| 49 | UNION, 12MP-8FP | T403085 |

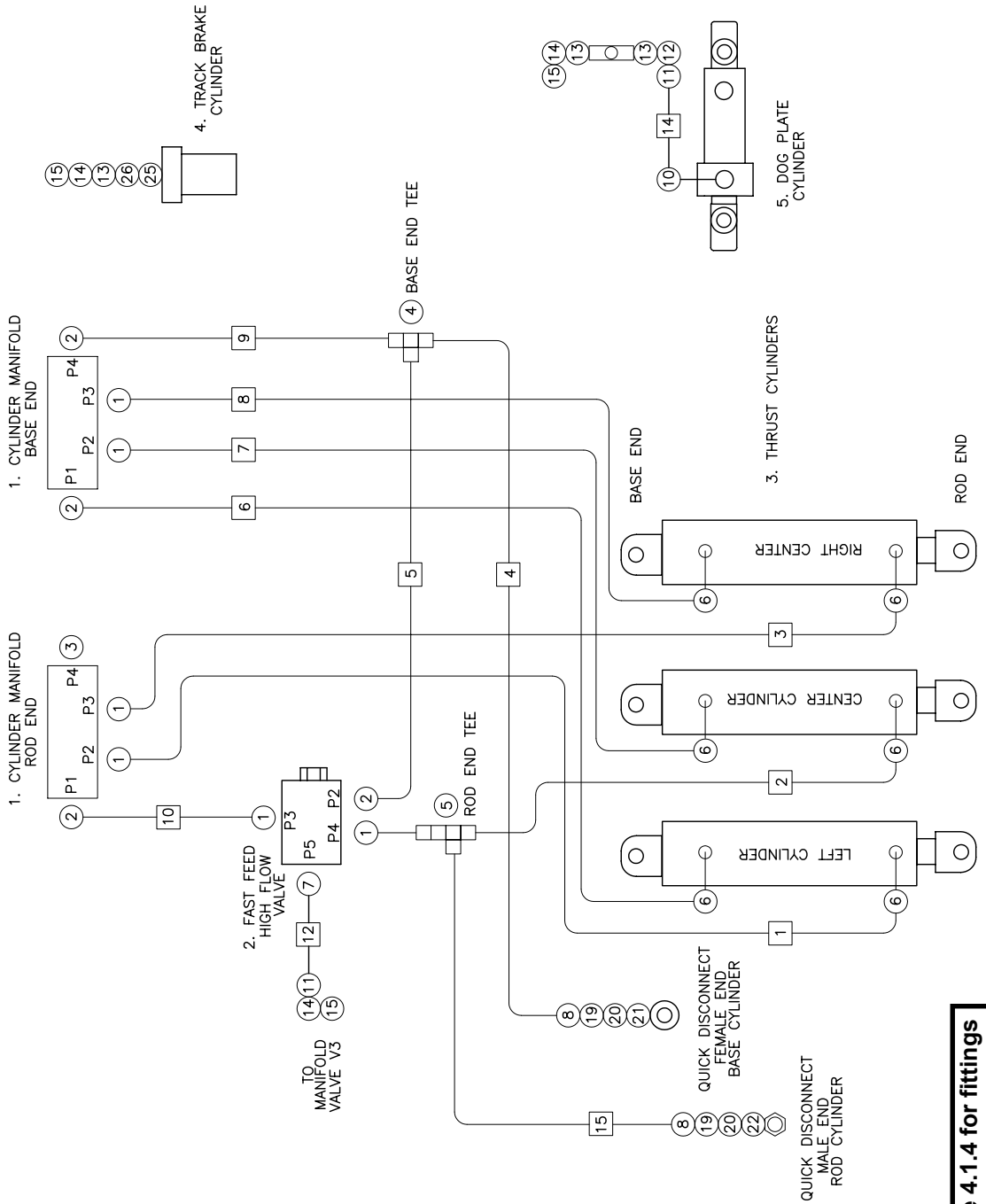
| | FITTING DESCRIPTION | PART NO. |
|---|---|---|
| 50 | UNION, 8MP-6FP | T404010 |
| 51 | UNION, 6MP-6MB | T400027 |
| 52 | UNION, 8FJ-6MB | T400710 |
| 53 | TEE, 6MB-6MJ-6MJ | T402148 |
| 54 | BULKHEAD, 6MJ-6MJ | T400391 |
| 55 | UNION, 10MB-6MJ | T400035 |
| 56 | UNION, 6FJ-4MJ | T400039 |
| 57 | UNION, 6MJ-5MB | T400033 |
| 58 | UNION, 24MJ-16MB | T400290 |
| 59 | UNION, 8FJ-6MJ | T400705 |
| 60 | UNION, 6MB-6FJ | T400036 |
| 61 | ELBOW,90 10MB-6MJ | T401290 |
| 62 | UNION, 10MB-8MJ | T400160 |
| 63 | UNION, 8FJ-6MP | T400142 |

| | HYDRAULIC COMPONENTS | PART NO. |
|---|---|---|
| 1 | IN-TANK RETURN FILTER | 4800723 |
| 2 | SECOND CIRCUIT RETURN FILTER | T700080 |
| 3 | HYDRAULIC PUMP | 4800769 |
| 4 | CONTROL VALVE | 4800778 |
| 5 | PRESSURE GAUGE | 4800784 |
| 6 | PRESSURE REDUCING VALVE | - |
| | BODY | 4800765 |
| | CARTIDGE | 4801720 |
| 7 | SHUTTLE VALVE | - |
| | BODY | 4801700 |
| | CARTIDGE | 4801703 |
| 8 | PLUMBING MANIFOLD | 2400367 |
| 9 | CHECK VALVE | 4800785 |
| 10 | MANIFOLD, SECOND CIRCUIT | 4810713 |
| 11 | SOLENOID VALVE (V1,V2 & V3) | - |
| | CARTIDGE | 4801701 |
| | COIL | 4801702 |
| 12 | CLUTCH PRESSURE REDUCING VALVE ASSEMBLY | 4810712 |
| 13 | CLUTCH SOLENOID VALVE | - |
| | CARTIDGE | 3600345 |
| | BODY | 3600346 |
| | COIL | 3600347 |
| 14 | FILTER SCREEN ASSEMBLY | - |
| | FILTER SCREEN CARTIDGE | 2400368 |
| | FILTER SCREEN BODY | 2400367 |
| 15 | CLUTCH PRESSURE GAUGE (0-600 PSI) | T720012 |

| | HOSE ROUTING | PART NO. |
|---|---|---|
| 1 | HYD. TANK — PUMP (INLET) | TH48120 |
| 2 | CASE DRAIN — HYD. TANK | TH48121 |
| 3 | MANIFOLD DRAIN — HYD. TANK 2ND FILTER | TH48122 |
| 4 | PRV #3 — MANIFOLD TEE DRAIN | TH48123 |
| 5 | PLUMBING MANIFOLD — CHECK VALVE MANIFOLD | TH48124 |
| 6 | MANIFOLD, V1 — DOG PLATE CYLINDER | TH48125 |
| 7 | MANIFOLD, V2 — TRACK BRAKE CYLINDER | TH48126 |
| 8 | PUMP (OUTLET) — PRV #2 | TH48127 |
| 9 | PUMP #X — SHUTTLE VALVE #2 | TH48128 |
| 10 | CONTROL VALVE #T — HYD. TANK MAIN FILTER | TH48129 |
| 11 | SHUTTLE VALVE #3 — CONTROL VALVE L.S. TEE | TH48130 |
| 12 | PUMP (OUTLET) — CONTROL VALVE #P1 | TH48131 |
| 13 | CONTROL VALVE L.S. TEE — PRESSURE GAUGE | TH48132 |
| 14 | CONTROL VALVE #B — FITTING BULKHEAD ROD END | TH48133 |
| 15 | CONTROL VALVE #A — FITTING BULKHEAD BASE END | TH48134 |

# HYDRAULIC SYSTEM
## McL 48/54

# JACKING STATION




**See page 4.1.4 for fittings and components callout**

# HYDRAULIC SYSTEM
## McL 48/54

# JACKING STATION

| # | FITTING DESCRIPTION | PART NO. |
|---|---|---|
| 1 | UNION 16MB-16MF | T400545 |
| 2 | ELBOW 90 16MB-16MF | T401635 |
| 3 | PLUG 16MB | T405120 |
| 4 | TEE 16MF-16MF-16MF | T402225 |
| 5 | TEE 16FF-16MF-16MF | T402228 |
| 6 | ELBOW 90 20MB-16MF | T401710 |
| 7 | ELBOW 90 6MB-6MJ | T401250 |
| 8 | BULKHEAD 90 16MF-16MF | T400395 |
| 9 | UNION 16MP-16MF | T400546 |
| 10 | SWIVEL 90 4MP-6MJ | T401700 |
| 11 | UNION 6MJ-6MP | T400028 |
| 12 | ELBOW, 90 6FP-6MP | T401065 |
| 13 | UNION 6MP-6MP | T400803 |
| 14 | QUICK DISC, MALE 6FP | T412008 |
| 15 | CAP QUICK DISC | T412010 |
| 16 | UNION 4MP-4MJ | T400020 |
| 17 | UNION 4FP-6MP | T400023 |
| 18 | UNION 4FP-4FJ | T400081 |
| 19 | UNION 16FF-16MJ | T400812 |
| 20 | UNION 16FJ-16MP | T400815 |
| 21 | QUICK DISC FEMALE 16FP | 4800776 |
| 22 | QUICK DISC MALE 16FP | 4800775 |
| 23 | QUICK DISC FEMALE 6FP | T412009 |
| 24 | VENTED CAP 4MP | T400801 |
| 25 | UNION 16MP-8FP | T403060 |
| 26 | UNION 8MP-6FP | T400024 |

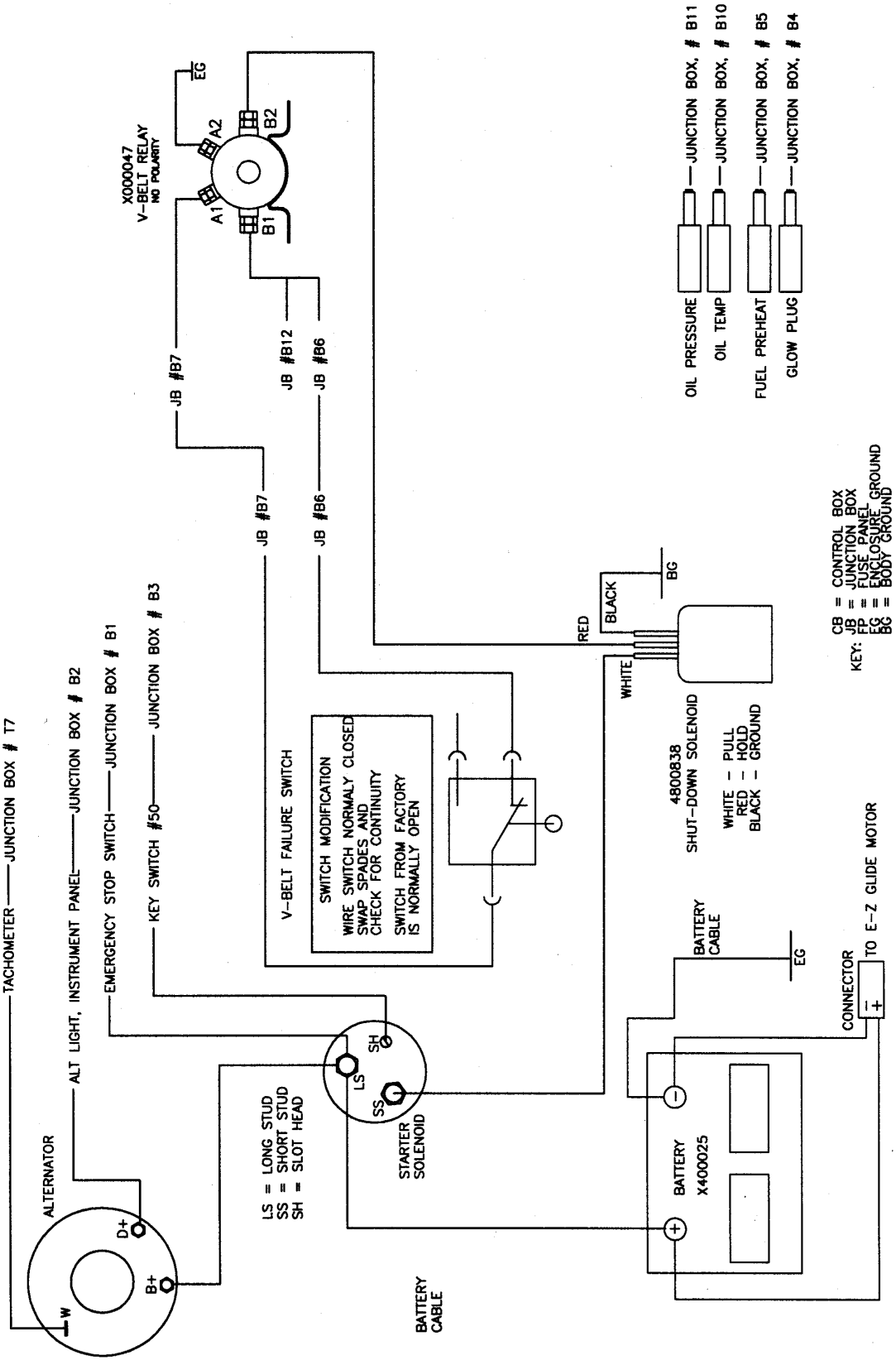
| # | HYDRAULIC COMPONENTS | PART NO. |
|---|---|---|
| 1 | CYLINDER MANIFOLD (QTY 2) | 4800731 |
| 2 | FAST FEED VALVE | - |
| | FAST FEED CARTIDGE | 4800779 |
| | FAST FEED BODY | 4800780 |
| 3 | THRUST CYLINDER (QTY 3) | 4800729 |
| 4 | TRACK BRAKE CYLINDER | 4810750 |
| 5 | DOG PLATE CYLINDER | 4801710 |

| # | HOSE ROUTING | PART NO. |
|---|---|---|
| 1 | LEFT CYLINDER, ROD END -- ROD MANIFOLD P2 | TH48101 |
| 2 | CENTER CYLINDER, ROD END -- TEE, ROD END | TH48102 |
| 3 | RIGHT CYLINDER, ROD END -- ROD MANIFOLD P3 | TH48103 |
| 4 | CYLINDER BASE TEE -- QUICK DISC FEMALE | TH48104 |
| 5 | CYLINDER BASE TEE -- HIGH FLOW VALVE P2 | TH48105 |
| 6 | LEFT CYLINDER, BASE END -- BASE MANIFOLD P1 | TH48106 |
| 7 | CENTER CYLINDER, BASE END -- BASE MANIFOLD P2 | TH48107 |
| 8 | RIGHT CYLINDER, BASE END -- BASE MANIFOLD P3 | TH48108 |
| 9 | CYLINDER BASE TEE -- BASE MANIFOLD P4 | TH48109 |
| 10 | ROD MANIFOLD P1 -- HIGH FLOW VALVE P3 | TH48110 |
| 11 | HIGH FLOW VALVE P1 -- HYD TANK (JACKING STATION) | TH48111 |
| 12 | HIGH FLOW VALVE P5 -- MANIFOLD V3 (JACKING STATION) | TH48112 |
| 13 | - | - |
| 14 | DOG PLATE CYLINDER -- HOUSING COUPLING | TH48114 |

**NOTE: For replacement Hose Assemblies, please include hose length and end fittings.**

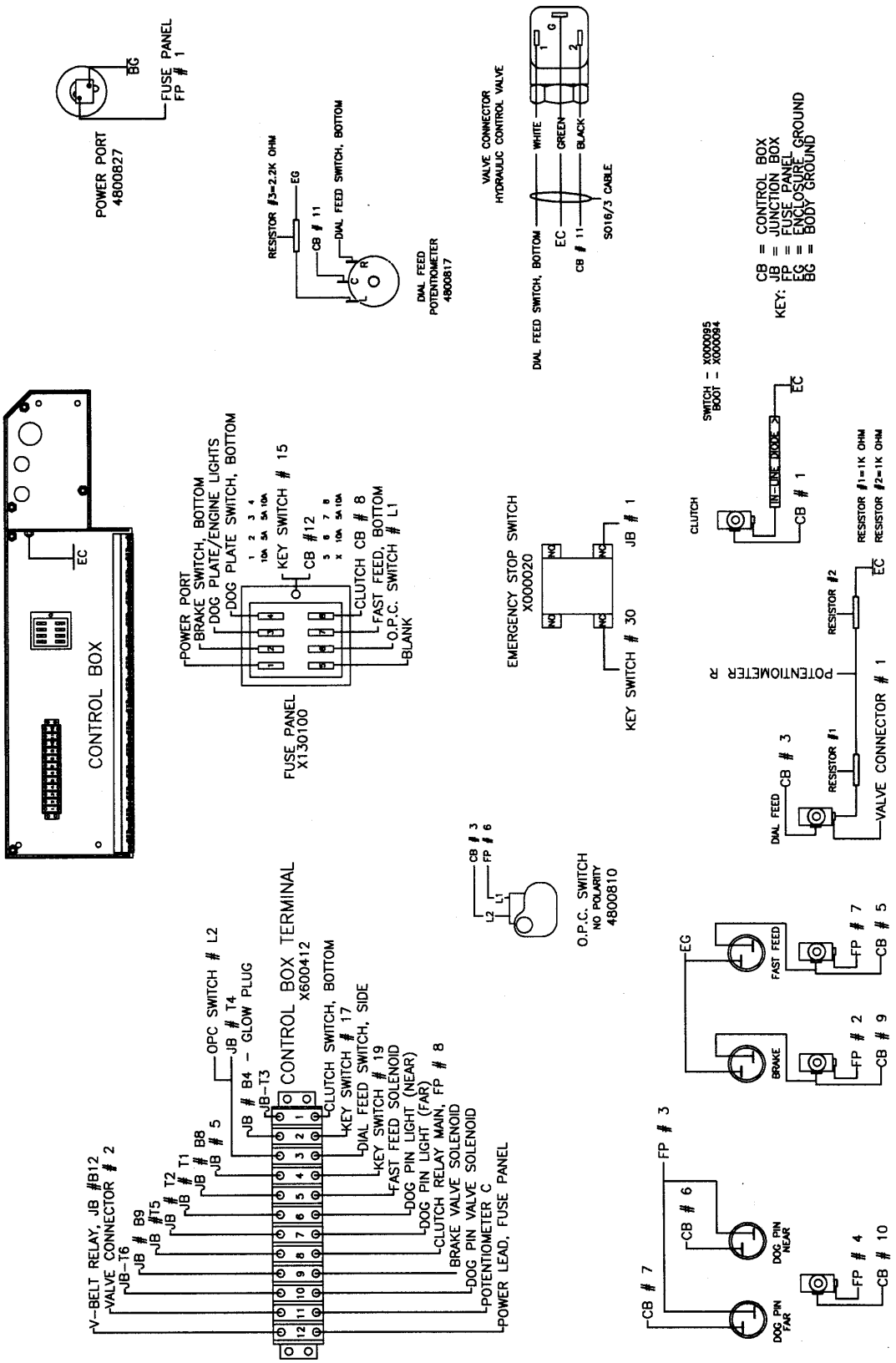
# ELECTRICAL SYSTEM
## McL 48/54

# WIRING DIAGRAM
# ENGINE DETAIL



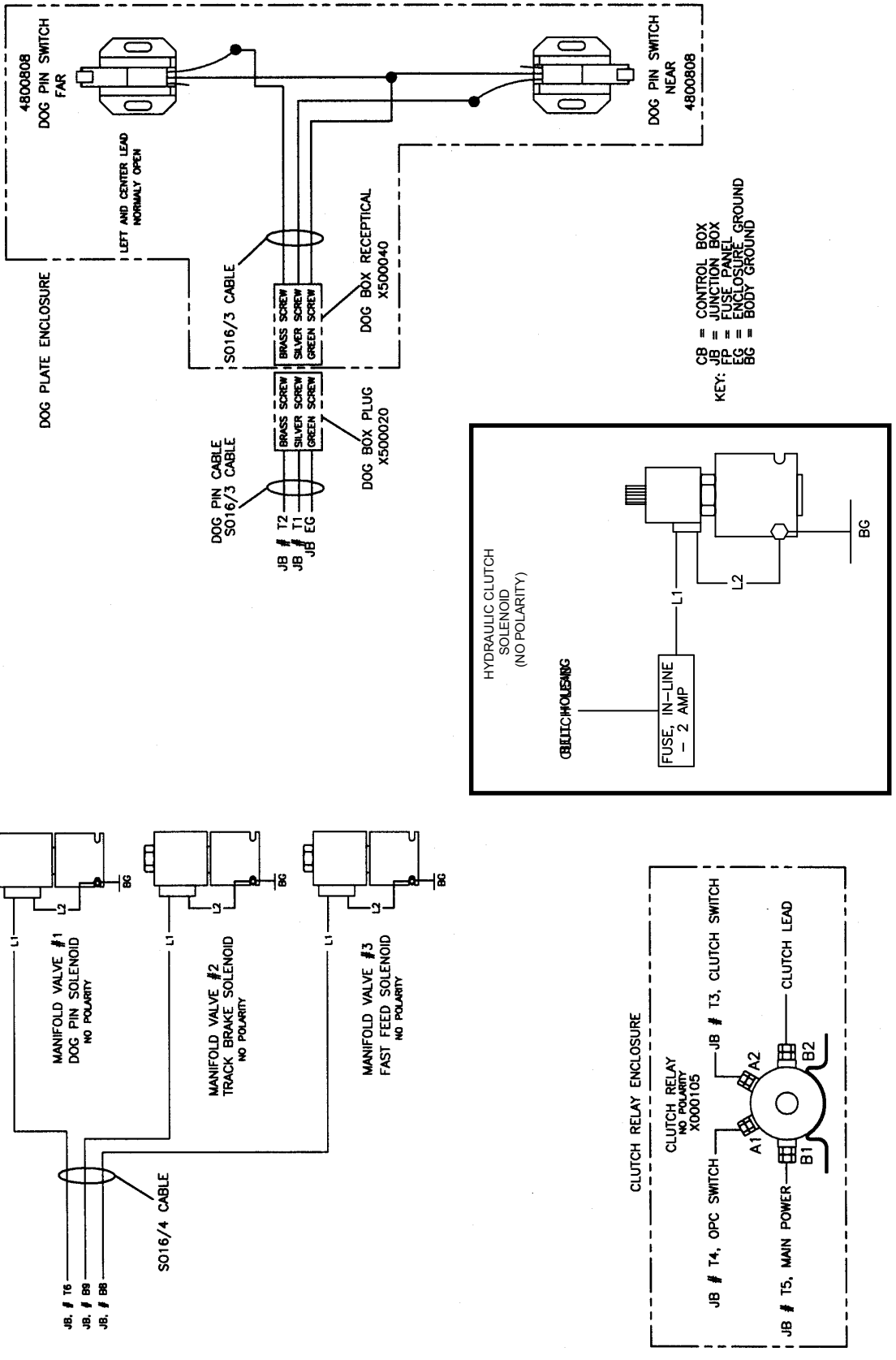
# ELECTRICAL SYSTEM
## McL 48/54

# WIRING DIAGRAM
# JUNCTION BOX DETAIL



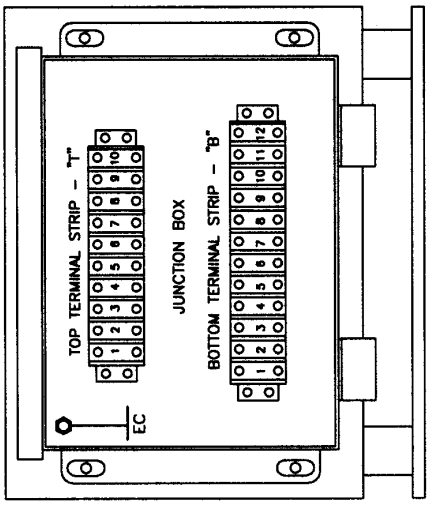
# WIRING DIAGRAM
## McL 48/54

# CONTROL BOX

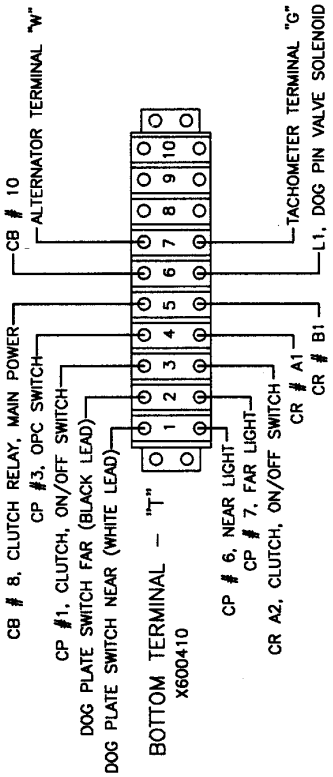


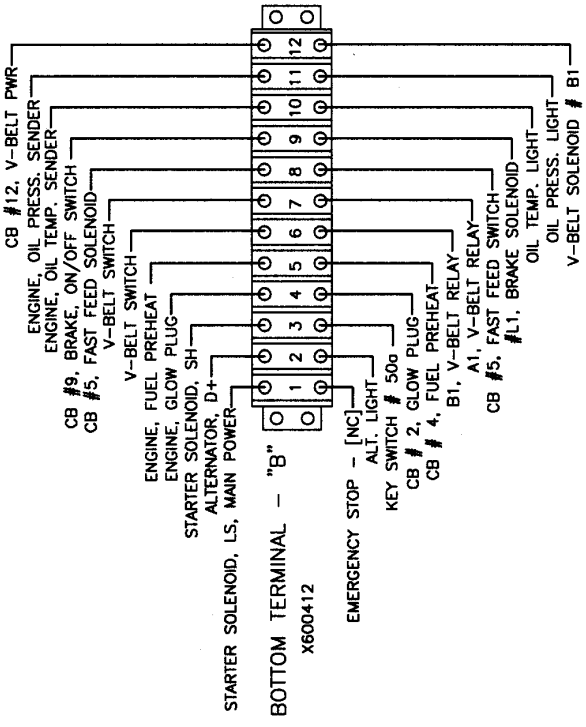
# WIRING DIAGRAM
## McL 48/54

# INSTRUMENT PANEL




KEY: CB = CONTROL BOX
JB = JUNCTION BOX
FP = FUSE PANEL
EC = ENCLOSURE GROUND
BG = BODY GROUND



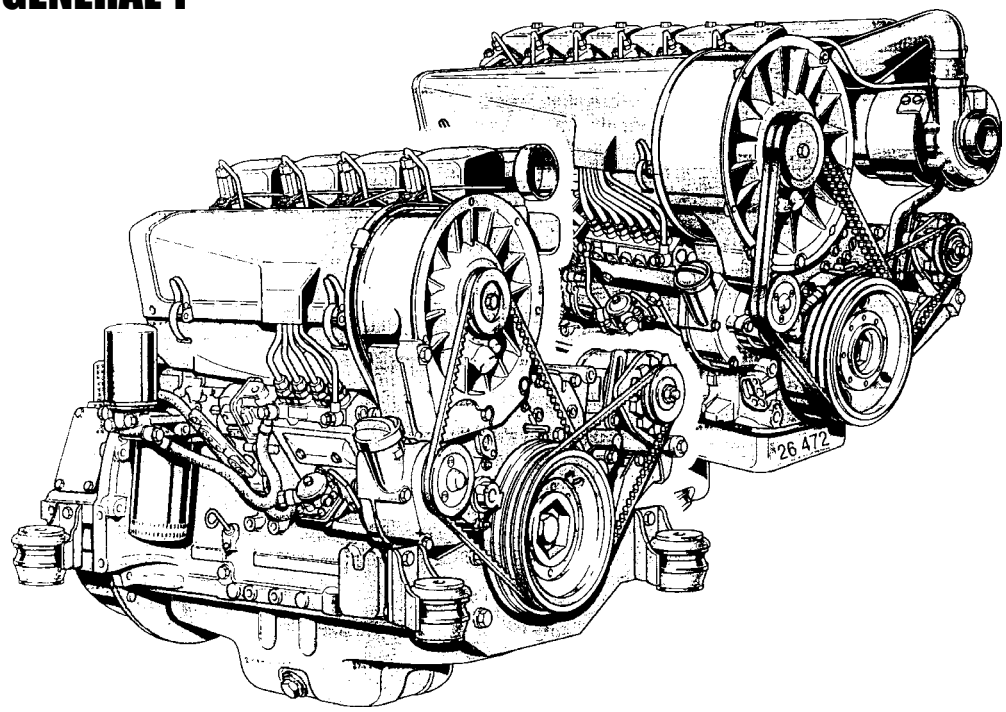



# WIRING DIAGRAM
## McL 48/54

# COMPONENT WIRING

# 5.1 ENGINE DETAILS
## McL 48/54

# ENGINE DESCRIPTION
## GENERAL 1




### DEUTZ Diesel Engines

are the product of research and development ranging over many years. The know-how thereby gained, coupled with high demands with regard to quality, forms the guarantee for the manufacture of engines featuring long service-life, high reliability, and low fuel consumption.
It goes without saying that the high demands regarding protection of the environment are also fulfilled.

### Beware of Running Engine

Shut the engine down before carrying out maintenance or repair work. Ensure that the engine cannot be accidentally started - accidents may otherwise occur. When the work is complete, be sure to refit any panels and guards that have been removed.
Never fill the fuel tanks while the engine is running. Observe industrial safety regulations when running the engine in an enclosed space or underground.

### Service and Maintenance

will also play a decisive role as to whether the engine fulfills to your satisfaction the demands you make on it. Observance of the prescribed maintenance intervals and careful carrying out of the service and maintenance jobs are therefore essential.
Particular attention must be given with regard to applications involving differing and harder operating conditions as compared with normal operation.

### Safety

When reading through this Manual, you will find this symbol marking all safety instructions and proceed with special care. Pass on these safety instructions to your operating personnel.
In addition, it is also necessary to observe the official safety and accident prevention rules.

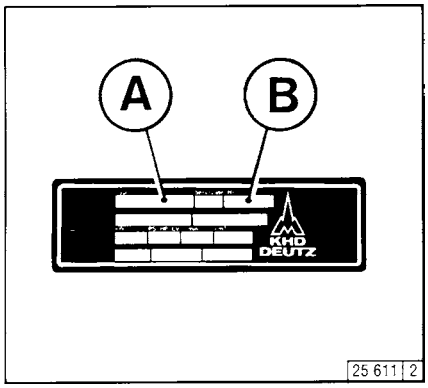
### DEUTZ Service

In case of operational troubles and queries concerning spare parts, please contact your DEUTZ agent. Where necessary, our trained specialists will ensure a quick and professional repair, using DEUTZ spare parts. Genuine DEUTZ spare parts are always manufactured to the latest technical standards.
More information on DEUTZ SERVICE can be found at the end of this Operation Manual.

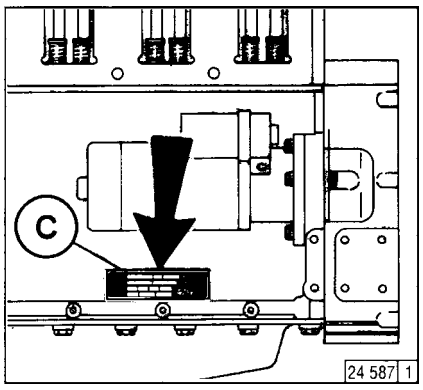
### Asbestos

The seals and gaskets used in this engine are asbestos-free. When carrying out maintenance and repair work, please use appropriate spare parts.

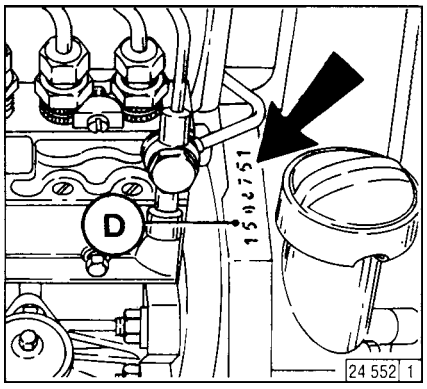
# MODEL DESIGNATION
## 2.1 Model



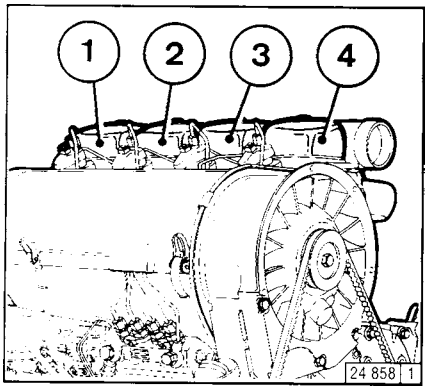

**2.1.1 Rating Plate**
The model designation **A**, the engine serial number **B** and the performance data are stamped on the rating plate. The model and engine serial number must be given when ordering parts.




**2.1.2 Location of Rating Plate**
The rating plate **C** is attached to the crankcase; depending on the design, a second rating plate may be attached to the air duct.



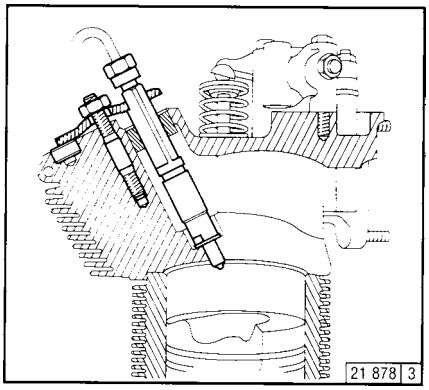

**2.1.3 Engine Serial Number**
The engine serial number **D** is stamped onto the crankcase as well as on the rating plate.



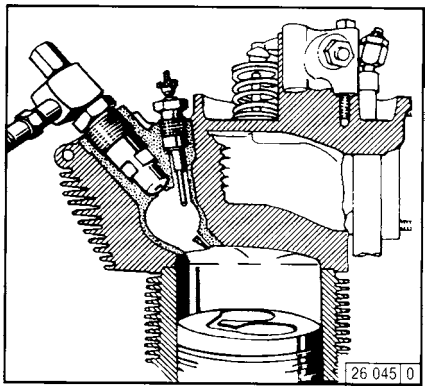

**2.1.4 Numbering of Cylinders**
The cylinders are numbered consecutively, beginning at the flywheel end.

Adjustments to the regulator are to be carried out only by authorized DEUTZ SERVICE - specialists.

# ENGINE DESCRIPTION
## 2.1 Model



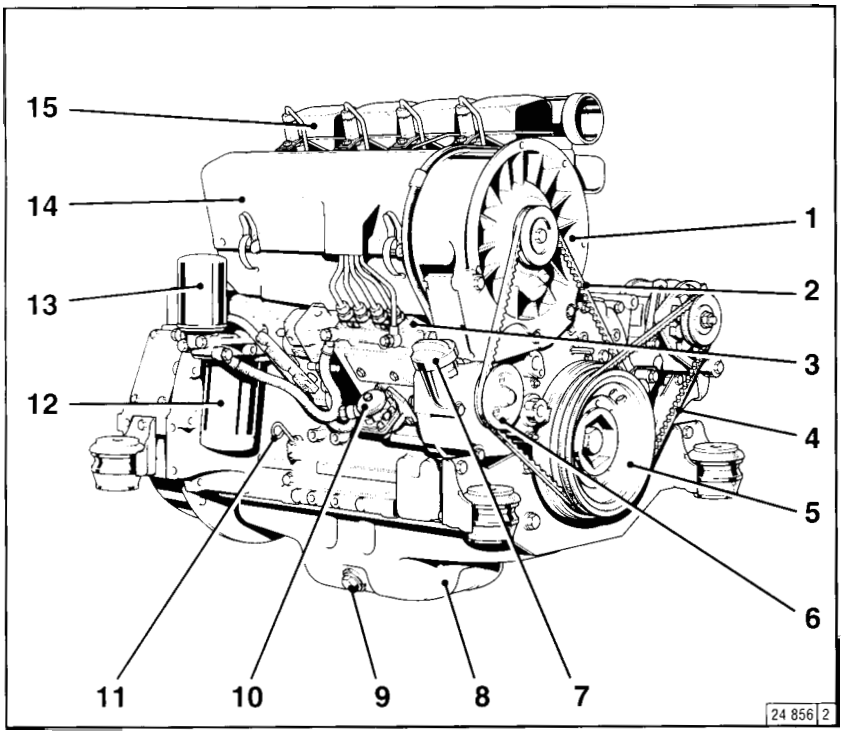

**2.1.5 Direct Injection FL 912**
Engines with direct injection are used where high performance is required.




**2.1.6 Two-stage Combustion FL 912W**
Engines with two-stage combustion are used where it is particularly important to keep exhaust emissions to an absolute minimum.

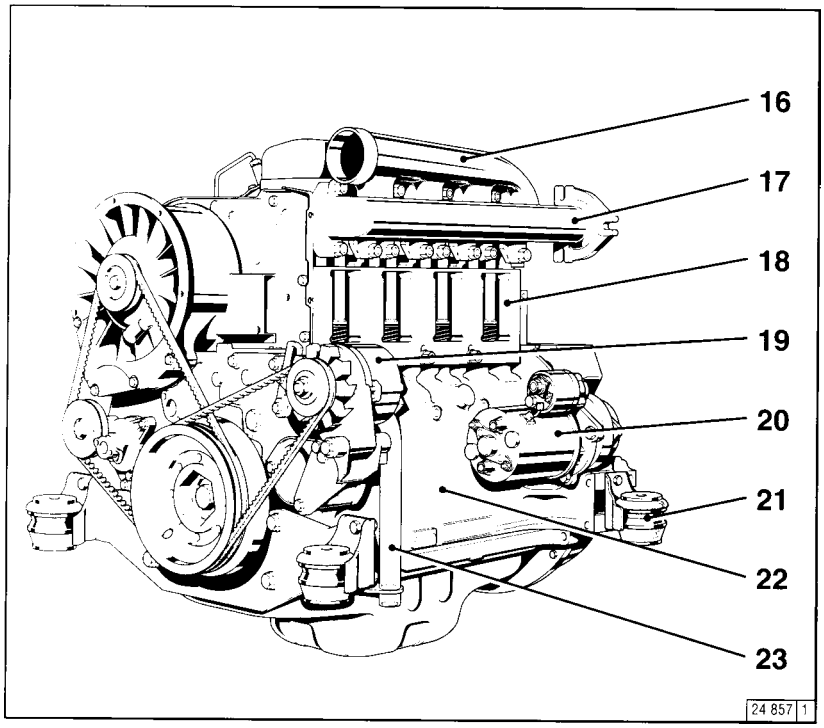
# ENGINE DESCRIPTION
## 2.2 Engine Illustrations

### 2.2.1 Service Side F4L 912




1 Fan
2 V-belt (fan)
3 Injection pump
4 V-belt (alternator)
5 V-belt pully
6 Tension roller
7 Oil fill point
8 Oil pan
9 Oil drain plug
10 Fuel pump
11 Oil dipstick
12 Lube oil filter
13 Easy-change fuel filter
14 Air duct cover
15 Cylinder-head cover

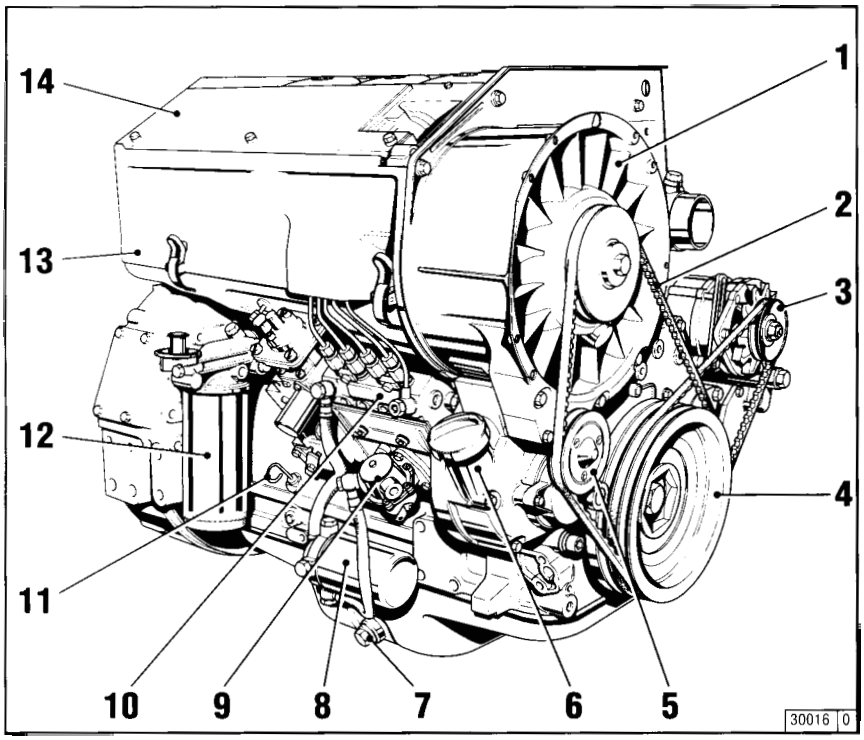
### 2.2.2 Exhaust Side F4L 912




16 Air intake pipe
17 Exhaust manifold pipe
18 Screen
19 Alternator
20 Starter
21 Engine mounting
22 Crankcase
23 Crankcase ventilation

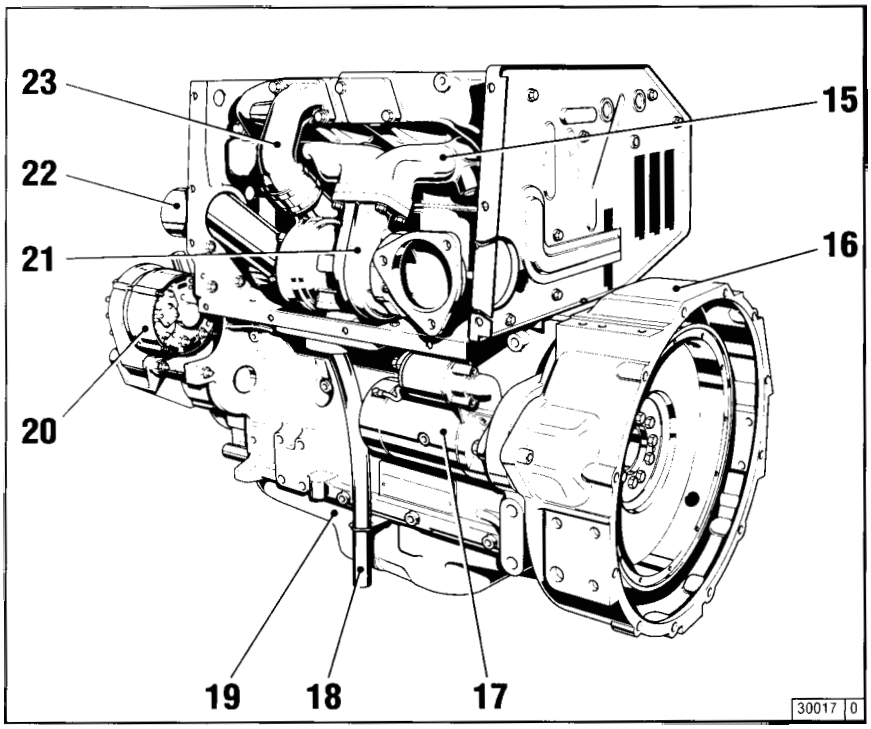
# ENGINE DESCRIPTION
## 2.2 Engine Illustrations

### 2.2.3 Service Side BF4L 913




1 Fan
2 V-belt (fan)
3 V-belt (alternator)
4 V-belt pully on crankshaft
5 Tension roller
6 Oil fill point
7 Oil drain plug
8 Fuel filter cartridge
9 Fuel pump with fuel precleaner
10 Injection pump
11 Oil dipstick
12 Lube oil filter cartridge
13 Air duct cover
14 Engine oil radiator cover

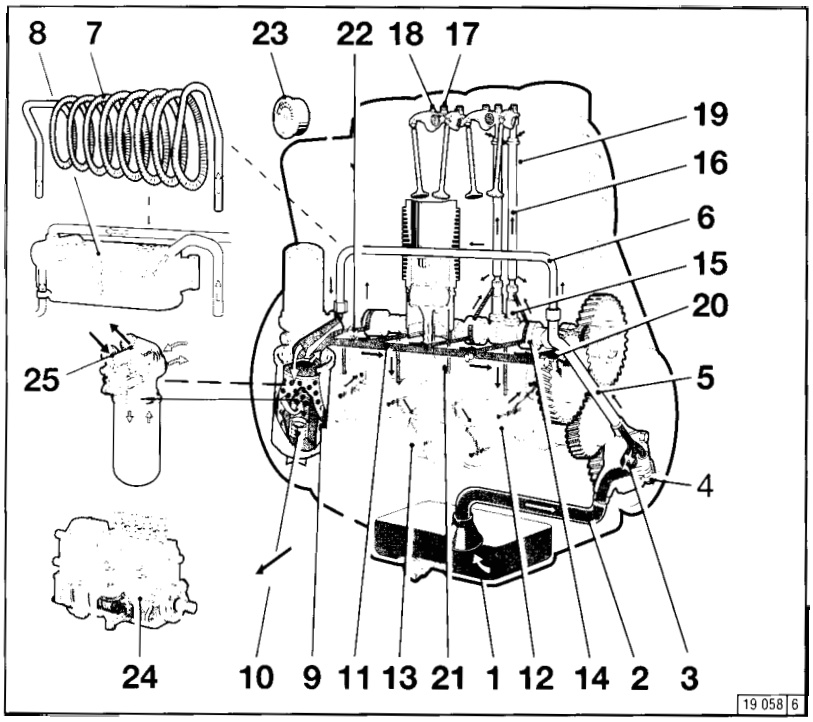
### 2.2.4 Exhaust Side BF4L 913




15 Exhaust manifold line
16 Terminal housing
17 Starter
18 Crankcase ventilation
19 Oil pan
20 Alternator
21 Exhaust turbocharger
22 Air-intake pipe-exhaust turbocharger
23 Charge-air line

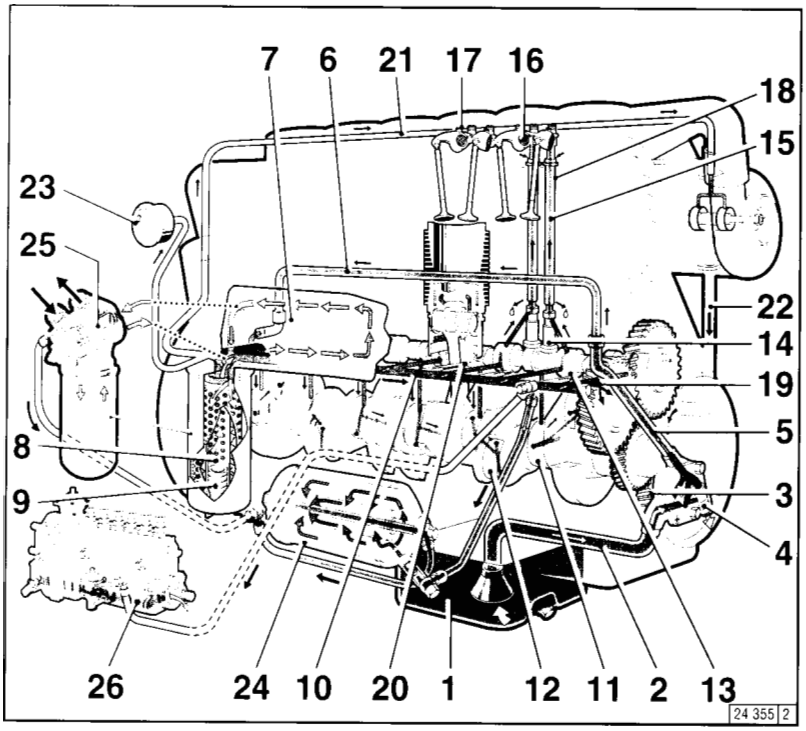
# ENGINE DESCRIPTION
## 2.3 Lube Oil Circuit

### 2.3.1 Lube Oil Circuit FL 912/913




1 Oil Pan
2 Intake Manifold
3 Oil pump
4 Oil pressure control valve
5 Pressure-oil line
6 Bypass line or selectively
7 Finned pipe spiral or selectively
8 Frame oil cooler
9 Lube oil filter
10 Safety valve
11 Main oil gallery
12 Crankshaft bearing
13 Con-rod bearing
14 Camshaft bearing
15 Tappets
16 Push rod (hollow, for oil feed to rocker arm lubrication)
17 Rocker arm bearing
18 Metering plug (r arm lubrication)*
19 Protective sleeve for push rod
20 Throttle bore (for lubrication of the gear wheels)
21 Injection jet for cooling the pistons
22 Connection for oil pressure gauge
23 Oil pressure gauge
24 Injection pump connected to lube oil circuit
25 Connection point for oil heating**

### 2.3.2 Lube Oil Circuit BF6L 913

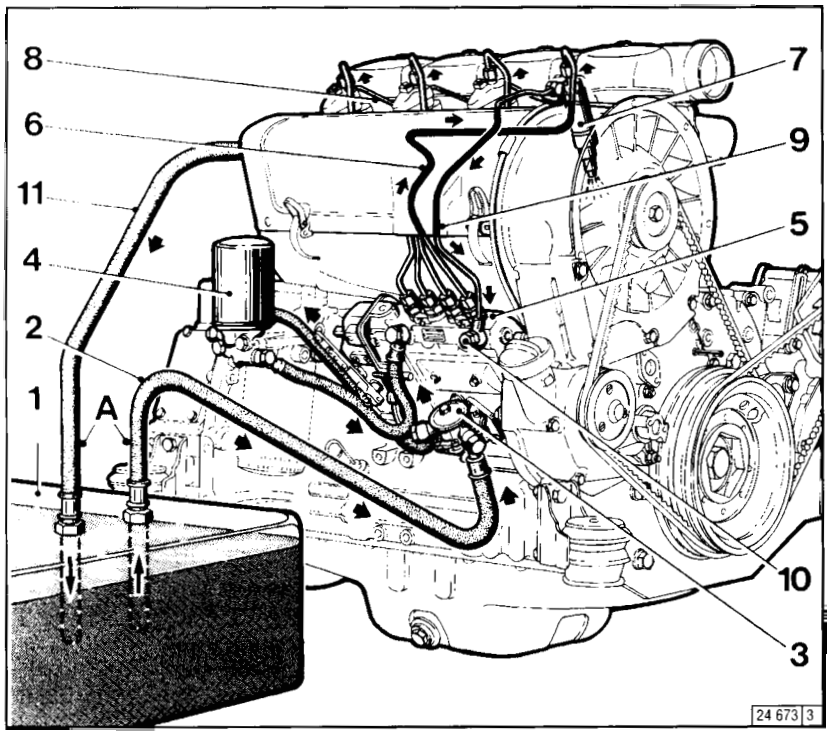



1 Oil Pan
2 Intake manifold
3 Oil pump
4 Oil pressure control valve
5 Pressure-oil line
6 Connecting line to oil cooler
7 Frame oil cooler
8 Lube oil filter
9 Safety valve
10 Main oil gallery
11 Crankshaft bearing
12 Con-rod bearing
13 Camshaft bearing
14 Tappets (with impulse lubrication of the rocker arm)
15 Push rod (hollow, for oil feed to r. arm lubrication)
16 Rocker arm bearing
17 Metering plug (r arm lubrication)*
18 Protective sleeve for push rod (oil return form cylinder head to crankcase)
19 Throttle bore (for lubrication of the gear wheels)
20 Injection jet for cooling the pistons
21 Oil line for lub. of the exhaust turbocharger
22 Oil ret. line from exhaust turboc. to the crankcase
23 Oil pressure gauge
24 Partial flow lube oil filter
25 Connection point for oil heating**
26 Injection pump connected to lube oil circuit

* only for inclined engines
** in this instance the filter holder must be replaced. Please contact our service representative for this alteration.

# ENGINE DESCRIPTION
## 2.4 Fuel System Schematic

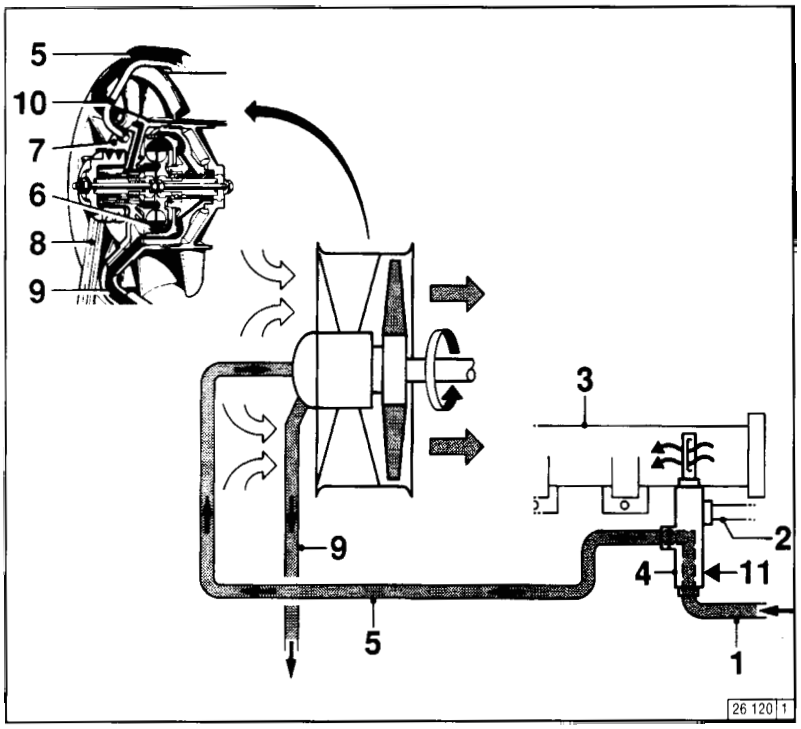
### 2.4.1 Fuel Circuit




1 Fuel Tank
2 Fuel line from tank to fuel pump
3 Fuel supply pump
4 Easy-change fuel filter
5 Injection pump
6 Injection lines
7 Injection valves
8 Oil leakage line
9 Fuel overflow valve
10 Overflow valve
11 Fuel return line to tank A
Clearance: keep as far apart as possible.

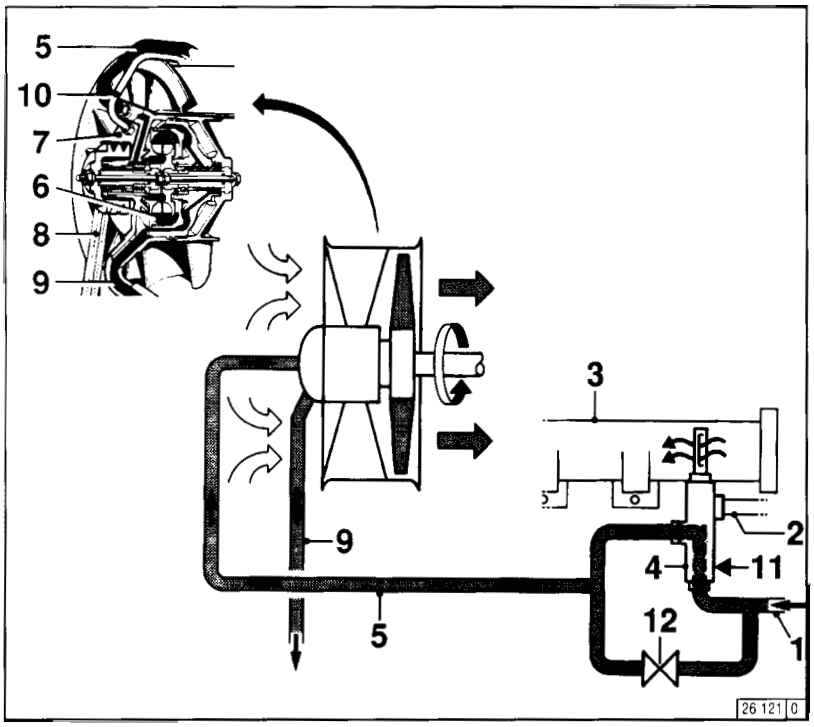
# ENGINE OPERATION
## 2.5 Engine Cooling

### 2.5.1 Regulation of Coolant Flow using the Exhaust Thermostat




1 Pressure-oil line from engine to exhaust thermostat
2 Air line to exhaust thermostat
3 Exhaust manifold pipe
4 Exhaust thermostat
5 Control line to hydraulic coupling
6 Hydraulic coupling
7 Cooling fan
8 Cooling fan drive
9 Oil return line to crankcase
10 Ventilation line
11 Adjusting pin with special seal

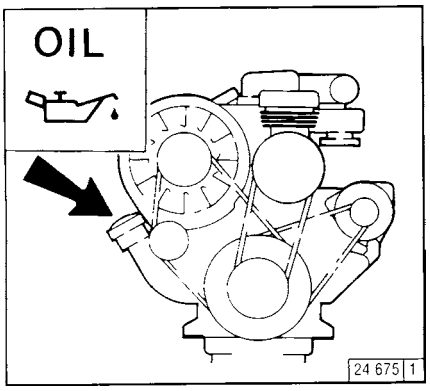
### 2.5.2 Regulation of Coolant Flow using the Exhaust Thermostat and Solenoid




1 Pressure-oil line from engine to exhaust therostat
2 Air line to exhaust thermostat
3 Exhaust manifold pipe
4 Exhaust thermostat
5 Control line to hydraulic coupling
6 Hydraulic coupling
7 Cooling fan
8 Cooling fan drive
9 Oil return line to crankcase
10 Ventilation line
11 Adjusting pin with special gasket
12 Solenoid

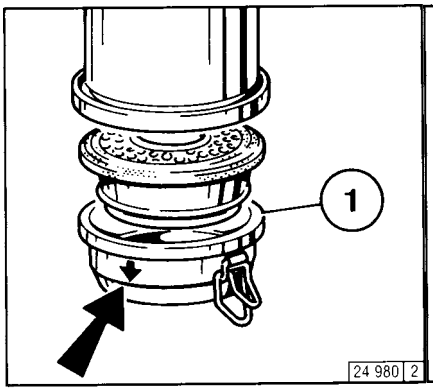
# ENGINE OPERATION
## 3.1 Commissioning

### 3.1.1 Adding Engine Oil



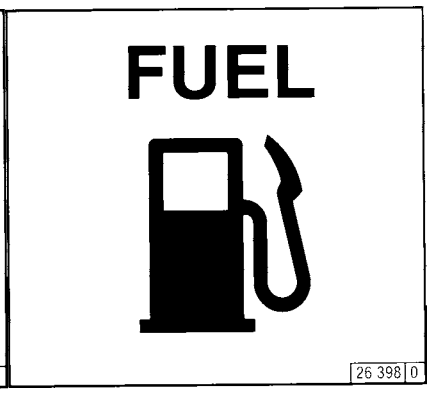

As a rule, engines are delivered empty of oil. Pour lube oil into the oil filler neck (arrow). For oil grade and viscosity, see pg 4.1

### 3.1.2 Filling Oil Bath Air Cleaner




Fill oil cup 1 of the oil bath air cleaner with engine oil up to the arrow. For oil grade and viscosity, see 4.1

### 3.1.3 Adding Fuel

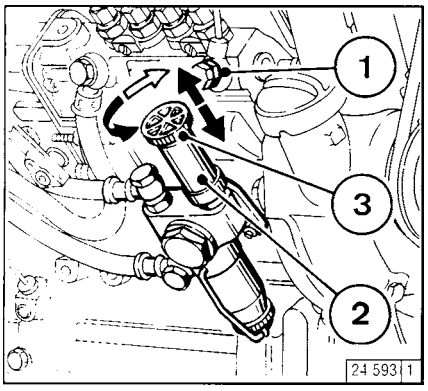



Use only commercial-grade diesel fuel. For fuel grade see 4.2. Use summer or winter-grade fuel, depending on the ambient temperature.

Oil may not be filled into the dust collector of the precleaner, if this is fitted.

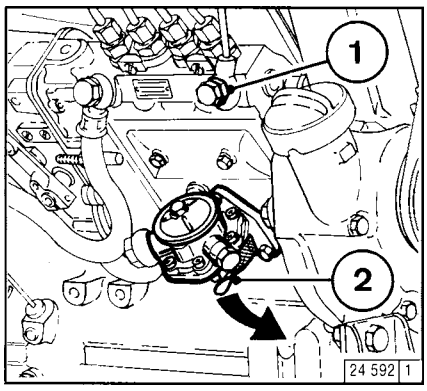
Never fill the tank while the engine is running. Keep the filler cap area clean and do not spill fuel.

### 3.1.4 Ventilation Model: "Bosch" fuel pump




- Loosen overflow valve 1 at the lower (larger) hexagon.
- Loosen hand pump 2 at the notched grip 3 by unscrewing by several turns to the left.
- Actuate hand pump 2 until bubble-free fuel is emitted at the loosened overflow valve 1.
- Tighten overflow valve1, continuing to pump at the same time.
- Tighten grip 3.

### 3.1.4 Ventilation Model: "IMSA" fuel pump




- Loosen overflow valve 1 at the lower (larger) hexagon.
- Actuate preliminary pump lever 2 against the spring pressure until bubble-free fuel is emitted at the loosened overflow valve 1.
- Tighten overflow valve 1, continuing to pump at the same time.

# ENGINE OPERATION
## 3.1 Commissioning

### 3.1.5 Other Preparations

- Check battery and cable connections see 6.7.1
- Transport hooks
  Remove if fitted (see 6.7.3)
- Trial run
  After the engine has been prepared, let it run for about 10 minutes without load.

  During and after trial run
  - Check the engine for leaks.

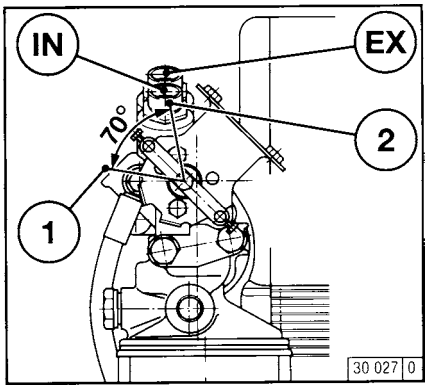
  After the engine has been turned off
  - Check the oil level, see 6.1.2
    If necessary, top oil, see 3.1.1
    Retension V-belts, see 6.5
- Breaking in
  During the break-in phase - about 200 operating hours - check the oil level twice a day. After the engine is broken in, checking once a day will be sufficient.

### 3.1.6 Additional Maintenance Work

The following maintenance should be carried out after 50-150 operating hours:

- Change lube oil,
  see 6.1.2
- Change oil filter cartridge,
  see 6.1.3
- Change fuel filter cartridge,
  see 6.2.1
- Check V-belts and retension as necessary,
  see 6.5
- Check valve clearance and adjust as necessary, see 6.6.1
- Check the engine for leaks.
- Check the engine mount and adjust as necessary, see 9.2

### 3.1.7 Selector Switch for Oil Heater




Position of selector switch for oil filter console with oil heater connection:
Pos. 1: open
Pos. 2: closed

For engines without oil heating, the selector switch is always open
Pos. 2: to lock closed.

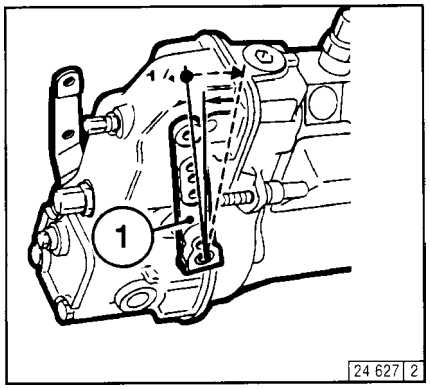
# ENGINE OPERATION
## 3.2 Starting

### 3.2.1 Electric Starting

Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.

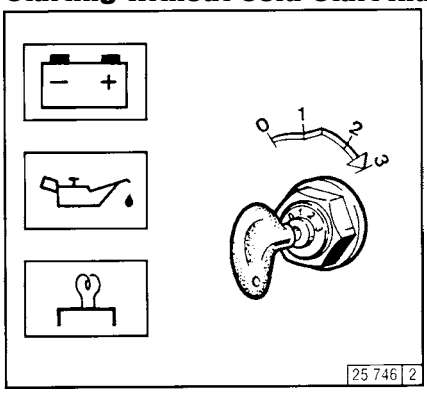
After repair work:
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with flame glow system, do not use any other starter substance (e.g. injection with start pilot).
**Caution: If the speed regulator has been removed, the engine must not be tested under any circumstances: Disconnect the battery.**

Do not actuate the starter for more than 20 seconds. If the engine does not catch wait a minute then try again.
If the engine does not catch after two attempts, refer to the Diagnosis Chart (see 7.1)



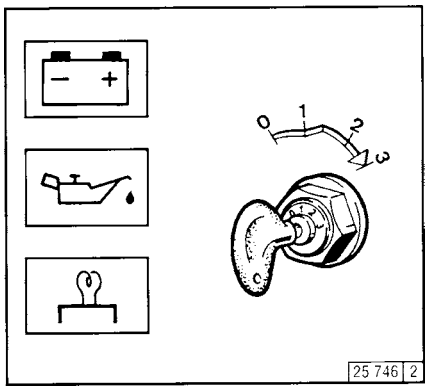

- Where possible, disengage the clutch to separate the engine from any driven parts.
- Move speed control lever 1 into idle position.

#### Starting without Cold-Start Aid




- Insert key.
  - Position 0 = no operating voltage
- Turn key clockwise
  - Position 1 = no operating voltage
  - Pilot lights come on.
- Push the key in and turn it further clockwise against spring pressure
  - Position 2 = no function
  - Position 3 = start

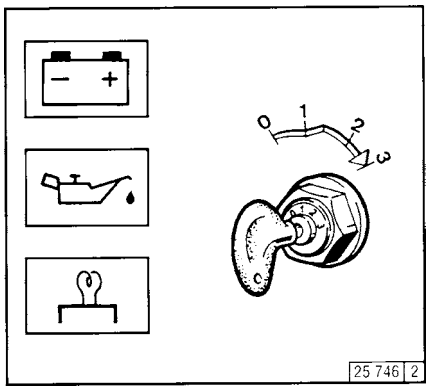
#### with Cold-Start Aid/Flame Glow fr 60=9.5 and 19 volts




- Insert key.
  - Position 0 = no operating voltage
- Turn key clockwise.
  - Position 1 = operating voltage
  - Pilot lights come on.
- Push the key in and turn further clockwise against spring pressure
  - Glow plug indicator light comes on
  - Position 2 = Preheat for approx. 60 seconds (hold key in position)*
  - Glow plug indicator light goes out
  - Position 3 = start
- Release key as soon as engine fires.
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

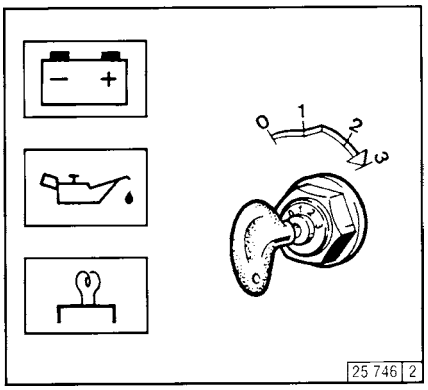
#### with Cold-Start/Flame Glow Plug FR 20/30 = 11 and 23 volts




- Insert key.
  - Position 0 = no operating voltage
- Turn key clockwise
  - Position 1 = operating voltage
  - Pilot lights comes on.
- Push the key in and turn further clockwise against spring pressure
  - Glow plug indicator light comes on
  - Position 2 = Preheat for approx. 20-30 seconds (hold key in position)*
  - Glow plug indicator light goes out
- Release key as soon as engine fires.
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

#### with heating pipe

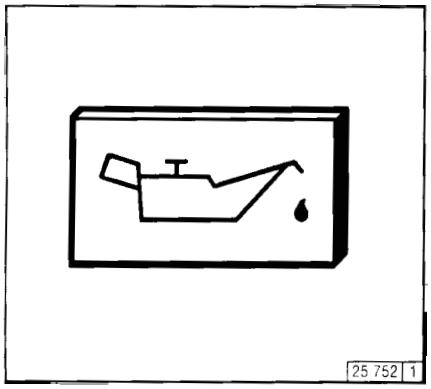



- Insert key.
  - Position 0 = no operating voltage
- Turn key clockwise
  - Position 1 = operating voltage
  - Pilot lights comes on.
- Push key in and turn further clockwise against spring pressure.
  - Position 2 = Preheat for approx. 60 seconds (hold key in position)*
  - Position 3 = Start
- Release key as soon as engine fires.
  - Pilot lights go out.

* By afterignition in position 2 for up to approx. 3 mins, it is possible to lower further the exhaust gas opacity in the revving-up phase.

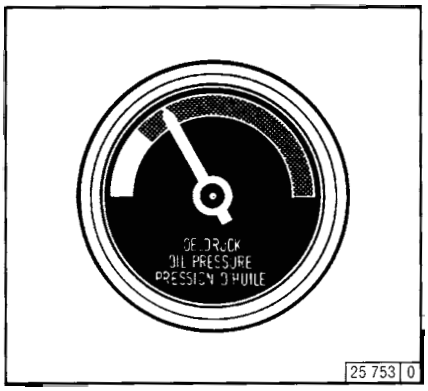
# ENGINE OPERATION
## 3.3 Monitering Systems

### 3.3.1 Engine Oil Pressure



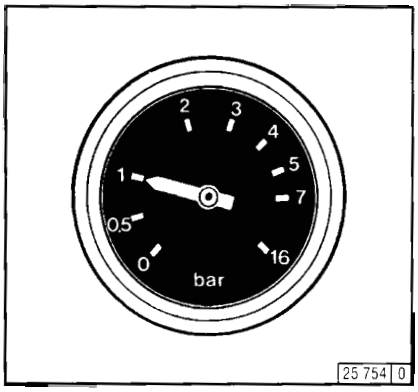

#### Oil Pressure Pilot Light

- The oil pressure pilot light comes on with operating voltage on and engine off.
- The oil pressure pilot light should go out when the engine is running.




#### Oil Pressure Indicator

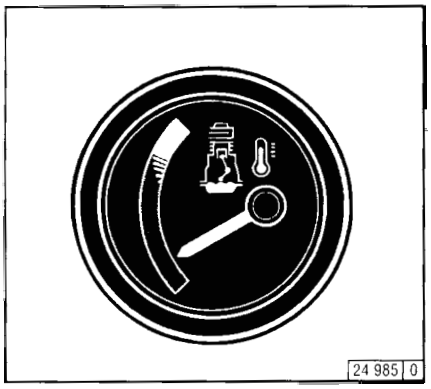
- The pointer must remain in the green sector over the entire range.




#### Oil Pressure Gauge

- The pointer must indicate the minimum oil pressure (see 9.1).

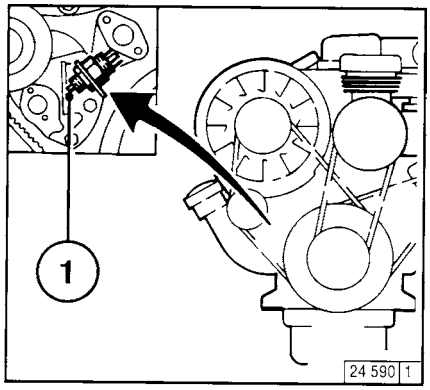
### 3.3.2 Engine Temperature




#### Temperature Gauge

- The engine temperature gauge pointer should remain in the green sector most of the time. It should rarely enter the yellow-green sector. If the pointer enters the orange sector, the engine is overheating. Turn off and establish the cause from the Diagnosis Chart (see 7.1).

### 3.3.3 Cooling Fan Drive

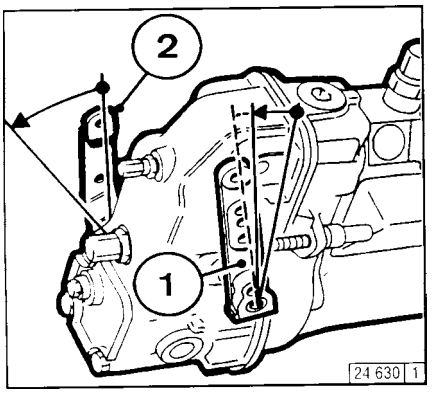



- If the V-belt rips, pressure pin 1 of the electrical switch is actuated by the tension roller and an acoustic or light signal is given.
  **Switch off the engine immediately to prevent overheating.**

# ENGINE OPERATION
## 3.4 Stopping

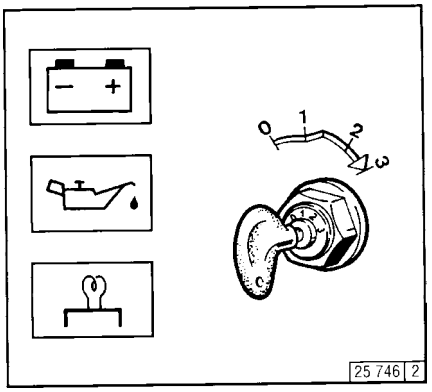
### 3.4.1 Mechanical Shutdown

- Move speed control lever to low idle.
- Operate shutdown lever 2 until the engine comes to a stop. The charge pilot light and the oil pressure pilot light will come on when the engine stops.
- Turn key counter-clockwise (to position 0) and remove. The pilot lights will go out.




### 3.4.2 Electrical Shutdown

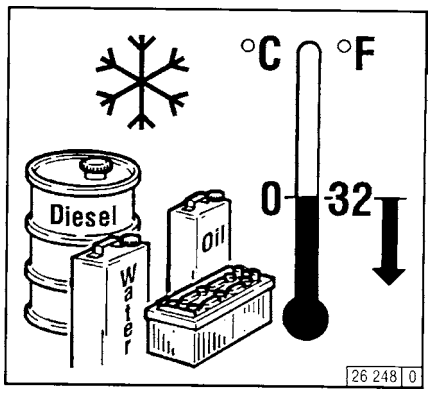
- Turn key counter-clockwise (to position 0) and remove. The pilot lights will go out.




**Ignition Key**

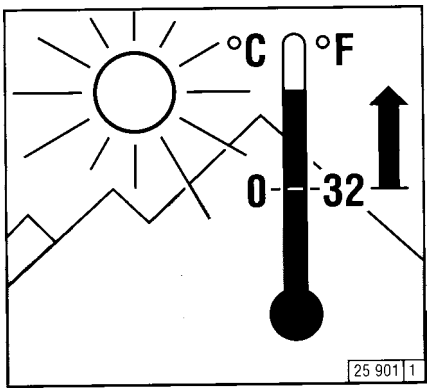
# ENGINE OPERATION
## 3.5 Operating Conditions

### 3.5.1 Winter Operation




- Lube Oil Viscosity
  - Select the oil viscosity (SAE grade) according to the ambient temperature when the engine is started, see 4.1.2
  - Increase oil change frequency when operating below -10°C, see 6.1.1
- Diesel Fuel
  - Use winter-grade diesel fuel for operation below 0°C, see 4.2.2
- Additional Maintenance Work
  - Drain the sludge from the fuel tank once a week. (Unscrew the sludge drain plug).
  - If necessary, allow the oil in the oil bath air cleaner and the engine oil to settle at the ambient temperature.
  - Below -20°C, after removing the starter if necessary, smear the ring gear on the fly wheel via the pinion bore from time or time with cold-resistant grease, (e.g. Bosch grease FT 1 V 31).
- Cold-Start Aid
  - At temperatures near or below freezing point, use glow plugs if necessary, see 3.2.1. This not only lowers the starting limit temperature, but provides easier starting at temperatures normally not requiring a starting aid.
- Battery
  - Efficient cold starting requires a healthy battery, see 6.7.1
  - The starting limit temperatures can be lowered by 4-5 °C by heating the battery up to about +20°C. (To do so, remove the battery and store in a warm place.)

### 3.5.2 High Ambient Temperatures
### High Altitude




- As the altitude and ambient temperature rise, the density of air tends to decrease, which affects the maximum power output of the engine, the exhaust gas quality and, in extreme cases, the starting behavior. Under transient conditions, the engine can be used at altitudes up to 1000m and temperatures up to 30°C. If the engine is to operate under more severe conditions (at higher altitudes or temperatures), it will be necessary to reduce the injected fuel quality and thus, engine power.
- If you have any doubts about engine operation under these or similar conditions, ask your engine or equipment supplier whether the engine has been derated in the interests of reliability, service life and exhaust gas quality (smoke). Otherwise contact DEUTZ SERVICE.

# OPERATING MEDIA
## 4.1 Lube Oil

### 4.1.1 Quality Grade

Lube oils are differentiated according to their performance and quality class. In commom use are specifications named after the **API** (American Petroleum Institute) and **ACEA** (European Engine OIl Sequences).

**Approved API Oils:**

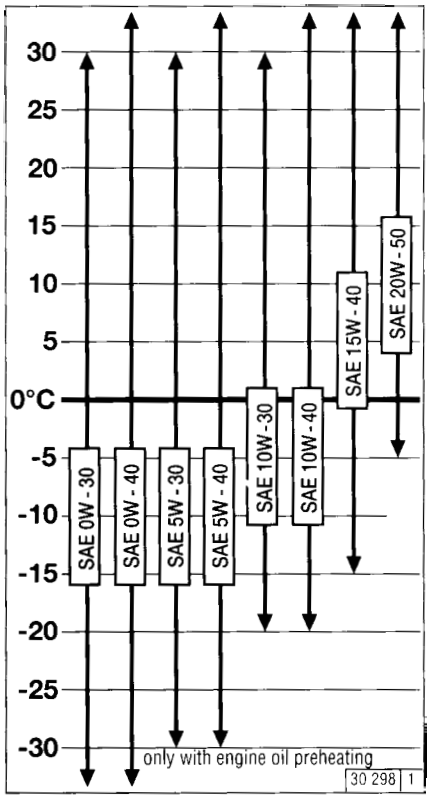
At least: CF-4

**Approved ACEA Oils:**

At least E1-96

### 4.1.2 Viscosity

As the viscosity of the lube oil is dependent on temperature, the choice of SAE grade should be governed by the ambient temperature prevailing at the engine operating site. Optimum operating behaviour will be attained if you take the accompanying oil viscosity diagram as a guide.
Should the temperature fall temporarily below the limits of SAE grade selected, cold starting may be affected but the engine will not be damaged.
In order to keep wear to a minimum, do not exceed application limits for extended periods of time.
Oil changes dictated by the seasons can be avoided by using multi-grade lube oils. Multi-grade oils - particularly light flowing oils - also reduce fuel consumption.




Oil change intervals, see 6.1.1
Oil capacities, see 9.1

# OPERATING MEDIA
## 4.2 Fuel

### 4.2.1 Quality Grade

Use commercially available diesel fuel with less than 0.5% sulphur content. If the sulphur content is higher than 0.5% oil change intervals should be reduced, see 6.1.1

The following fuel specifications / standards are approved:

- DIN EN 590
- BS 2869: A1 and A2
  (with A2, take note of the sulphur content!)
- ASTM D 975-88; 1-D and 2-D
- NATO Code F-54 and F-75

Any exhaust emission levels, which may have been determined during type approval tests always refer to the reference fuel prescribed by the authorities for the type approval test.

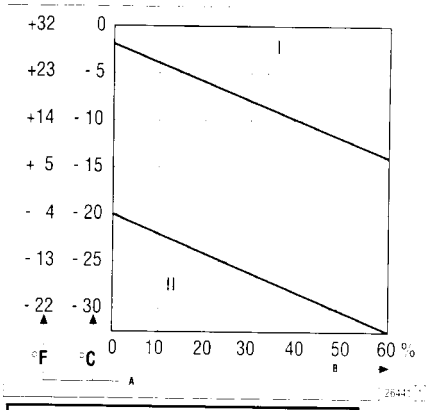
### 4.2.2 Winter-Grade Fuel

Waxing may occure at low temperatures, clogging the fuel system and reducing engine efficiency. If the ambient temperature is less than 0°C, winter-grade fuel (suitable down to -15°C) should be used. (This fuel is usually available from the filling stations well in advance of the cold months). Diesel fuel containing additives (Super diesel) is often on sale as well, for use down to -20°C.

- Below -20°C, petroleum must be added. For the required mixing ratios please refer to the adjacent diagram.
- For artic climate zones down to -44°C special diesel fuels can be used.

If summer-grade diesel fuel must be used at temperatures below 0°C, up to 60% kerosene can be added (see diagram).

In most cases, adequate resistance to cold can be obtained by adding a flow improver (additive). Please inquire at DEUTZ-PARTNER.




| Legend: | |
|---|---|
| I | Summer diesel fuel |
| II | Winter diesel fuel |
| A | Ambient |
| B | Proportion of Kerosene to be |

Mix in tank only. Fill with the appropriate amount of kerosene first, then add the diesel fuel.

# ROUTINE MAINTENANCE

## 5.1 Maintenance Schedule

| Operating hours (OP)[1] Once after [2] 50-150 | every 10 OH or daily | every 125 | 250 | 500 | 1000 | 2000 | 3000 | 5000 | check | clean | change | Operation | See Section |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ● | | | | | | | | ● | | | Oil level in engine / separate container | 6.1.2 |
| ● | | | | | | | | | ● | | | Engine leaks | |
| | ● | | | | | | | | ● | | | Oil bath- and dry type air cleaners 3) 4) | 6.3/6.4 |
| | | ● | | | | | | | ● | | | Battery and cable connectors | 6.7.1 |
| | | ● | ● | ● | | | | | ● | | | Cooling system (depending on engine use) 3) 6) | 6.3.1/6.3.2 |
| ● | | ● | ● | ● | | | | | ● | | ● | Engine oil (depending on engine use) 5) | 6.1.1/6.1.2 |
| ● | | | | ● | | | | | | | ● | Oil filter cartridge | 6.1.3 |
| ● | | | | | | | | | | | ● | Fuel filter cartridge | 6.2.1 |
| ● | | | | ● | ● | | | | ● | | | Valve clearance (adjust if necessary) | 6.6.1 |
| ● | | | | | ● | | | | ● | | | Engine mounts (retighten if necessary) | 9.2 |
| ● | | | ● | | | | | | ● | | | V-belts (retension if necessary) | 6.5 |
| | | | ● | | | | | | ● | | | Warning system | 6.5.5 |
| ● | | | | | | | | | | ● | | Fuel precleaner | 6.2.2 |
| ● | | | | | ● | | | | ● | | | Mountings | 6.8.1 |
| | | | | | ● | | | | ● | | | Flame glow plugs 4) | 6.8.3 |
| | | | | ● | | | | | | | ● | Partial-flow oil filter | 6.1.4 |
| | | | | | | | ● | | ● | | | Sheathed element heater plugs | |
| | | | | | | | | | | | | | |

The specified engine maintenance times are maximum values. Depending on the operating environment, shorter maintenance intervals may be required. Please observe the operating instructions of the equipment manufacturer.

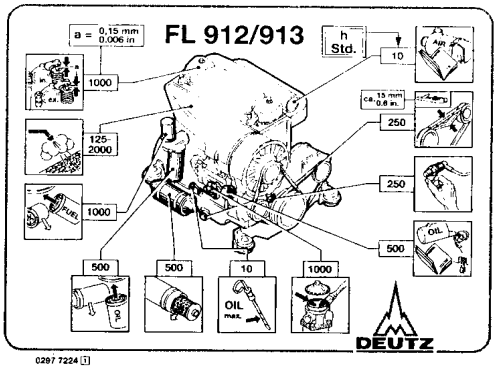
1) Recommended maximum
2) Commissioning new or reconditioned engines
3) Clean if needed, see Section 6.3
4) Change if necessary. If fitted, service after service indicator.
5) Oil change interval, see Section 6.1.1
6) Clean system / cooling fins.

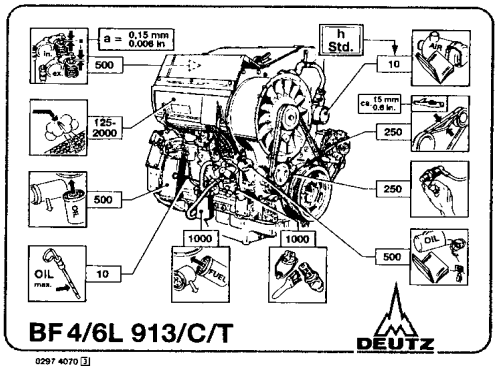
## 5.2 Maintenance Charts

The maintenance charts shown here are supplied as self-adhesive labels with each engine. They should be affixed where they can be seen clearly on the engine or driven equipment.

Check that this is the case.

If necessary, ask your engine or equipment supplier for a fresh supply of labels. Routine work should be carried out according to the schedule in 5.1




Stop the engine before carrying out any maintenance work.

# ROUTINE MAINTENANCE

## 5.3 Completed Maintenance Jobs

| Hours | Date | Signature / Stamp | Hours | Date | Signature / Stamp |
|---|---|---|---|---|---|
| 50-150* | | | – | | |
| 125 | | | 250 | | |
| 375 | | | 500 | | |
| 625 | | | 750 | | |
| 875 | | | 1000 | | |
| 1125 | | | 1250 | | |
| 1375 | | | 1500 | | |
| 1625 | | | 1750 | | |
| 1875 | | | 2000 | | |
| 2115 | | | 2250 | | |
| 2375 | | | 2500 | | |
| 2625 | | | 2750 | | |

* Commissioning new and overhauled engines.

The maintenance jobs duly completed can be recorded in the above table.

# SERVICE AND MAINTENANCE

## 6.1 Lubrication System

### 6.1.1 Oil Change Intervals

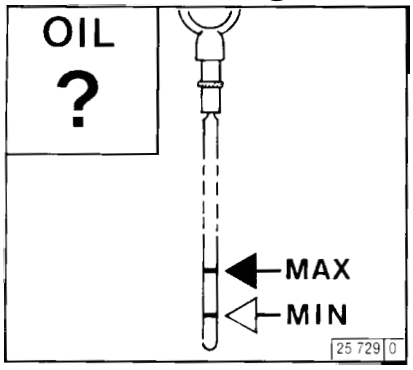
- The oil change intervals are dependent on the engine application and the quality of the lube oil.
- If the engine runs fewer hours during the year than stated in the table, the oil should be changed at least once a year.
- The table refers to the following conditions:
  - For diesel fuel: sulphur content max. 0.5% by weight.
  - Continuous ambient temperatures down to -10°C (+14°F)
- If the sulphur content is > 0.5 to 1% or the continuous ambient temperature below -10°C (+14°F), the intervals between oil changes should be halved.
- In case of fuels containing more than 1% sulphur, contact your **service representative.**

| Installed engines | | Lube oil intervals in OH | | |
|---|---|---|---|---|
| | | Naturally aspirated engines | Turbocharged engines | |
| Lube oil quality | API classification | CF-4/CH-4/CG-4 | CF-4 | CH-4/CG-4 |
| | ACEA classification | E1-E3/96+ E4-98 | E1-E2/96 | E3-96+ E4-98 |
| Normal oil usage, e.g.: Road vehicles, cranes, construction machinery, ships, electrical units, pumps, rail-run vehicles | | 500 | 250 | 500 |
| Heavy-duty oil usage, e.g.: Combine harvesters, emergency pumps, underground equipment, sweeping machines, winter operation equipment, emergency power generating units | | 250 | 125 | 250 |
| **Vehicle engines** | | **Lube oil intervals in km** | | |
| | | Naturally aspirated engine | Turbocharged engine | |
| Lube oil quality | API classification | CF-4/CH-4/CG-4 | CF-4 | CH-4-/CG-~ |
| | ACEA classification | E1-E3/96+ E4-98 | E1-E2/96 | E3-96+ E4- |
| Service group | Annual kilometrage km | average speed approx km/h | | |
| I | > 30 000 | 20 | 10 000 | 5 000 | 10 000 |
| II | 30 000 – 100 000 | 40 | 20 000 | 10 000 | 20 000 |
| III | < 100 000 | 60 | 30 000 | 15 000 | 30 000 |

Change the oil with the engine off but still warm (lube oil temperature approx. 80°C)

### 6.1.2 Checking Oil/ Checking Engine Oil

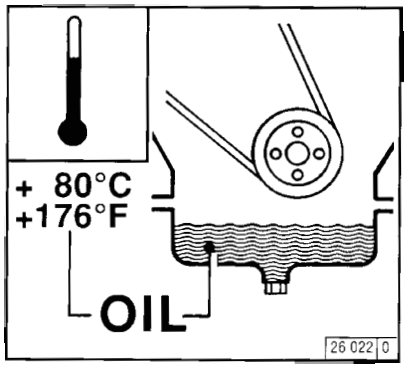
#### 6.1.2.1 Checking Oil Level



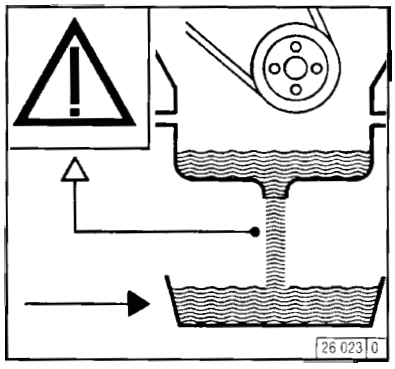

- Ensure that the engine or vehicle is in a horizontal position.
- - **Warm Engine:**
  Switch off engine, wait 5 minutes and check the oil level.
- - **Cold Engine:**
  Check oil level.
  To this end:
- Remove the oil dipstick.
- Wipe the dipstick with a non-fibrous, clean cloth.
- Insert it to the top and remove again.
- Check the oil level, and if necessary, top up to the **"MAX"** mark.
  - If the oil level is only just above the **"MIN"** mark, more oil must be added.

The oil level must not fall below the **"MIN"** marking.

#### 6.1.2.2 Engine Oil Change




- Ensure that the engine or vehicle is on a level surface.
- Allow the engine to warm up
  - Lube oil temperature approx. 80°C.
- Switch off the engine.

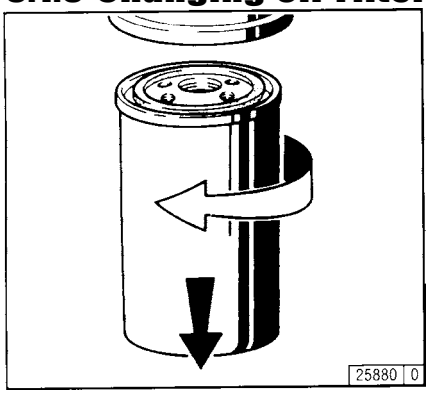



- Place oil tray under the engine.
- Unscrew drain plug.
- Drain oil.
- Fit oil drain plug, with the new gasket and tighten firmly (for torque, see 9.2)
- Fill with lube oil.
  - For grade/viscosity, see 4.1
  - For quantity, see 9.1
- Check oil level, see 6.1.2.1

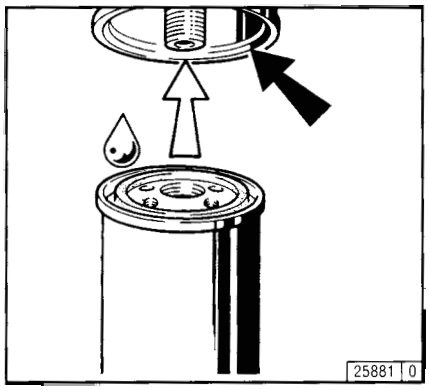
Be careful when draining hot oil - danger of scalds! Do not let used oil run into the soil but catch it in a container ready for proper disposal.

# SERVICE AND MAINTENANCE
## 6.1 Lubrication System

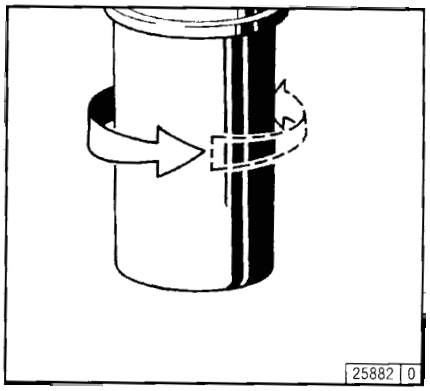
### 6.1.3 Changing Oil Filter




- Undo the filter cartridge using a commercial tool and spin off.
- Catch any dripping oil.



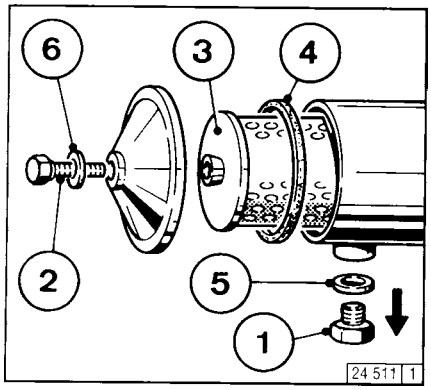

- Clean any dirt from the filter carrier rim.
- Lightly oil the rubber gasket of the new oil filter cartridge.
- Screw in the new cartridge finger tight against the gasket.




- Tighten the oil filter cartridge with another half-turn.
- Check oil level, see 6.1.2
- Check oil pressure, see 3.3.1
- Check cartridge seal for leaks.

Beware of burns from hot oil.

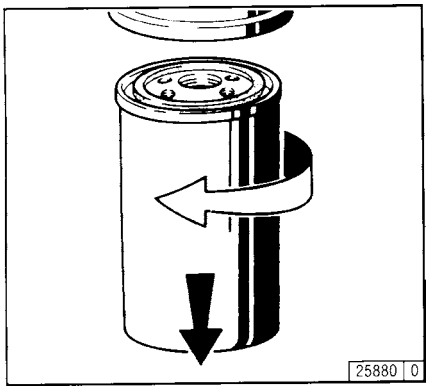
### 6.1.4 Changing the Partail - Flow Oil Filter Insert



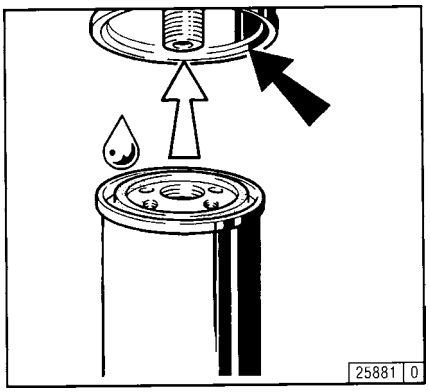

- Unscrew oil drain plug 1 and drain off oil.
- Unscrew tension screw 2. Remove the cover.
- Unscrew the dirtied filter insert 3. Clean the filter housing.
- Check and if necessary replace cover seal 4.
- Screw in oil drain plug 1 with new seal
- Fit new filter insert.
- Screw on cover and sealing ring 6.
- Check for leaks and check the oil pressure during a test run.

# SERVICE AND MAINTENANCE
## 6.2 Fuel System

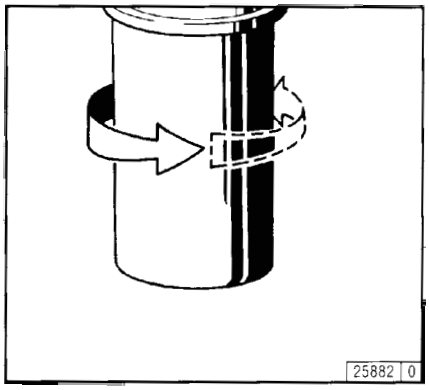
### 6.2.1 Changing Fuel Filter




- Close fuel stopcock.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any fuel.




- Clean any dirt from the filter cartridge with a final half-turn.
- Apply light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- Screw in the new cartridge finger tight against the gasket.

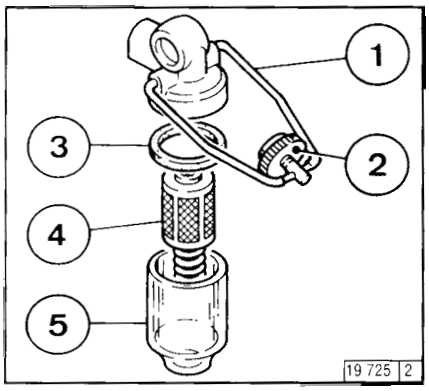



- Tighten the fuel filter cartridge with a final half-turn.
- Open fuel stopcock.
- Check for leaks.

No naked flames when working on the fuel system.
NO SMOKING!

### 6.2.2 Fuel Precleaner

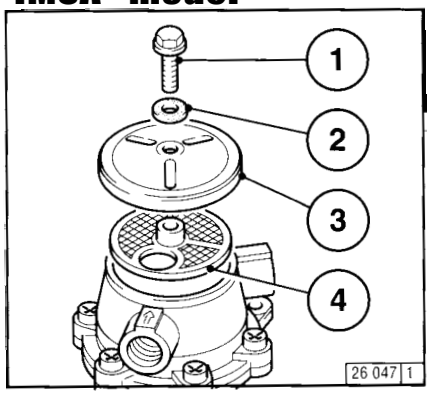
#### Cleaning the Fuel "Bosch" model




- Close the fuel shut-off valve.
- Loosen tensioning nut 2.
- Swing wire cup 1 to the side.
- Remove filter cone 5 with strainer 4 and clean in fuel.
- Use a new seal 3 for filter cone 5.
- Bleed the fuel system, see 3.1.4
- Check for leaks.

No naked flames when working on the fuel system.
NO SMOKING!

#### Cleaning the Fuel Filter "IMSA" model




- Close the fuel shut-off valve.
- Loosen hexagonal nut 1 and unscrew with sealing ring 2.

Close the fuel shut-off valve.

- Remove cover 3.
- Remove fuel strainer 4.
- Clean the fuel strainer 4 in fuel. Replace if necessary.
- Refit in the reverse order.
- Bleed fuel system, see 3.1.4
- Check for leaks.

# SERVICE AND MAINTENANCE
## 6.3 Cooling System

### 6.3.1 Cleaning Intervals

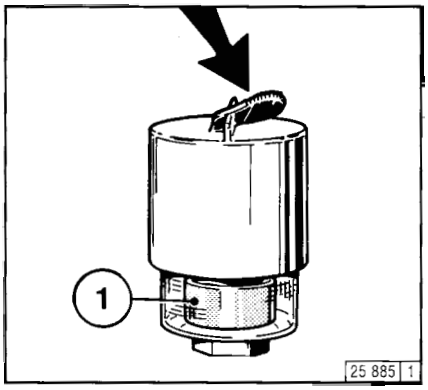
- The amount of contamination in the cooling system depends on the engine
- Spilled oil or fuel on the engine increases the risk of contamination. Be especially careful if the engine is used in dusty environments.
- Serious contamination can occur, for example:
  - on construction sites where there is a high level or air borne dust.
  - in harvesting applications where here are high concentrations of chaff and chopped straw in the vicinity of the machine.
- Because applications vary, cleaning intervals have to be determined from case to case. The cleaning intervals given in the table on the right can be used as a guide.

| **Inspection and cleaning intervals** Recommended OH | **Engine application** |
|---|---|
| 2000 | Ships, Electrical units in enclosed areas, pumps |
| 1000 | Vehicles on reinforced highways |
| 500 | Tractors, fork-lift trucks, mobile electrical units |
| 250 | Vehicles on construction sites and on roads with loose surfaces, constrution machinery, compressors, mining equipment |
| 125 | Agricultural machinery, tractors used for harvesting purposes |

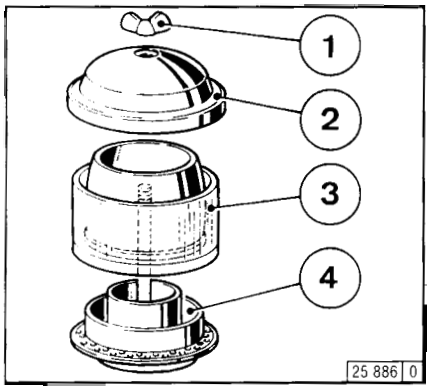
# SERVICE AND MAINTENANCE
## 6.4 Combustion Air Filter

### 6.4.1 Cleaning Intervals

- The amount of dirt in the air cleaner depends on the amount of dust in the air and the size of the air cleaner used. If a high level of dust is anticipated, a cyclone-type precleaner can be fitted to the air cleaner.
- Cleaning intervals will have to be determined from case to case.
- If dry-type air cleaners are used, they should be cleaned only in accordance with the service indicator or the service switch.
- Air cleaner servicing is needed when:
  - **Service indicator**
    the red signal 1 is fully visible when the engine is off.
  - **Service switch**
    the yellow pilot light comes on when the engine is running.
- After carrying out service work, reset the signal by pressing the button on the service indicator.



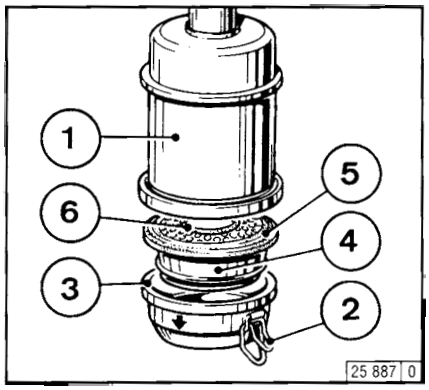

### 6.4.2 Emptying Cyclone Type Precleaner




- Undo wing nut 1 and remove cover 2.
- Remove collector bowl 3 from lower section 4 and empty. Clean leaves, straw and other foreign matter from lower section of precleaner.
- Reposition collector bowl 3 onto lower section 4, fasten cover 2 in place by tightening wing nut 1.

Never fill collector bowl with oil. Replace collector bowl if damaged.

### 6.4.3 Cleaning Oil Bath Air Cleaner



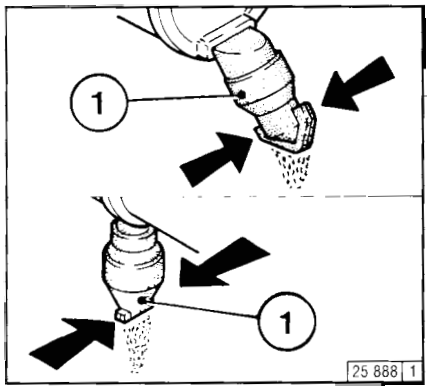

- Turn engine off and wait about 10 minutes for the oil to drain from filter housing 1.
- Release snap clips 2 and remove oil cup 3 together with filter element 4. If necessary pry element out with a screwdriver, taking care not to damage the rubber gasket 5.
- Remove dirty oil and sludge. Clean oil cup.
- Clean filter element 4 in diesel fuel and allow to drip-dry.
- Clean filter housing 1 if very dirty.
- Inspect and replace rubber gasket 5 and 6 if necessary.
- Fill oil cup with engine oil up to the mark (arrow) (for viscosity, see 4.1.2).
- Refit oil cup and element to filter housing and secure with snap rings.

Never clean air cleaner with gasoline. Dispose of cold oil in accordance with environmental regulations.

# SERVICE AND MAINTENANCE
## 6.4 Combustion Air Filter

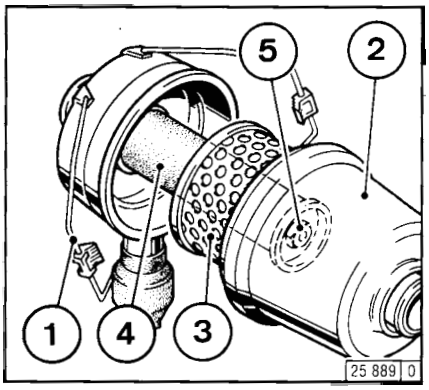
### 6.4.4 Dry Type Air Cleaner

### Dust Discharge Valve




- Empty dust discharge valve 1 by pressing apart lips of discharge slot as indicated by arrows.
- Clean discharge slot from time to time.
- Remove any caked dirt by pressing together the upper section of the valve.
- The amount of dirt in the air cleaner depends on the amount of dust in the air and the size of the air cleaner used. If a high level of dust is anticipated, a cyclone-type precleaner can be fitted to the air cleaner.

### Filter Cartridges



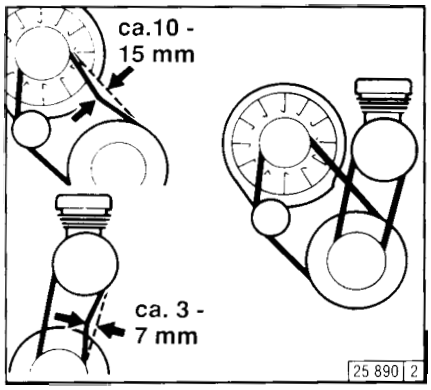

- Undo clip fasteners 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge (replace at least once a year).
- Clean cartridge 3.
  Blow out from inside out with dry compressed air (max. 5 bar), (or in difficult cases, tap out, taking care not to damage the cartridge, or wash according to manufacturer's instructions.
- Through regular removal and replacement, the gaskets on the filter cartridge can become damaged. Check paper filter (light showing through) and gaskets for damage. Replace if necessary.
- After five cleaner services or after two years at the latest, replace safety cartridge 4 (never clean).
  To do so:
  - Undo hex. nut 5 and remove cartridge 4.
  - Install new cartridge, insert and tighten hex. nut.
- Cleaning intervals will have to be determined from case to case.
- Install cartridge 3, replace hood 2 and do up clip fasteners 1.

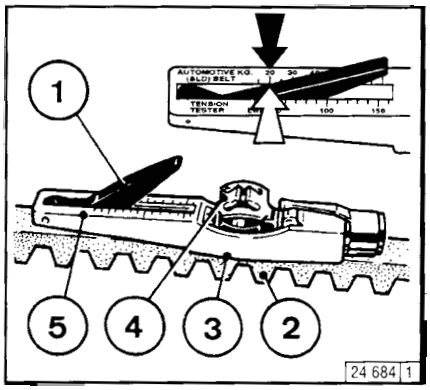
Never clean filter cartridge with gasoline or hot fluids.

# SERVICE AND MAINTENANCE

## 6.5 Belt Drives

### 6.5.1 Checking V-Belts

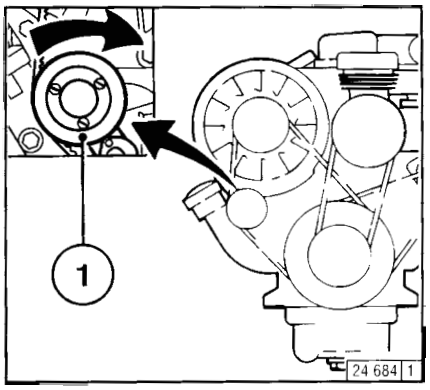



- Inspect entire V-belt for damage.
- Replace damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.
- To check the tension of the V-belt, use a tension gauge (see 9.3).
  - Place indicator arm 1 into gauge.
  - Position gauge on V-belt 2, midway between the pulleys, with flange 3 on bottom of gauge against the edge of belt.
  - Push slowly on the black pad 4 at right angles to belt 2 until the spring is heard or felt to trigger.
  - Carefully remove the gauge without altering the position of the indicator arm 1.
    Read off the value where the black indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1
  - If necessary, retension belt and measure again.

Check tension and change belts only with the engine off. Refit belt guard, if provided.

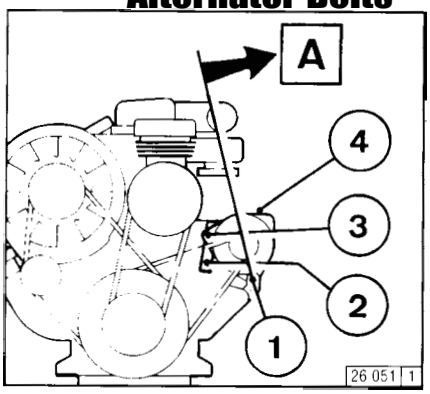
### 6.5.2 Changing the Fan V-Belt




- To replace, press tension roller 1 using a commercial tool and remove the V-belts.
- Fit new V-belts.

When new V-belts are fitted check the belt tension after ca. 15 minutes running time.

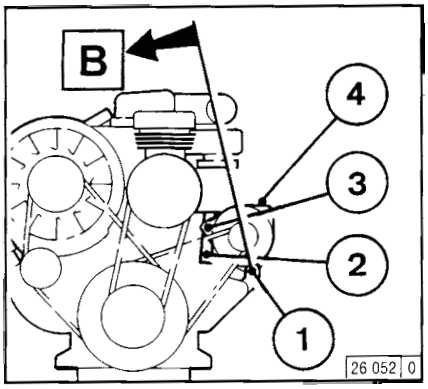
### 6.5.3 Tensioning Alternator Belts




- Loosen bolts 1, 2 and 3.
- Press alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.

Only check/tension/replace V-belts when the engine is at standstill. If necessary, replace V-belt cover.

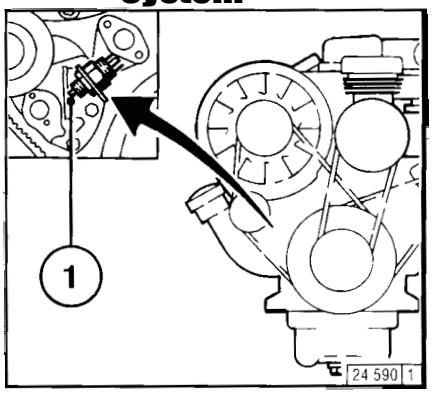
### 6.5.4 Changing Alternator Belts




- Remove fan V-belts as decribed under 6.5.2
- Loosen bolts 1, 2 and 3.
- Swing alternator 4 inwards in direction of arrow B.
- Remove V-belts and place on new belt.
- Swing alternator 4 outwards in direction of arrow A until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.
- Fit fan V-belts.

Retighten new V-belts after 15 minutes running time.

### 6.5.5 Checking Warning System



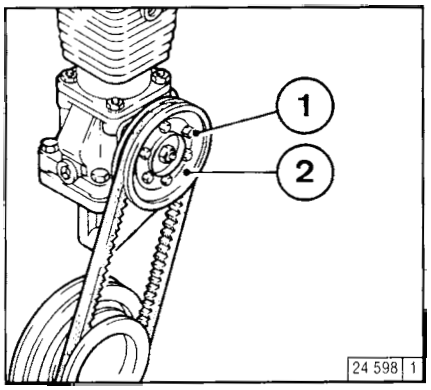

- If the V-belt rips, pressure pin 1 of the electrical switch is actuated by the tension roller and an accoustic or light signal is given.
- Functional check by pressing in pin 1.

Only carry out a check when the engine is at a standstill.

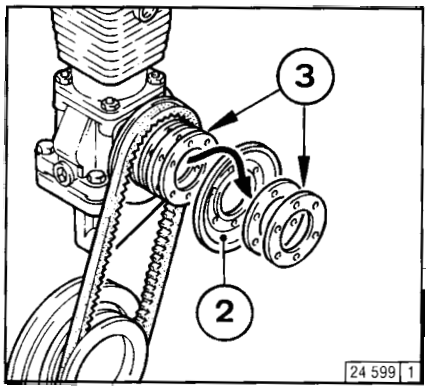
# SERVICE AND MAINTENANCE

## 6.5 Belt Drives

### 6.5.6 Tensioning and Changing Air Compressor V-Belts



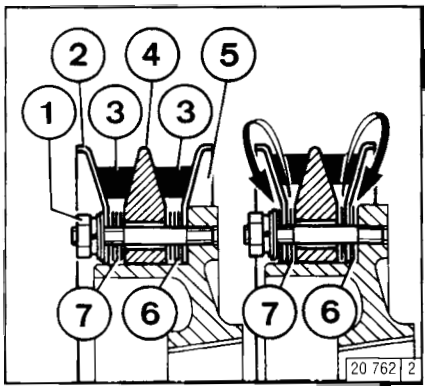

- Unscrew hexagonal bolts 1.
- Remove outer half of belt pulley 2.
- If necessary replace the V-belts.




- To tighten, remove one or more of the inner intermediate discs 3. Place the removed half of the V-belt pulley 2.
- Retighten bolt 1. While tightening, simultaneously rotate the engine to prevent the V-belt from being crushed.

When new V-belts are fitted, check the belt tension after ca. 15 minutes running time.

### 6.5.7 Air Compressor Design with Doube V-Belt



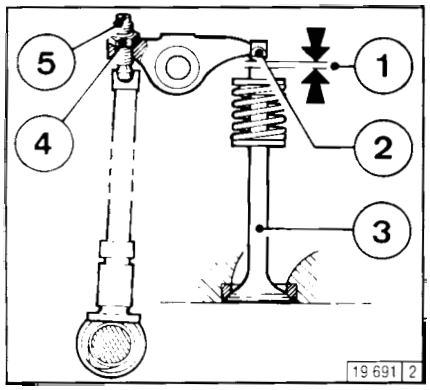

- Screw off hexagonal nut 1, remove V-belt pulley half 2, V-belt 3 and intermediate disc packet 7.
- Remove intermediate disc 4, rear V-belt 3, intermediate disc packet 6 and V-belt disc half 5.
- To tighten, remove on or more of the intermediate discs from packet 6 or 7. Place the removed discs in front of or behind V-belt pulley halves 2, so that the V-belt remains aligned. Always take the same number of discs from each packet.
- Fit in the reverse order. While tightening nut 1, the engine must be rotated to prevent the V-belts from being crushed.

If a V-belt is worn or damaged, both belts in the set must be replaced. The difference in the length of the new V-belts may not exceed 0.15%.

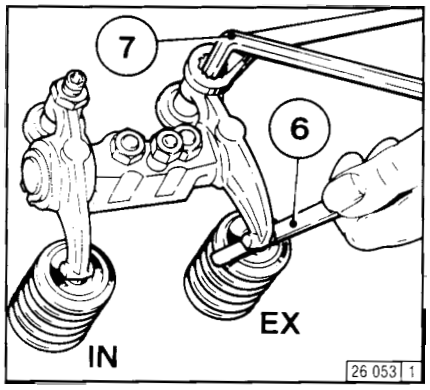
Only check or replace V-belts when the engine is at a standstill. If necessary replace V-belt cover. When new V-belts are fitted, check the belt tension after approx. 15 minutes running time.

# SERVICE AND MAINTENANCE
## 6.6 Adjustments

### 6.6.1 Checking / Adjusting Valve Clearances




- Remove the cylinder head cover.
- Position crankshaft as per schematic
- Before adjusting valve clearance, allow engine to cool down for at least 30 minutes. The oil temperature should be below 80°C.
- Check valve clearance 1 between rocker arm / tappet contact face 2 and valve stem 3 with feeler gauge 6 (there should be only slight resistance when feeler blade is inserted).
  For permissible valve clearance, see 9.1




- Adjust valve clearance if necessary:
  - Release locknut 4.
  - Use screwdriver 7 to turn setscrew 5 so that the correct clearance is attained after locknut 4 has been tightened.
- Check and adjust valve clearance on all remaining cylinders.
- Replace cylinder head cover (use new gasket if needed).

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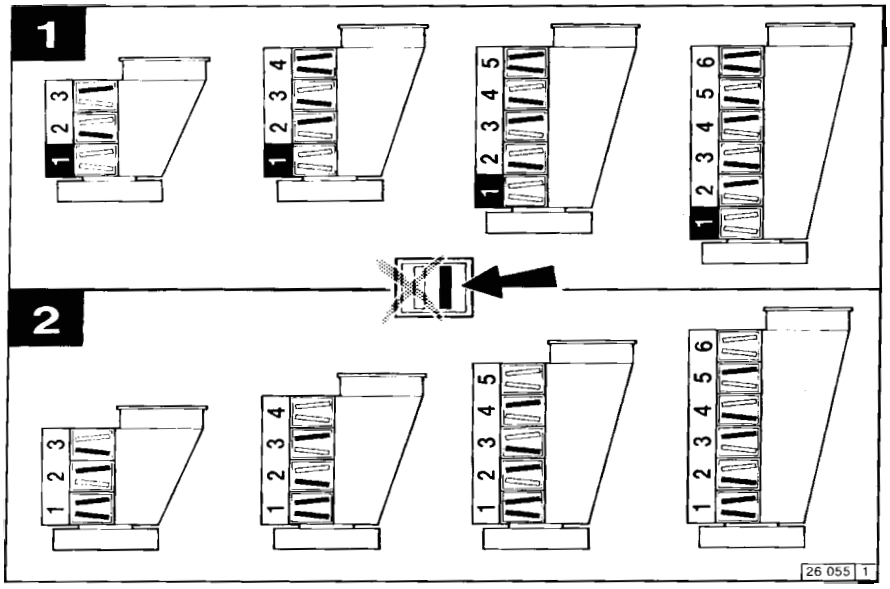
Only inclined engines are fitted with an additional oil jet for lubrication of the bearing. Any adjustments must be carried out in an authorized specialist workshop.

### 6.6.1.1 Valve Clearance Adjustments Schematic




- **Crankshaft Position 1:**
  Turn crankshaft until both valves in cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valve **marked in black** on schematic. Mark respective rocker arm with chalk to show that adjustment has been done.

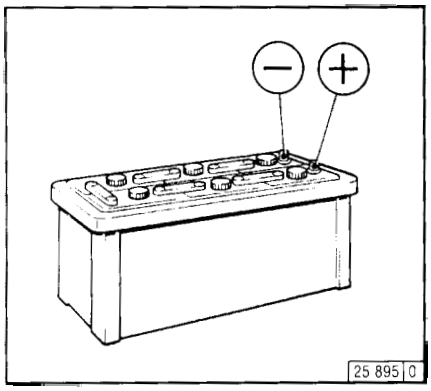
- **Crankshaft Position 2:**
  Turn crankshaft one full revolution (360°). Adjust clearance of valves **marked in black** on schematic.

# SERVICE AND MAINTENANCE

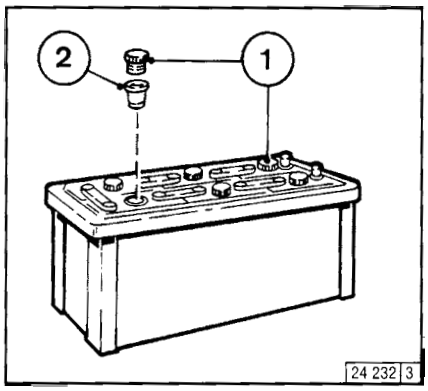
## 6.7 Accessories

### 6.7.1 Battery

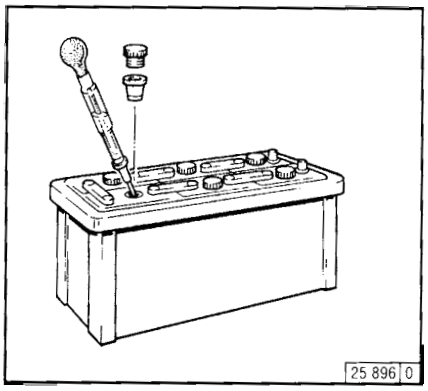
### 6.7.1.1 Checking Battery and Cable Connectors




- Keep battery clean and dry.
- Undo dirty clamps.
- Clean terminal posts (+ and - ) and clamps of the battery, grease with acid-free and acid-resistant grease.
- When reassembling, ensure that clamps make good contact. Turn clamp bolts finger tight.




- Remove caps 1.
- If testers 2 are used, the electrolyte should come up to their base.
- If testers are not used, the electrolyte level should be 10 - 15mm above the top of the plates.
- If necessary, top up with distilled water.
- Replace caps.




- Measure the electrolyte density of individual cells with a commercial hydrometer.

The hydrometer reading (see table on following page) indicates the state of charge.
During measurement, the temperature of the electrolyte should preferably be +20°C.

| in [kg/ l] | | in[°Bé (Baumégrad)*] | | State of Charge |
|---|---|---|---|---|
| Normal | Tropics | Normal | Tropics | |
| 1,28 | 1,23 | 32 | 27 | Fully charged |
| 1,20 | 1,12 | 24 | 16 | Half charged, recharge |
| 1,12 | 1,08 | 16 | 11 | Discharged, recharge immediately |

* Measurement of electrolyte density in ° Bé (Baumégrad) is out of date and rarely used today.

The gasses emitted by the battery are explosive! Keep sparks and naked flames away from the battery. Do not allow battery acid to come into contact with skin or clothing. Wear protective goggles. Do not rest tools on the battery.

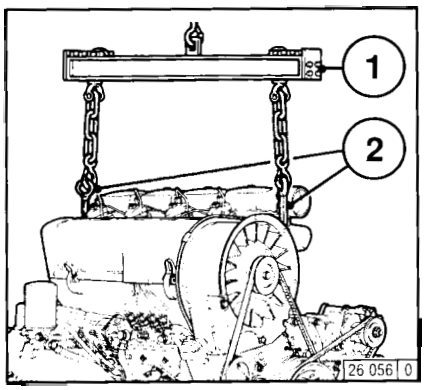
# SERVICE AND MAINTENANCE

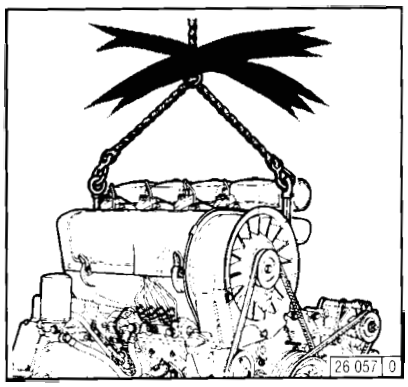
## 6.7 Accessories

### 6.7.2 Three-Phase Alternator

- Never disconnect the cable between battery, alternator and regulator while the engine is **running.**
- If, however, it is necessary to start and operate the engine without the battery, disconnect the regulator from the alternator before starting.
- Be sure not to confuse the battery terminals.
- Replace defective bulb of the charge pilot lamp immediately.
- When washing the engine, cover up the alternator and regulator.
- The habit of touching a lead against the frame to check whether it is live must under no circumstances be used with three-phase electrical systems.
- In case of electric welding connect ground terminal on the welder directly to the piece being welded.

### 6.7.3 Lifting Tackle




- Always use proper lifting tackle 1 when transporting the engine.
- After transportation and before commissioning of the engine: Remove transport eyes 2.

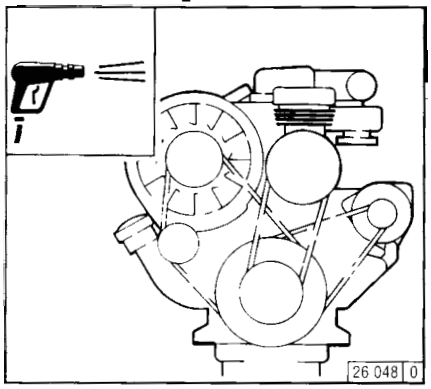
Use only the correct lifting tackle.

# SERVICE AND MAINTENANCE

## 6.8 Engine Cleaning

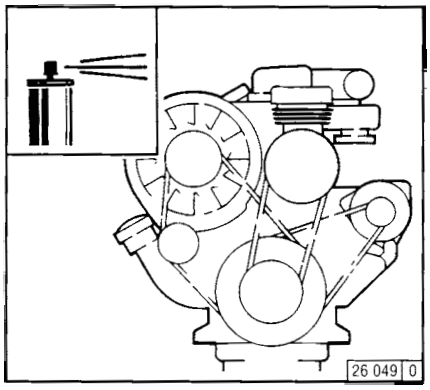
### 6.8.1 Cleaning the Engine

#### With Compressed Air



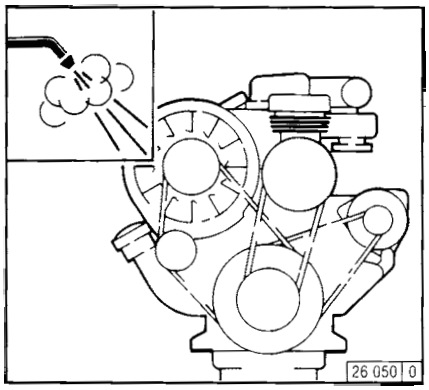

- Switch off the engine.
- Remove engine covers, cooling air hoods.
  Replace following cleaning and before test run.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Pass compressed air through the engine, being careful with the cooler and cooling fins (start at the exhaust side).
  Remove dirt which has been blown into the inner compartment.

#### With Cold-Cleaning Compound




- Switch off the engine.
- Remove engine covers, cooling-air hoods.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Spray engine with commercial cold-cleaning compound and leave to work for approx. 10 minutes.
- Spray engine clean with water jet and if necessary repeat procedure.
- Drive the engine warm so that remaining water evaporates.

#### With High=Pressure Equipment

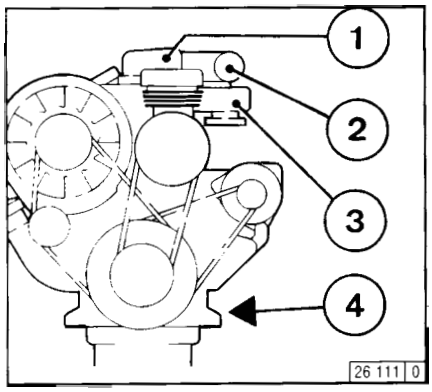



- Switch off the engine.
- Remove engine covers, cooling-air hoods.
- Cover electrical / electronic components / connections (e.g. alternator, starter, regulator, solenoid).
- Clean engine with steam jet (max. spray pressure 60 bar, max. steam temperature 90°C).
- Drive the engine warm so that remaining water evaporates.

The engine may only be cleaned when it is at a standstill.

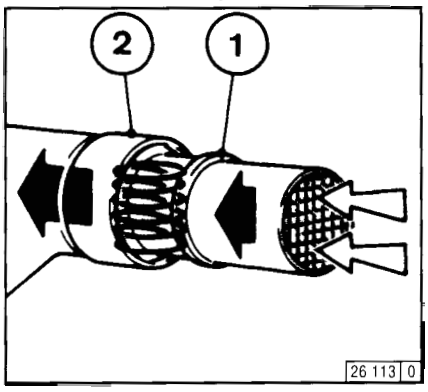
# SERVICE AND MAINTENANCE
## 6.9 Additional Maintenance

### 6.9.1 Checking the Mountings



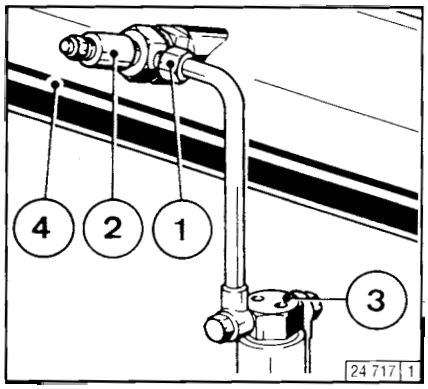

- Cylinder head cover 1
- Air-intake pipe 2
- Coupling sleeves
- Exhaust line 3
- Engine mounting 4

### 6.9.2 Checking the Function of the Heating Pipe

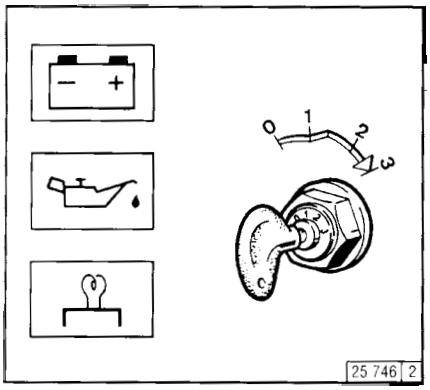



- When functioning correctly, the heating pipe heats up via the integrated heating coil when starting the preheating
  - heating pipe
  - air intake pipe

### 6.9.3 Checking the Function of the Flame Glowing System

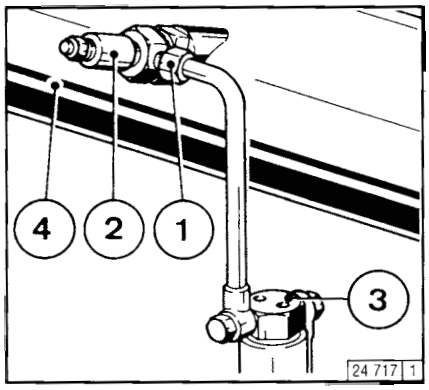



- When functioning correctly, intake pipe 4 heats up in the vicinity of flame glow plug 2 when starting with preheating.



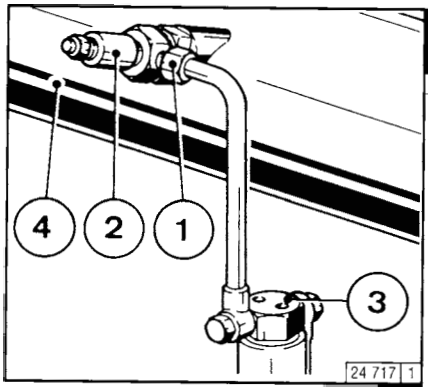

### Test Stage 1:

- Move speed adjustment lever and shut-off lever to “stop” position.
- Insert key
  - Position 0 = no operating voltage
- Turn key clockwise.
  - Postion 1 = operating voltage
  - Pilot light comes on.
- Press in key and turn further clockwise against the spring pressure.
  - Position 2 = preheat, hold for approx. 1 minute.
  - Preheat lamp lights up.
- Otherwise flame glow plug defective or power interrupted.




### Test Stage 2:

- Loosen pipe connection 1.
- Rotate engine with starter, key on switch position 3.
- Fuel must be emitted at loosened pipe connection. Otherwise have the system, solenoid 3, checked by a specialist.




### Test Stage 3:

- Loosen pipe connection 1.
- Remove flame glow plug 2.
- Rotate engine with starter, key in switch postition 3.
- Fuel must be emitted at flame glow plug 2, replace plug 2 as necessary.
- Use sealant DEUTZ DW 47 when fitting flame glow plug 2.
- Refit flame glow plug 2 on fuel line. Keep clear of rotating parts.

Collect any leaked fuel and dispose of in an environmentally friendly fashion.

# FAULTS, CAUSES AND REMEDIES

## 7.1 Diagnosis Chart

| Fault: Engine fails or is difficult to start | Engine starts but runs unevenly or stalls | Engine overheats. Temperature monitor gives warning | Engine gives poor performance | Engine not firing on all cylinders | Engine has little or no oil pressure | Engine oil consumption excessive | Engine smokes – blue | – white | – black | Cause | Remedy | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Inspect | I |
| | | | | | | | | | | | Adjust | A |
| | | | | | | | | | | | Replace | R |
| | | | | | | | | | | | Clean | C |
| | | | | | | | | | | | Top up | T |
| | | | | | | | | | | | Lower level | L |
| ● | | | | | | | | | | Not declutched (where possible) | **Section** | |
| ● | | | | | | | | ● | | Below starting limit temperature | **Operation** | **I** |
| ● | | | ● | | | | | | | Engine shut-off lever not in stop position (shut-off magnet defective) | | **I** |
| | | ● | | | ● | | | | | Oil level too low | | **I** |
| | | ● | ● | | | ● | ● | | | Oil level too high | | **T** |
| | | | | | ● | ● | ● | | | Excessive inclination of engine | | **L** |
| | | | | | | ● | ● | | | Engine predominantly operated at lower load | | **I/A** |
| ● | | ● | ● | | | ● | ● | | ● | Air cleaner clogged / turbocharger defective | | **I** |
| | | ● | ● | | | | | | ● | Air cleaner service switch / indicator defective | **Combustion air** | **R** |
| | | | ● | | | | | | | LDA defective (leak in connecting line) only with charged engines | | **I/R** |
| | | ● | ● | | | | | | ● | Exhaust counter pressure too high | | **I/R** |
| | | | ● | | | | | | ● | Charge-air line leaking, only with charged engines | | **I** |
| | | ● | | | | | | | | Charge-air line leaking, only with charged engines | | **I/A** |
| | | ● | ● | | | | | | ● | Charge air cooler clogged | **Cooling system** | **I/C** |
| | | ● | | | ● | | | | | Oil cooler air and/or oil side clogged | | **I/C** |
| | | ● | | | | | | | | Cooling fan or exhaust thermostat defective, V-belts ripped or loose | | **I/C** |
| | | ● | | | | | | | | Cooling air temperature rise / heating short circuit | | **I/R** |
| | | ● | | | | | | | | Cooling air fins loose, cracked or missing | | **I** |

| Fault: Engine fails or is difficult to start | Engine starts but runs unevenly or stalls | Engine overheats. Temperature monitor gives warning | Engine gives poor performance | Engine not firing on all cylinders | Engine has little or no oil pressure | Engine oil consumption excessive | Engine smokes – blue | – white | – black | Cause | Remedy | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Inspect | I |
| | | | | | | | | | | | Adjust | A |
| | | | | | | | | | | | Replace | R |
| | | | | | | | | | | | Clean | C |
| | | | | | | | | | | | Top up | T |
| | | | | | | | | | | | Lower level | L |
| ● | | | | | | | | | | Battery defective or discharged | **Section** | |
| ● | | | | | | | | | | Electric cable connections to starter electrical system loose or oxidised | **Electrics** | **I** |
| ● | | | | | | | | | | Starter defective or pinion does not engage | | **I** |
| | | | | | ● | | | | | Oil pressure switch/oil pressure gauge defective | | **I** |
| ● | ● | ● | ● | ● | | | | ● | ● | Incorrect valve clearance | | **I/R** |
| ● | ● | | ● | ● | | | | | | Leaking injection line | **Engine** | **A** |
| | | ● | | | | | | | | Vent line clogged | | **I/C** |
| ● | ● | | | | | | | ● | | Flame glow system/heating pipe defective | | **I/C** |
| ● | ● | ● | ● | ● | | | | ● | ● | Injection valve defective | | **I/R** |
| ● | ● | | ● | ● | | | | | | Air in fuel system | | **I/R** |
| ● | ● | | ● | ● | | | | | | Fuel filter/fuel precleaner clogged | | **P/R** |
| | | ● | | | | ● | | | | Oil filter defective | | **I/C/R** |
| ● | | | | | ● | ● | | | | Incorrect SAE class or grade of engine lube oil | | **R** |
| ● | ● | | ● | ● | | | | ● | ● | Compression pressure too low | | **R** |
| | | | | | | | ● | | | Oil in combustion chamber | | **I** |
| | | | | | | | | | | | | **I/C** |

# ENGINE PRESERVATION
# 8.1

If the engine is to remain idle for an extended period of time, it is necessary to take protective measures to prevent rust formation. The preservative measures described here will protect the engine for up to 6 months. The procedure will have to be reversed before the engine is recommissioned.

- Anti-corrosion oils to specification:
  - MIL-L-21260B
  - TL 9150-037/2
  - Nato Code C 640 / 642
- Recommended cleansing agent to remove preservatives when recommissioning engine:
  - Petroleum benzine (hazardous materials class A3)

## 8.1.1 Preserving Engine

- Clean engine (with cold cleansing agent if preferred) using high pressure equipment.
- Run engine until warm, then turn off.
- Drain engine oil, see 6.1.2 and fill with anti-corrosion oil.
- If necessary, clean oil bath cleaner, see 6.4.3, and fill with anti-corrosion oil.
- Drain fuel from tank.
- Make up a mixture of 90% diesel fuel and 10% anti-corrosion oil, and refill fuel tank.
- Run engine for about 10 minutes.
- Turn engine off.
- Turn engine over manually several times to preserve the cylinders and combustion chamber. When rotating with starter, place shut-off lever in stop position.
- Remove V-belts and store dry in wrapped condition.
- Spray grooves on V-belts pulleys with anti-corrosion spray.

## 8.1.2 Removing Engine Preservatives

- Remove anti-corrosion agent from grooves in V-belt pulleys.
- Install V-belts. Retension after brief operation if necessary, see 6.5
- Remove plugs from intake port and exhaust port.
- Set the engine in operation.

# TECHNICAL SPECIFICATIONS
## 9.1 Engine Specifications and Settings

| Model | | F3L 912 | F4L 912 | F5L 912 | F6L 912 |
|---|---|---|---|---|---|
| Numbers of cylinders | | 3 | 4 | 5 | 6 |
| Cylinder arrangement | | vertical in line | | | |
| Bore | [mm] | 100 | | | |
| Stroke | [mm] | 120 | | | |
| Total displacement | [cm³] | 2827 | 3770 | 4712 | 5655 |
| Compression ratio | [ε] | 19 | | | |
| Working cycle | | 4-stroke diesel induction engine | | | |
| Combustion system | | direct injection | | | |
| Direction of rotation | | counterclockwise | | | |
| Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator) | [ca. kg] | 270 [5] | 300 [5] | 380 [5] | 410 [5] |
| Engine power | [kW (PS)] | 1) | | | |
| Speed | [1/min] | 1) | | | |
| Lubrication | | pressure lubrication | | | |
| SAE oil | | 15W 40 | | | |
| Oil temperature in oil pan | [°C] | 125 | | | |
| Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed | [bar] | 0,4 [4] | | | |
| Oil change quantity without filter | [ca. ltr.] | 9,0 [3] | 12,0 [3] | 13,5 [3] | 14,5 [3] |
| Oil change quantity with filter | [ca. ltr.] | 9,5 [3] | 12,5 [3] | 14,0 [3] | 15,5 [3] |
| Valve clearance with cold engine | [mm] | inlet 0.15 + 0.05 / exhaust 0.15 + 0.05 | | | |
| Opening pressure of the injection valve | [bar] | 250 +8 | | | |
| Start of delivery | [°crank angle b TDC] | 1) | | | |
| Firing order | | 1–2–3 | 1–3–4–2 | 1–2–4–5–3 | 1–5–3–6–2–4 |
| V-belt pressure: pretension / tighten | | preload / torquing load [2] | | | |
| Alternator fan | [N] | 450 / 300 ± 20 | | | |
| Compressor | [N] | 550 / 400 ± 20 | | | |

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1
2) Tighten after 15 minutes, after the engine has been driven under load.
3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**
4) Values for engines without engine oil heating.
5) Ca. value can vary depending on oil pan design.

| Model | | F3L 913 | F4L 913 | F6L 913 |
|---|---|---|---|---|
| Numbers of cylinders | | 3 | 4 | 6 |
| Cylinder arrangement | | vertical in line | | |
| Bore | [mm] | 102 | | |
| Stroke | [mm] | 125 | | |
| Total displacement | [cm³] | 3064 | 4086 | 6128 |
| Compression ratio | [ε] | 19 | | |
| Working cycle | | 4-stroke diesel induction engine | | |
| Combustion system | | direct injection | | |
| Direction of rotation | | counterclockwise | | |
| Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator) | [ca. kg] | 277 [4] | 320 [4] | 420 [4] |
| Engine power | [kW (PS)] | 1) | | |
| Speed | [1/min] | 1) | | |
| Lubrication | | pressure lubrication | | |
| SAE oil | | 15W 40 | | |
| Oil temperature in oil pan | [°C] | 125 | | |
| Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed | [bar] | 0,4 [4] | | |
| Oil change quantity without filter | [ca. ltr.] | 8,0 [3] | 12 [3] | 16,5 [3] |
| Oil change quantity with filter | [ca. ltr.] | 9,5 [3] | 13,5 [3] | 18,5 [3] |
| Valve clearance with cold engine | [mm] | inlet 0.15 + 0.05 / exhaust 0.15 + 0.05 | | |
| Opening pressure of the injection valve | [bar] | 250 + 8 | | |
| Start of delivery | [°crank angle b TDC] | 1) | | |
| Firing order | | 1–2–3 | 1–3–4–2 | 1–5–3–6–2–4 |
| V-belt pressure: pretension / tighten | | preload / torquing load [2] | | |
| Alternator fan | [N] | 450 / 300 ± 20 | | |
| Compressor | [N] | 550 / 400 ± 20 | | |

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1
2) Tighten after 15 minutes, after the engine has been driven under load.
3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**
4) Ca. value can vary depending on oil pan design.

# TECHNICAL SPECIFICATIONS

## 9.1 Engine Specifications and Settings

| Model 913/C/CT | | F3L 913W | F4L 912W | F6L 912W |
|---|---|---|---|---|
| Numbers of cylinders | | 3 | 4 | 6 |
| Cylinder arrangement | | | vertical in line | |
| Bore | [mm] | | 102 | |
| Stroke | [mm] | | 125 | |
| Total displacement | [cm³] | 3064 | 4086 | 6128 |
| Compression ratio | [ε] | | 22 | |
| Working cycle | | | 4-stroke diesel induction engine | |
| Combustion syst | | | direct injection | |
| Direction of rotation | | | counterclockwise | |
| Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator) | [ca. kg] | 270 [4] | 300 [4] | 410 [4] |
| Engine power | [kW (PS)] | | 1) | |
| Speed | [1/min] | | 1) | |
| Lubrication | | | pressure lubrication | |
| SAE oil | | | 15W 40 | |
| Oil temperature in oil pan | [°C] | | 125 | |
| Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed | [bar] | | 0,4 [4] | |
| Oil change quantity without filter | [ca. ltr.] | 8,0 [3] | 12 [3] | 16,5 [3] |
| Oil change quantity with filter | [ca. ltr.] | 9,5 [3] | 13,5 [3] | 18,5 [3] |
| Valve clearance with cold engine | [mm] | | inlet 0.15 + 0.05 / exhaust 0.15 + 0.05 | |
| Opening pressure of the injection valve | [bar] | | 120 + 10 | |
| Start of delivery | [°crank angle b TDC] | | 1) | |
| Firing order | | 1–2–3 | 1–3–4–2 | 1–5–3–6–2–4 |
| V-belt pressure: pretension / tighten | | | preload / torquing load [2] | |
| Alternator fan | [N] | | 450 / 300 ± 20 | |
| Compressor | [N] | | 550 / 400 ± 20 | |

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1
2) Tighten after 15 minutes, after the engine has been driven under load.
3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**
4) Ca. value can vary depending on oil pan design.

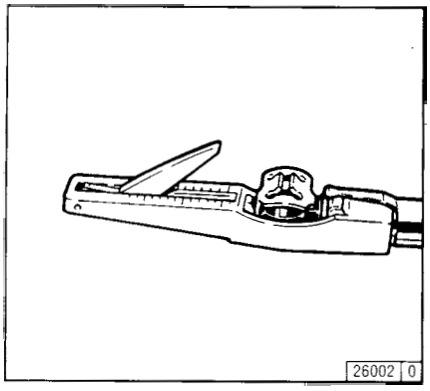
| Model 913/C/CT | | BF4L 913 | BF6L 913 | BF6L 913 C |
|---|---|---|---|---|
| Numbers of cylinders | | 4 | 6 | 6 |
| Cylinder arrangement | | | vertical in line | |
| Bore | [mm] | | 102 | |
| Stroke | [mm] | | 125 | |
| Total displacement | [cm³] | 4086 | 6128 | 6128 |
| Compression ratio | [ε] | 18 | 18 | 17 |
| Working cycle | | | supercharged 4-stroke diesel induction engine | |
| Combustion syst | | | direct injection | |
| Direction of rotation | | | counterclockwise | |
| Weight incl. integrated cooling system as per DIN 70020-A (without starter, with alternator) | [ca. kg] | 360 [5] | 485 [5] | 510 [5] |
| Engine power | [kW (PS)] | | 1) | |
| Speed | [1/min] | | 1) | |
| Lubrication | | | pressure lubrication | |
| SAE oil | | | 15W 40 | |
| Oil temperature in oil pan | [°C] | | 125 | |
| Min. oil pressure in warm condition (120 °C) at low idling speed / rated speed | [bar] | | 0,5 [4] | |
| Oil change quantity without filter | [ca. ltr.] | 9,5 [3] | 16,0 [3] | 16,0 [3] |
| Oil change quantity with filter | [ca. ltr.] | 11,5 [3] | 18,2 [3] | 18,2 [3] |
| Valve clearance with cold engine | [mm] | | inlet 0.15 + 0.05 / exhaust 0.15 + 0.05 | |
| Opening pressure of the injection valve | [bar] | | 250 + 8 | |
| Start of delivery | [°crank angle b TDC] | | 1) | |
| Firing order | | 1–3–4–2 | 1–5–3–6–2–4 | 1–5–3–6–2–4 |
| V-belt pressure: pretension / tighten | | | preload / torquing load [2] | |
| Alternator fan | [N] | | 450 / 300 ± 20 | |
| Compressor | [N] | | 550 / 400 ± 20 | |

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1
2) Tighten after 15 minutes, after the engine has been driven under load.
3) Ca. value can vary depending on model. **The upper oil dipstick marking should always be taken as authoritative.**
4) Values for engines without engine oil heating.
5) Ca. value can vary depending on oil pan design.

# TECHNICAL SPECIFICATIONS
## 9.2 Torque Wrench Settings

| Location | Preload [Nm] | Torquing load 1st stage | 2nd stage | 3rd stage | 4th stage | Total | Remarks |
|---|---|---|---|---|---|---|---|
| Alternator mounting | 20 | 180° | – | – | – | 180° | M10 x 180 |
| | 30 | 180° | – | – | – | 180° | M14 x 230 |
| Cylinder head cover | – | – | – | – | – | 12 ± 1,2 Nm | – |
| Rocker arm set screw | – | – | – | – | – | 22 ± 2 Nm | – |
| Support foot | 30 | 15° | 60° | – | – | 75° | M14 x 100 |
| | 30 | 45° | 60° | – | – | 105° | M14 x 110 |
| | 30 | 45° | 60° | – | – | 105° | M14 x 125 |
| Air intake manifold | – | – | – | – | – | 22 ± 2 Nm | – |
| Exhaust manifold | – | – | – | – | – | 40 ± 4 Nm | – |
| Oil drain plug – cast iron oil pan | – | – | – | – | – | 150 ± 10 Nm | M22 x 1,5 |
| Oil drain plug – sheet metal oil pan | – | – | – | – | – | 100 ± 10 Nm | M30 x 1,5 |
| Injection valve mounting | – | – | – | – | – | 25–30 Nm | – |

# TECHNICAL SPECIFICATIONS
## 9.3 Tools




The V-belt tension gauge can be obtained under order number **8115** from:

**COMPANY WILBÄR**
**Postfach 14 05 80**
**D-42826 Remscheid**

# ORDERING SPARE PARTS

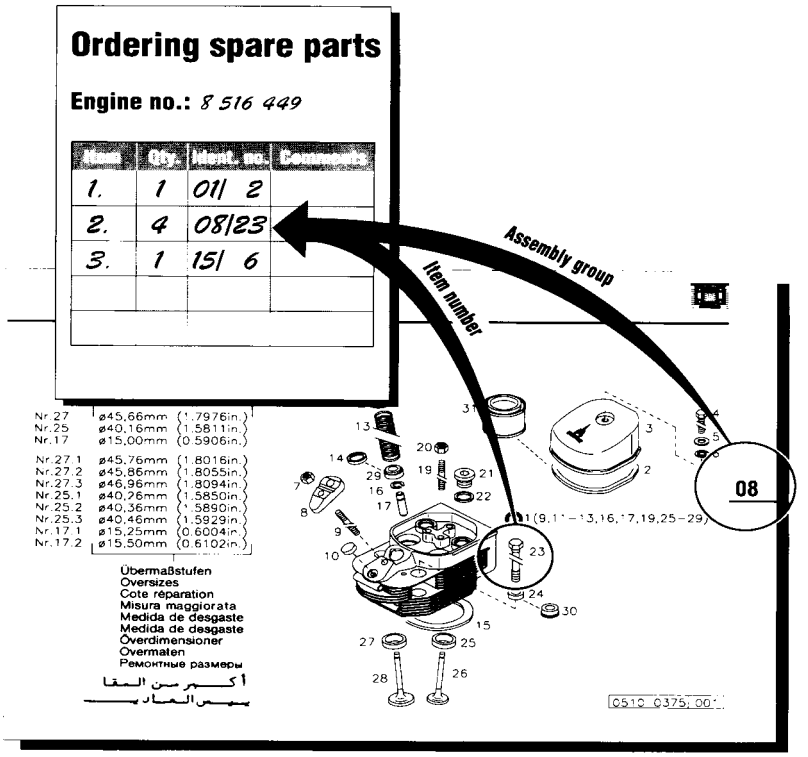
## Order information

Please specify the following information when ordering original DEUTZ parts.

- Engine no.
- Ident. no.
- Quantity

## Document structure

- The picture diagrams in this spare parts list are sorted according to engine assembly groups.
- Each section is preceded by an overview of the assembly groups.
- The ident. no. **08/23** us made up of the assembly group (e.g. **08**) and item number (e.g. **23**).






# Service

### Knowing it's DEUTZ

DEUTZ has always stood for excellence in motor construction pioneering many developments in the industry. As an independent motor manufacturer, we offer — worldwide — a comprehensive range of diesel and gas motors spanning from 4kW to 7,400kW. Our products are perfectly tailored to meet our customers' individual requirements.

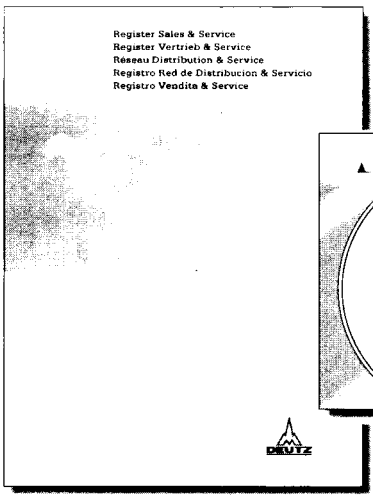
Over 1.4 million DEUTZ motors do their job reliably all over the world. We are determined to preserve the high standard of performance and dependability of our motors, thus keeping our customers satisfied at all times. Therefore we are represented worldwide through a network of highly competent service partners who will meet the needs of our customers, wherever they are.

This is why DEUTZ is not only the name for motors which pack a lot of inventive genius. DEUTZ also means reliable service and comprehensive support to enhance your motor's performance.

This index Sales & Service offers you an overview of the DEUTZ partners in your vicinity, including the products for which they are responsible and the range of services provided. But even when no direct product responsibility is mentioned, your DEUTZ partner will be happy to help you with expert advice.

The Index is constantly updated. Please ask your DEUTZ service partner for the latest edition.

DEUTZ AG — at your service.




Order-No.: 0297 7444


**Order-No.: 0297 7445** (CD-ROM)

Obtainable from the local service Partner reponsible for you or from:

DEUTZ AG
Deutz-Mülheimer Str. 147-149
D-51057 Köln

Phone: 0049-221-822-0
Telefax: 0049-221-822-5304
Telex: 8812-0 khd d
http://www.deutz.de

# ENGINE MAINTENANCE SCHEDULE
## McL 48/54

| DATE/HRS | SERVICE PERFORMED | BY |
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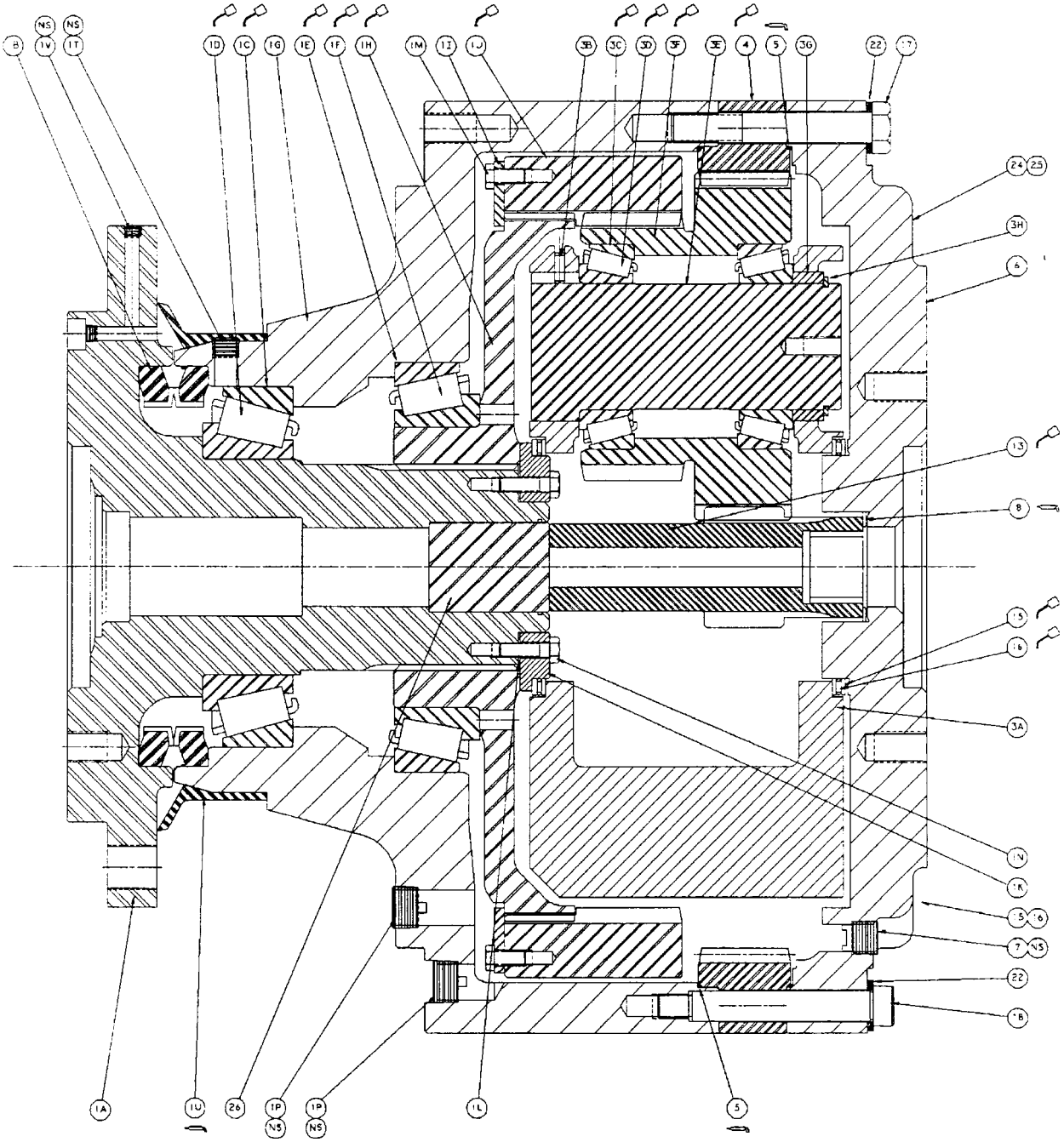
# NOTES
## McL 48/54

# 5.2 -5.8 MACHINE COMPONENTS
## McL 48/54

# GEARBOX COMPONENTS
## McL 48/54



# GEARBOX COMPONENTS
## McL 48/54

**MODEL#**_____

**SERIAL #**_____

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1A | 1 | 480030201 | Spindle |
| 1K | 1 | 480030202 | Carrier, Bearing |
| 1I | 4 | 480030203 | Plate, Rectangular |
| 1G | 1 | 480030204 | Housing |
| 1C | 1 | 480030205 | Bearing, Tapered |
| 1D | 1 | 480030206 | Bearing, Tapered |
| 1E | 1 | 480030207 | Bearing, Tapered |
| 1F | 1 | 480030208 | Bearing, Tapered |
| 1B | 1 | 480030209 | Seal, Face |
| 1L | 1 | 480030210 | Shim, Steel |
| 1N | 8 | 480030211 | Bolt, Hex-Special |
| 5 | 2 | 480030212 | O-Ring |
| 24 | 1 | 480030213 | Plate, ID |
| 1M | 8 | 480030214 | Bolt, Hex-UNC |
| 17 | 16 | 480030215 | Bolt, Hex-UNC |
| 18 | 4 | 480030216 | Bolt, Shoulder |
| 1U | 1 | 480030217 | Seal, Boot |
| 3C | 6 | 480030218 | Bearing, Cup |
| 3B | 3 | 480030219 | Pin, Roll |
| 3E | 3 | 480030220 | Shaft, Planet |
| 3A | 1 | 480030221 | Carrier |
| 3F | 1 | 480030222 | Gear, Cluster Set |
| 1J | 1 | 480030223 | Gear, Internal |
| 1H | 1 | 480030224 | Coupling, Internal |
| 4 | 1 | 480030225 | Gear, Ring |
| 3G | 3 | 480030226 | Spacer, Thrust |
| 3D | 6 | 480030227 | Bearing, Tapered |
| 3H | 3 | 480030228 | Ret, Ring-Extension |
| 16 | 2 | 480030229 | Bearing, Thrust |
| 15 | 4 | 480030230 | Washer, Thrust |
| 26 | 1 | 480030231 | Spacer, Input |
| 13 | 1 | 480030232 | Gear, Sun |
| 25 | 2 | 480030233 | Screw, Drive |
| 1V | 2 | 480030234 | Pipe Plug, STD-NPT |
| 1T | 1 | 480030235 | Pipe Plug, STD-NPT |
| 7 | 2 | 480030236 | Pipe Plug, MAGN-NP |
| 1P | 3 | 480030237 | Pipe Plug, MAGN-NP |
| 22 | 20 | 480030238 | Washer, Lock |
| 6 | 1 | 480030239 | Plug, Cardboard |
| 8 | 1 | 480030240 | Washer, Thrust |
| 6 | 1 | 480030241 | Cover, Input |

**Note:** McLaughlin Manufacturing Co. is not authorized to service Gearboxes. Consult McLaughlin Manufacturing Co. for repair manual or the name of an authorized service dealer near you.

# GEARBOX MAINTENANCE SCHEDULE
## McL 48/54

| DATE/HRS | SERVICE PERFORMED | BY |
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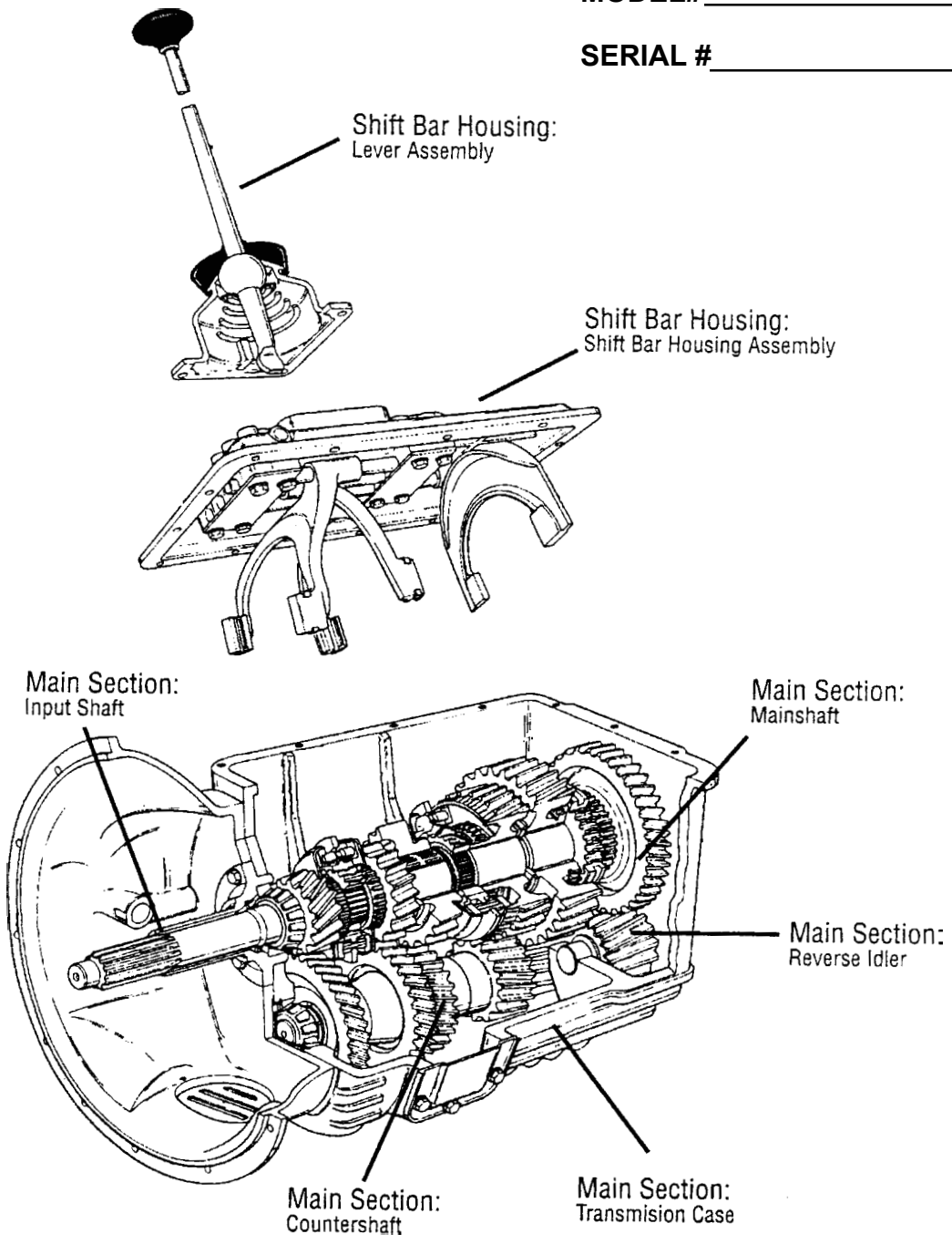
# TRANSMISSION COMPONENTS
## McL 48/54

**MODEL#**_____

**SERIAL #**_____

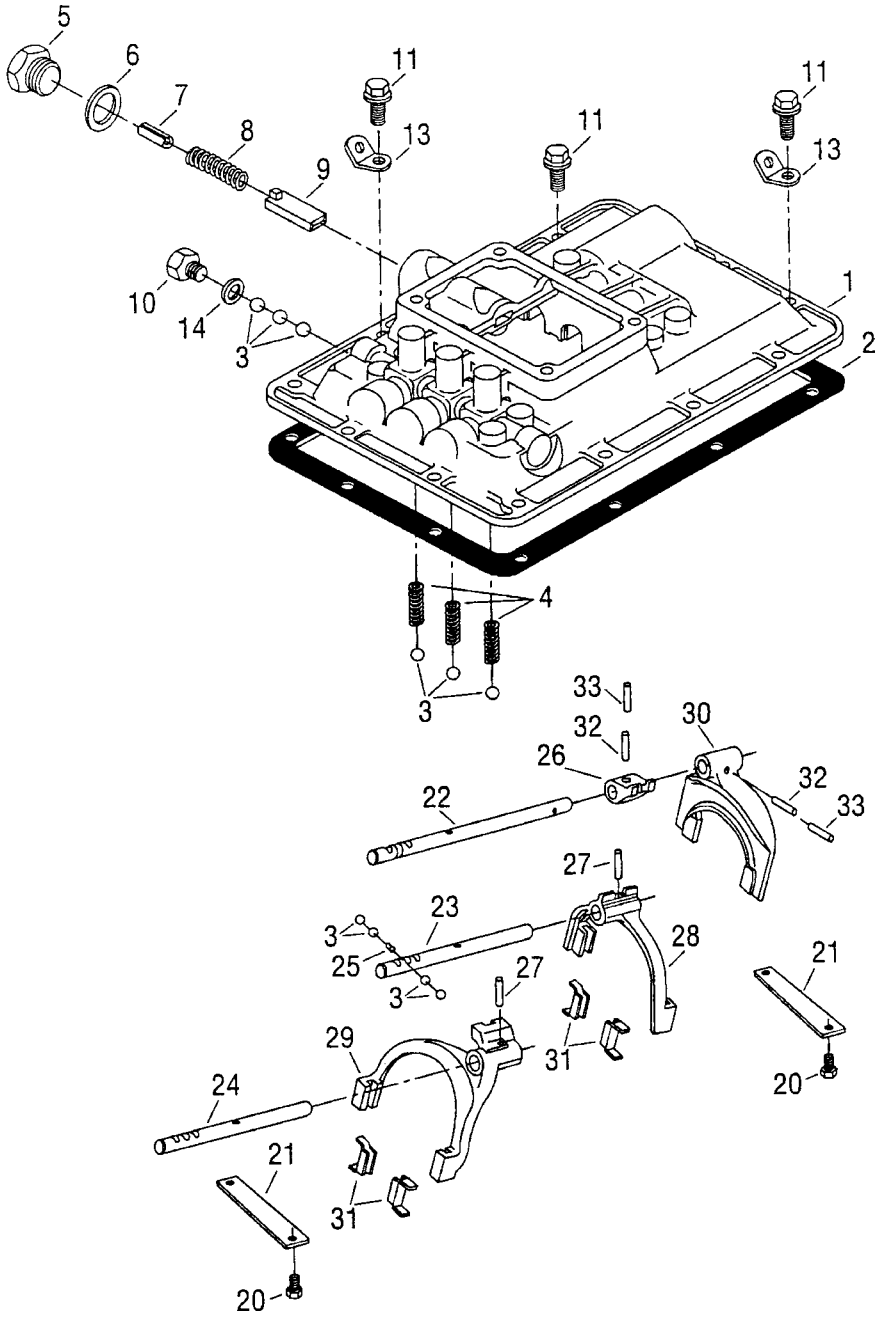



**Note: McLaughlin Manufacturing Co. is not authorized to service transmissions. Consult an authorized dealer of the transmission manufacturer for parts and /or service. Transmission model and serial number is required for part orders.**

**Contact McLaughlin Manufacturing Co. for a distributer near you.**

# TRANSMISSION DETAIL
## McL 48/54

## SHIFT BAR HOUSING



# TRANSMISSION DETAIL
## McL 48/54

**Shift Bar Housing**

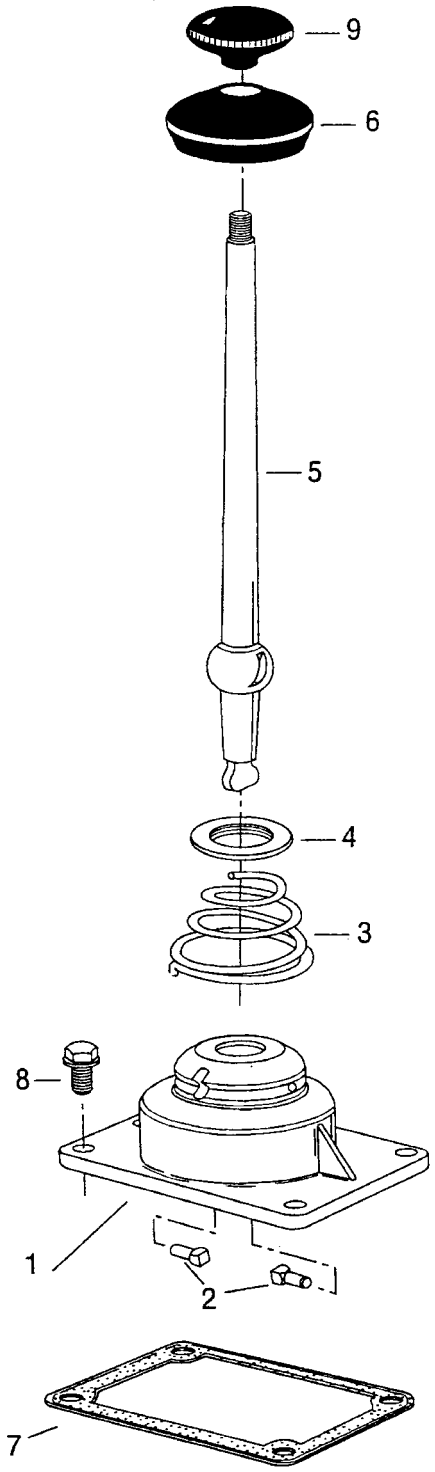
| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | 239834 | Shift Bar Hsg | | 1 | Housing Only | |
| 2 | 240038 | Gasket | | 1 | | K-2143/S-7077 |
| 3 | 10J14 | Steel Ball | | 10 | 7/16" | |
| 4 | 201045 | Spring | | 3 | | |
| 5 | 235621 | Plug 1" | | 1 | | |
| 6 | 235622 | Gasket | | 1 | | K-2143 |
| 7 | 240496 | Spacer | | 1 | | |
| 8 | 233794 | Spring | | 1 | | |
| 9 | 23576 | Plunger | | 1 | | |
| 10 | 235052 | Plug | | 1 | | |
| 11 | 239611 | Capscrew | | 13 | 3/8"-16X7/8" | |
| 13 | 238370 | Bracket | | 2 | | |
| 14 | 15900 | Gasket | | 1 | | K-2143/S-7077 |
| 20 | 233043 | Capscrew | | 4 | 3/8"-16X1" | |
| 21 | 4301277 | Shift Bar Retainer | | 2 | | |
| 22 | 4301541 | Yoke Bar 1st/Rev | | 1 | | |
| 23 | 4301540 | Yoke Bar 2nd/3rd | | 1 | | |
| 24 | 4301539 | Yoke Bar 4th/5th | | 1 | | |
| 25 | 201044 | Pin | | 1 | | |
| 26 | 4300402 | Shift Block 1st/Rev | | 1 | | |
| 27 | 14J1818 | Pin | | 2 | | |
| 28 | A-6146 | Yoke Assy 2nd/3rd | 4301595 | 1 | | |
| 29 | A-6145 | Yoke Assy 4th/5th | 4301593 | 1 | | |
| 30 | 4300401 | Shift Yoke 1st/Rev | | 1 | | |
| 31 | 227675 | Bushing | | 4 | | K-2144 |
| 32 | 1JM6028 | Pin | | 2 | | |
| 33 | 1JM3528 | Pin | | 2 | | |
| 999 | S-7077 | Shift Bar Housing Assy | 239834 | 1 | Complete | |

**Kits and Assemblies**

K-2143 Gasket Kit
K-2144 Small Parts Kit
S-7077 Shift Bar Housing Assy

# TRANSMISSION DETAIL
## McL 48/54

## LEVER ASSEMBLY



# TRANSMISSION DETAIL
## McL 48/54

**Lever Assembly**

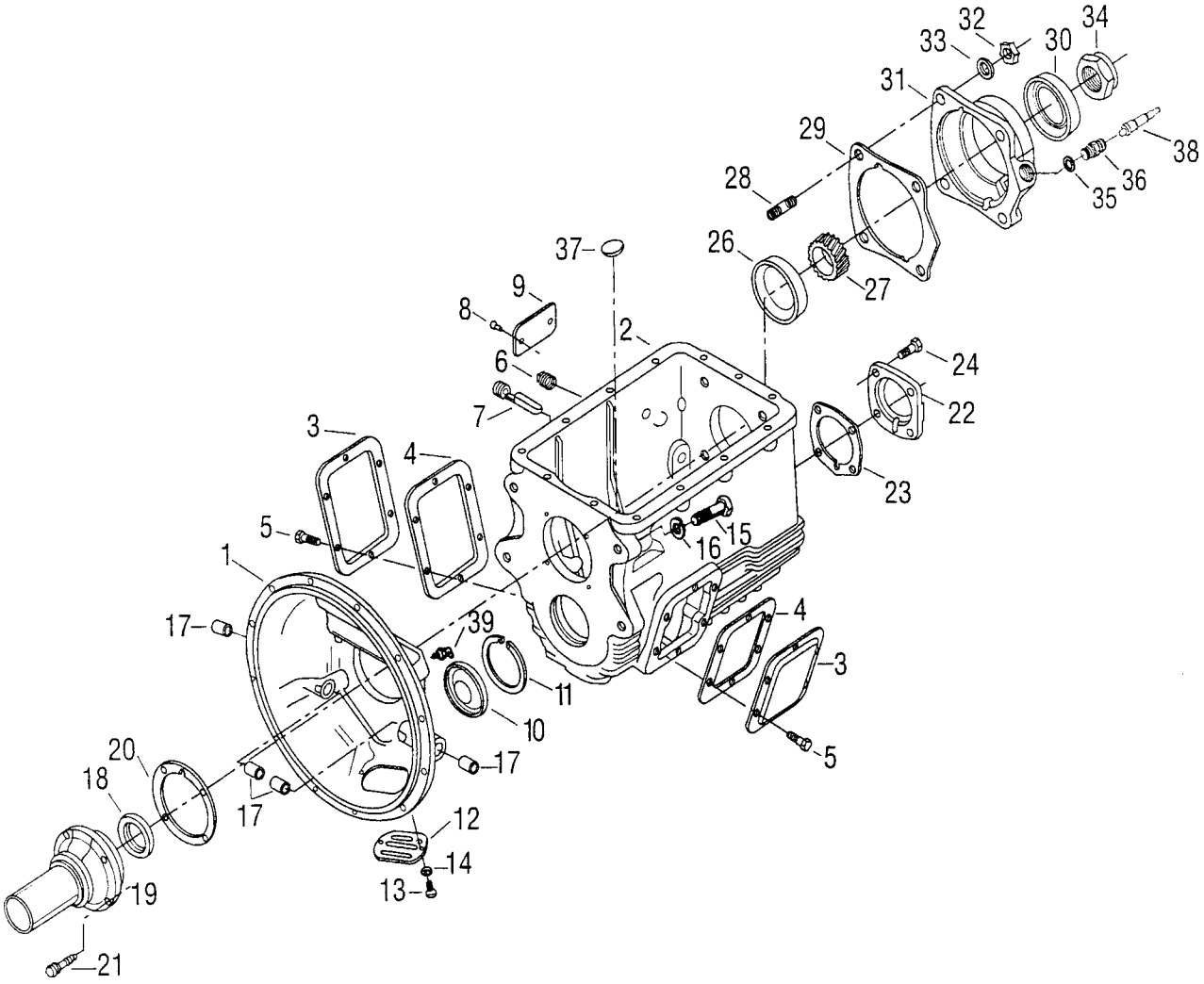
| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | 233080 | Shift Lever Hsg | | 1 | High | S-1643 |
| 2 | 201054 | Pin | | 2 | For High & Med. Hsg | S-1643/S-7079 |
| 2 | 23180 | Pin | | 2 | For Low Hsg | S-7045 |
| 3 | 4300690 | Spring | | 1 | | S-1643/S-7045/S-7079 |
| 4 | 23181 | Washer | | 1 | | S-1643/S-7045/S-7079 |
| 5 | 228648 | Shift Lever | | 1 | Use With 233080 | S-1643 |
| | | | | | Straight Lever - "Bend To Suit" | |
| 5 | 241076 | Shift Lever | | 1 | Use With 241075 | S-7079 |
| | | | | | Straight Lever - "Bend To Suit" | |
| 5 | 4302823 | Shift Lever | | 1 | Use With A-6448 | S-7045 |
| | | | | | Straight Lever - "Bend To Suit" | |
| 6 | 202484 | Dust Cover | | 1 | | S-1643/S-7045/S-7079 |
| 7 | 4301958 | Gasket | | 1 | | K-2143/S-7045/S-7077 |
| 8 | X-8C-604 | Capscrew | | 4 | 3/8"-16X1-1/4" | |
| 9 | 201401 | Knob | | 1 | | |

**Kits and Assemblies**

| | |
|---|---|
| K-2143 | Gasket Kit |
| S-1643 | Shift Lever Assy-High |
| S-7045 | Shift Lever Assy-Low |
| S-7077 | Shift Bar Housing Assy |
| S-7079 | Shift Lever Assy-Medium |

# TRANSMISSION DETAIL
## McL 48/54

## TRANSMISSION CASE



# TRANSMISSION DETAIL
## McL 48/54

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | A-5634 | Clutch Hsg Assy | 23726 | 1 | #2 Pull-Aluminum w/11H15 Fittings | |
| 1 | A-5771 | Clutch Hsg Assy | 23726 | 1 | #2 Pull-Aluminum | |
| 1 | A-5205 | Clutch Hsg Assy | 21646 | 1 | #2 Push-Aluminum | |
| 1 | A-5751 | Clutch Hsg Assy | 4300418 | 1 | #2 Push-Aluminum | |
| 1 | 3316239 | Clutch Hsg Assy | | 1 | #2 Push-Alumimun (Fork) | |
| 1 | A-5630 | Clutch Hsg Assy | 23722/229297 | 1 | #2 Push-Iron | |
| 1 | A-5629 | Clutch Hsg Assy | 23721 | 1 | #3 Push-Iron | |
| 2 | S-1874 | Case Assy | 4300878 | 1 | | |
| 2 | S-1875 | Case Assy | 4301099 | 1 | | |
| 2 | S-1923 | Case Assy | 4301032 | 1 | | |
| 2 | S-1924 | Case Assy | 4301033 | 1 | | |
| 3 | 201398 | PTO Cover | | 2 | | |
| 4 | 201400 | Gasket | | 2 | | K-2143 |
| 5 | 239613 | Capscrew | | 12 | 3/8"-16X5/8" | |
| 6 | X-12-1206 | Pipe Plug | | 1 | 3/4" | S-1874/S-1875/S-1923/S-1924 |
| 7 | X-12-1207 | Pipe Plug | | 1 | 3/4" Magnetic | S-1874/S-1875/S-1923/S-1924 |
| 8 | 207873 | Screw | | 2 | | |
| 9 | 22300 | Name Plate | | 1 | | |
| 10 | 239783 | Plug | | 1 | | K-2144 |
| 11 | 240040 | Snap Ring | | 1 | | K-2144 |
| 12 | 23380 | Cover | | 1 | | |
| 13 | 1C408 | Capscrew | | 2 | 1/4"-20 | |
| 14 | 4E04 | Lockwasher | | 2 | 1/4" | |
| 15 | 1C936 | Capscrew | | 4 | 9/16"-12 | |
| 16 | 4E09 | Lockwasher | | 4 | 9/16" | |
| 17 | 12815 | Bushing | | 4 | | |
| 17 | 8677 | Bushing | | 2 | Use w/A-5205 Clutch Hsg Assy | |
| 18 | 4300121 | Oil Seal | | 1 | | K-2129/K-7029 |
| 18 | 4300204 | Oil Seal | | 1 | Shaft 1.89 | |
| 18 | 4300798 | Oil Seal | | 1 | Shaft 1.62 | K-2120/K-7029 |
| 19 | 22129 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 23147 | Front Brg Cover-Pull | 3315538 | 1 | Use 4300121 Oil Seal | |
| 19 | 237743 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 238104 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 238870 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 239821 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 3315497 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 3315552 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 19 | 4300354 | Front Brg Cover-Push | | 1 | Use 4300204 Or 4300798 Oil Seal | |
| 19 | 4300355 | Front Brg Cover-Push | | 1 | Use 4300204 Oil Seal | |
| 19 | 4300882 | Front Brg Cover-Push | | 1 | Use 4300798 Oil Seal | |
| 20 | 240321 | Gasket | | 1 | | K-2143 |
| 21 | 239614 | Screw | | 4 | 3/8"-16X3/4" | |
| 22 | 4300261 | C/S Rear Brg Cover | | 1 | | |

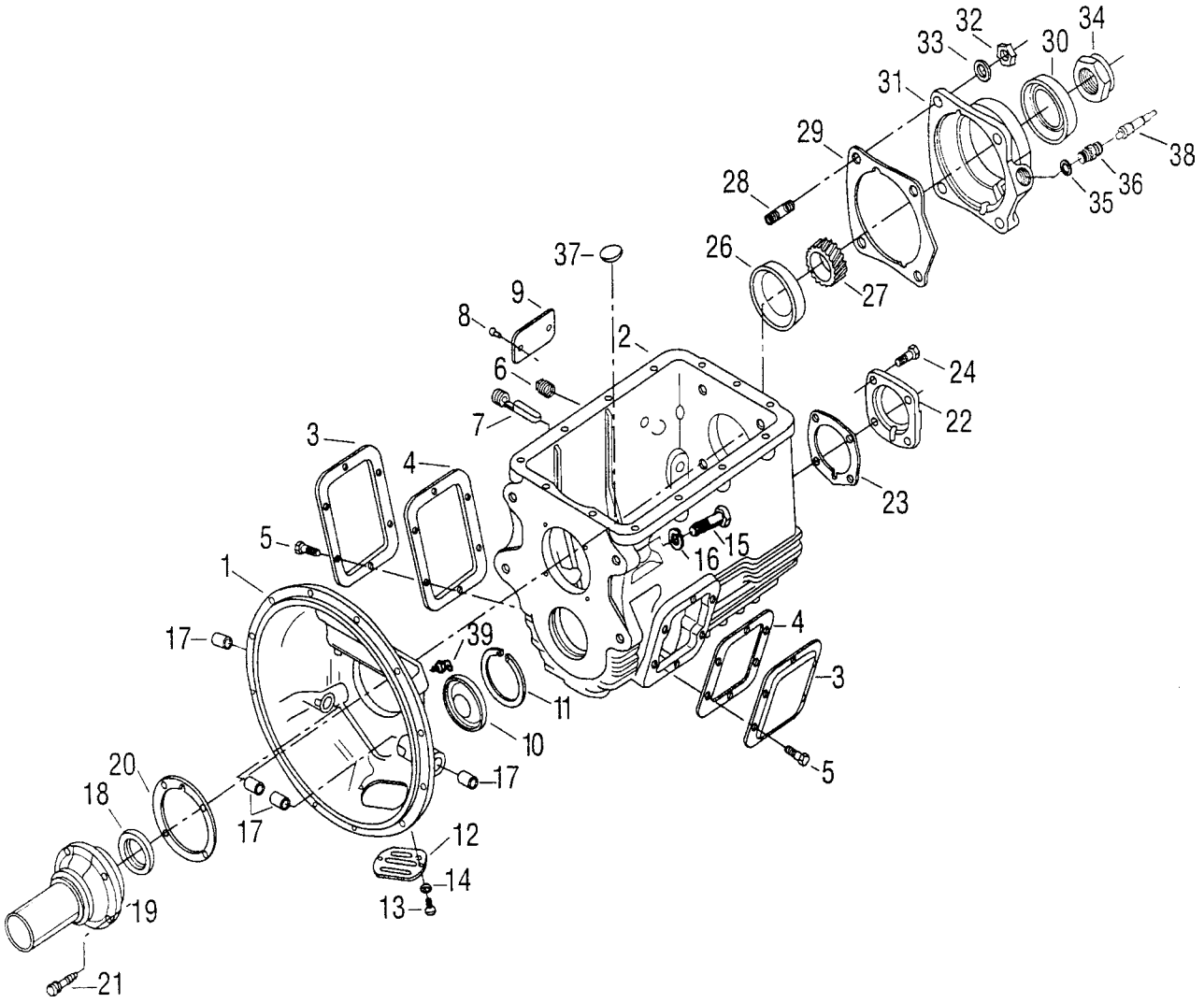
**Kits and Assemblies**

| | |
|---|---|
| K-2120 | Basic Rebuild Kit |
| K-2129 | Basic Rebuild Kit |
| K-2143 | Gasket Kit |
| K-2144 | Small Parts Kit |
| K-7029 | Rebuilder Kit |

| | |
|---|---|
| S-1874 | Case Assy |
| S-1875 | Case Assy |
| S-1923 | Case Assy |
| S-1924 | Case Assy |

# TRANSMISSION DETAIL
## McL 48/54

## TRANSMISSION CASE



# TRANSMISSION DETAIL
## McL 48/54

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 23 | 240017 | Shim .004 | | 1 | Quantity As Required | K-2116 |
| 23 | 240018 | Shim .007 | | 1 | Quantity As Required | K-2116 |
| 23 | 240019 | Shim .010 | | 1 | Quantity As Required | K-2116 |
| 23 | 240020 | Shim .020 | | 1 | Quantity As Required | K-2116 |
| 23 | 4300980 | Shim .040 | | 1 | | |
| 24 | X-8-688 | Capscrew | | 4 | 3/8"-16X1" | |
| 26 | 654166 | Bearing Cup | | 1 | | K-2120/K-2129/K-7029 |
| 27 | 21555 | Speedo Rotor | | 1 | | |
| 27 | 3314356 | Speedo Drive Gear | | 1 | | |
| 27 | 3314448 | Speedo Drive Gear | | 1 | | |
| 27 | 86301 | Speedo Drive Gear | | 1 | | |
| 28 | 239433 | Stud | | 4 | 1/2"-20X2-5/16" | S-1874/S-1875/S-1923/S-1924 |
| 29 | 240329 | Shim .004 | | 1 | Quantity As Required | K-2116 |
| 29 | 240330 | Shim .007 | | 1 | Quantity As Required | K-2116 |
| 29 | 240331 | Shim .010 | | 1 | Quantity As Required | K-2116 |
| 29 | 240332 | Shim .020 | | 1 | Quantity As Required | K-2116 |
| 29 | 4300981 | Shim .040 | | 1 | | |
| 30 | 208385 | Oil Seal | | 1 | | |
| 30 | 4300203 | Oil Seal | | 1 | | K-2120/K-7029 |
| 31 | K-7038 | Rear Brg Cover Kit | 4302614 | 1 | Use 4300203 Oil Seal<br>Note: Push-In Type Speedo Sensor | |
| 31 | K-7039 | Rear Brg Cover Kit | 4302615 | 1 | Use 4300203 Oil Seal<br>Note: Push-In Type Speedo Sensor | |
| 31 | S-7030 | Rear Brg Cover Assy | 4300845/4302037 | 1 | Use 4300203 Oil Seal<br>Note: Sensor Seal Required | |
| 31 | S-7031 | Rear Brg Cover Assy | 4301677/4302039 | 1 | Use 4300203 Oil Seal<br>Note: Sensor Seal Required | |
| 31 | 4300846 | Rear Brg Cover | | 1 | Use 4300203 Oil Seal | |
| 31 | 4300849 | Rear Brg Cover | | 1 | Use 4300203 Oil Seal | |
| 31 | 4300877 | Rear Brg Cover | | 1 | Use 4300203 Oil Seal | |
| 31 | 4300970 | Rear Brg Cover | | 1 | Use 208385 Oil Seal | |
| 31 | 4300972 | Rear Brg Cover | | 1 | Use 4300203 Oil Seal | |
| 31 | 4301053 | Rear Brg Cover | | 1 | Use 4300203 Oil Seal | |
| 32 | 86D08 | Nut | | 4 | 1/2"-20 | |
| 33 | 239436 | Washer | | 4 | 1/2" | |
| 34 | 21937 | Nut | | 1 | 1/4"-18 | |
| 35 | 4301954 | Seal | | 1 | | S-7030/S-7031 |
| 36 | 86016 | Sleeve | | 1 | | |
| 37 | 14373 | Magnet | | 1 | | S-1923/S-1924 |
| 38 | 3313714 | Speedo Driven Gear | | 1 | | |
| 38 | 3314433 | Speedo Driven Gear | | 1 | | |
| 38 | 3314449 | Speedo Driven Gear | | 1 | | |
| 38 | 3314545 | Speedo Driven Gear | | 1 | | |
| 38 | 3315575 | Speedo Driven Gear | | 1 | | |
| 38 | 5501502 | Speedo Driven Gear | | 1 | | |
| 38 | 5501503 | Speedo Driven Gear | | 1 | | |
| 39 | 11H15 | Fitting-45 Degree | | 2 | | |
| 39 | 12H15 | Fitting-90 Degree | | 2 | | |

**Kits and Assemblies**

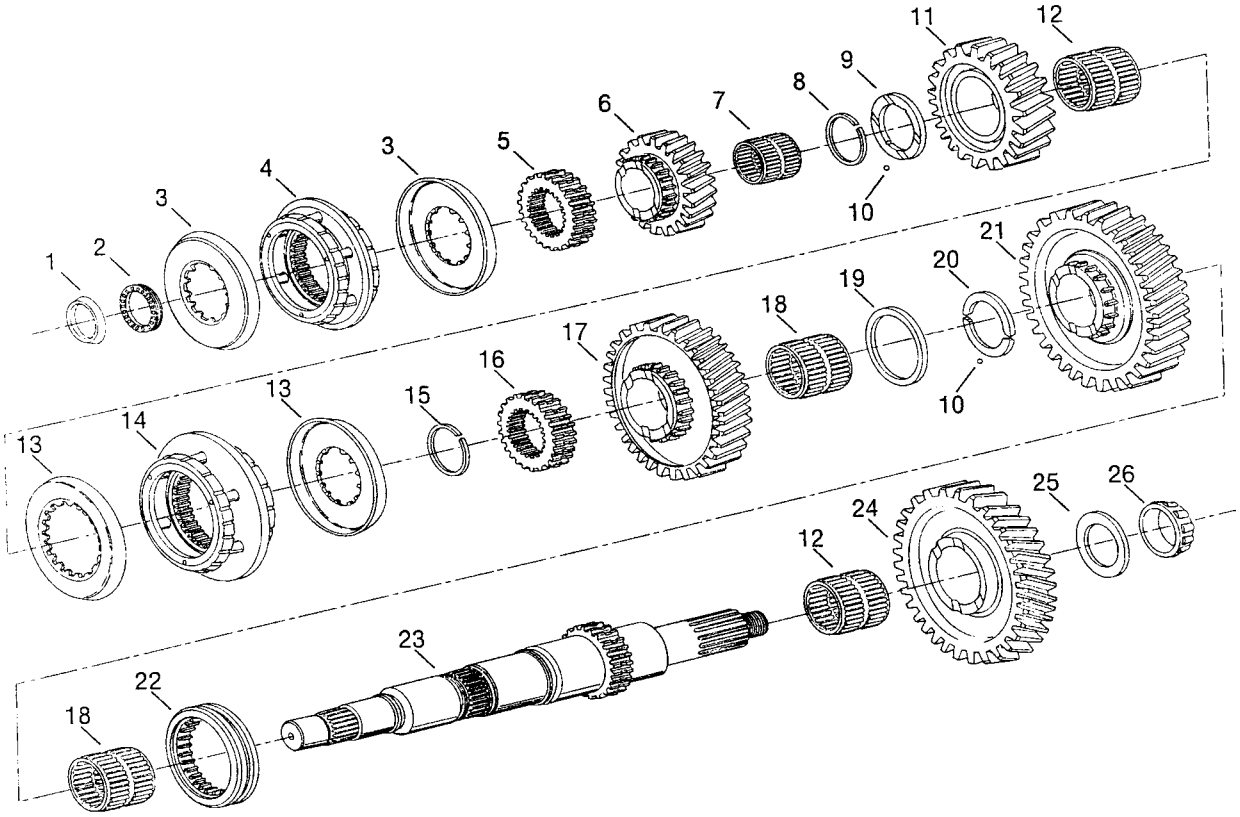
| | |
|---|---|
| K-2116 | Shim Kit |
| K-2120 | Basic Rebuild Kit |
| K-2129 | Basic Rebuild Kit |
| K-2143 | Gasket Kit |
| K-7029 | Rebuilder Kit |

| | |
|---|---|
| S-1874 | Case Assy |
| S-1875 | Case Assy |
| S-1923 | Case Assy |
| S-1924 | Case Assy |
| S-7030 | Rear Brg Cover Assy |
| S-7031 | Rear Brg Cover Assy |

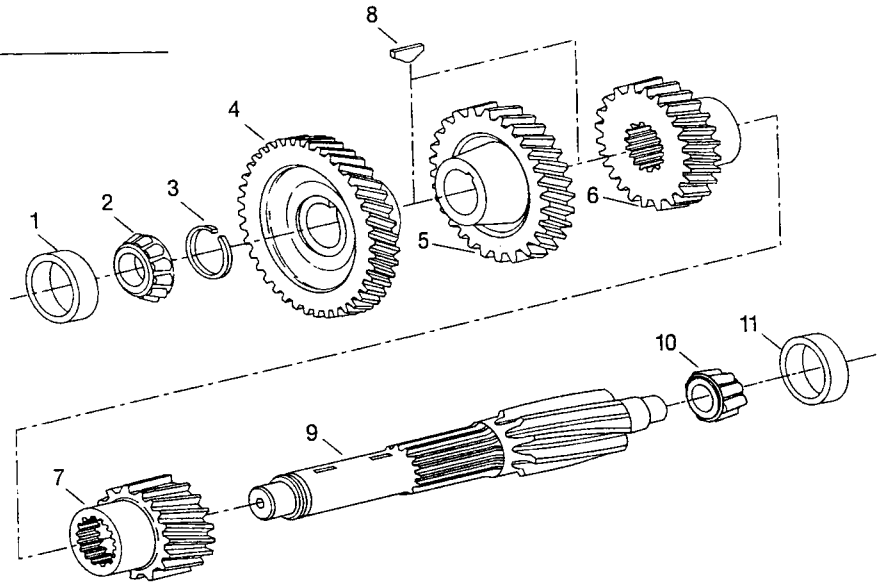
# TRANSMISSION DETAIL
## McL 48/54

## TRANSMISSION CASE

Mainshaft Assy




Countershaft Assy



# TRANSMISSION DETAIL
## McL 48/54

### Mainshaft Assy

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | 235383 | Bearing Race | | 1 | | K-2120/K-2129/K-7029 |
| 2 | 235382 | Bearing | | 1 | | K-2120/K-2129/K-7029 |
| 3 | 4301565 | Synchronizer Cup | | 2 | | K-7005 |
| 4 | A-6144 | Synchronizer Assy 4/5 | | 1 | | K-7005 |
| 5 | 4301534 | Clutch Hub 4/5 | | 1 | | |
| 6 | 4301527 | 4th Gear-Mainshaft | | 1 | | |
| 7 | 239651 | Bearing | | 1 | | K-2120/K-2129/K-7029 |
| 8 | 224069 | Snap Ring | | 1 | | |
| 9 | 23127 | Washer | | 1 | | |
| 10 | 10J06 | Steel Ball | | 2 | 3/16" | K-2144 |
| 11 | 4301528 | 3rd Gear-Mainshaft | | 1 | | |
| 12 | 239818 | Bearing | | 2 | | K-2120/K-2129/K-7029 |
| 13 | 4301467 | Synchronizer Cup | | 2 | | K-7004 |
| 14 | A-6137 | Synchronizer Assy 2/3 | | 1 | | K-7004 |
| 15 | 240037 | Snap Ring | | 1 | | K-2144 |
| 16 | 4301533 | Clutch Hub 2/3 | | 1 | | |
| 17 | 4301529 | 2nd Gear-Mainshaft | | 1 | | |
| 18 | 239653 | Bearing | | 2 | | K-2120/K-2129/K-7029 |
| 19 | 235379 | Retainer | | 1 | | K-2144 |
| 20 | 235378 | Split Washer | | 2 | | K-2144 |
| 21 | 4301530 | 1st Gear-Mainshaft | | 1 | | |
| 22 | 4301566 | Sliding Clutch | | 1 | | |
| 23 | 4301532 | Mainshaft | | 1 | | |
| 24 | 4301531 | Reverse Gear-Mainshaft | | 1 | | |
| 25 | 240026 | Washer | | 1 | | K-2144 |
| 26 | 654137 | Bearing Cone | | 1 | | K-2120/K-2129/K-7029 |

### Countershaft Assy

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | 672070 | Bearing Cup | | 1 | | K-2120/K-2129/K-7029 |
| 2 | 675246 | Bearing Cone | | 1 | | K-2120/K-2129/K-7029 |
| 3 | 240767 | Snap Ring | | 1 | | K-2144 |
| 4 | 241012 | Drive Gear-Cntrshft | | 1 | | |
| 5 | 4301535 | 4th Gear-Cntrshft | | 1 | | |
| 6 | 4301536 | 3rd Gear-Cntrshft | | 1 | | |
| 7 | 241017 | 2nd Gear-Cntrshft | | 1 | | |
| 8 | 230292 | Key | | 2 | | K-2144 |
| 9 | 4301537 | Countershaft | | 1 | | |
| 10 | 666554 | Bearing Cone | | 1 | | K-2120/K-2129/K-7029 |
| 11 | 730362 | Bearing Cup | | 1 | | K-2120/K-2129/K-7029 |

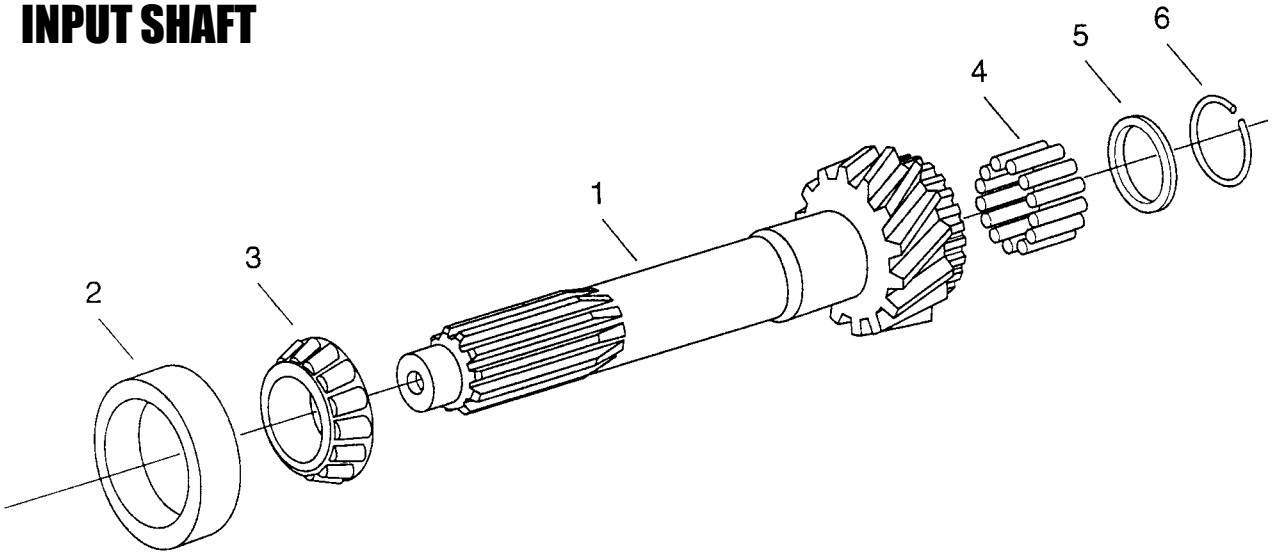
**Kits and Assemblies**

| | |
|---|---|
| K-2120 | Basic Rebuild Kit |
| K-2129 | Basic Rebuild Kit |
| K-2144 | Small Parts Kit |
| K-7004 | Synchronizer Kit |
| K-7005 | Synchronizer Kit |
| K-7029 | Rebuilder Kit |

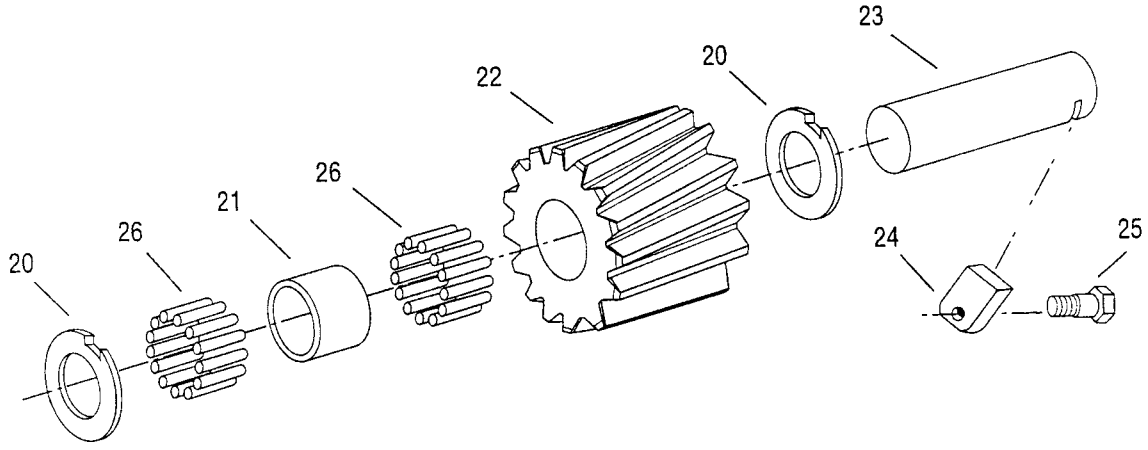
# TRANSMISSION DETAIL
## McL 48/54

Input Shaft

## INPUT SHAFT




Reverse Idler Gear Assy



# TRANSMISSION DETAIL
## McL 48/54

### Input Shaft

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 1 | 4302062 | Input Shaft-1.118" Push | | 1 | Use 3315494 Front Brg Cover | |
| 1 | 4301622 | Input Shaft-1.375" Push | | 1 | Use 237743 Front Brg Cover | |
| 1 | 4301623 | Input Shaft-1.375" Push | | 1 | Use 3315552 Front Brg Cover | |
| 1 | 4301624 | Input Shaft-1.375" Push | | 1 | Use 3315303 Front Brg Cover | |
| 1 | 4301827 | Input Shaft-1.375" Push | | 1 | Use 4300882 Front Brg Cover | |
| 1 | 4302061 | Input Shaft-1.375" Push | | 1 | Use 3315497 Front Brg Cover | |
| 1 | 4301526 | Input Shaft-1.50" Push | | 1 | Use 4300882 Front Brg Cover | |
| 1 | 4301616 | Input Shaft-1.50" Push | | 1 | Use 4300882 Front Brg Cover | |
| 1 | 4301618 | Input Shaft-1.50" Push | | 1 | Use 4300882 Front Brg Cover | |
| 1 | 4301619 | Input Shaft-1.50" Push | | 1 | Use 239821 Or 4300882 Front Brg Cover | |
| 1 | 4301620 | Input Shaft-1.50" Push | | 1 | Use 4300354 Or 4300355 Front Brg Cover | |
| 1 | 4301621 | Input Shaft-1.50" Push | | 1 | Use 22129 Front Brg Cover | |
| 1 | 4301615 | In/Shaft-1.50"Push/Pull | | 1 | Use 23147 Front Brg Cover | |
| 1 | 4301614 | In/Shaft-1.75"Push/Pull | | 1 | Use 23147 Or 4300882 Front Brg Cover | |
| 2 | 1314774 | Bearing Cup | | 1 | 1.118",1.375" & 1.50" Input | K-2120/K-7029 |
| 2 | 235417 | Bearing Cup | | 1 | 1.75" Input | K-2129/K-7029 |
| 3 | 1314773 | Bearing Cone | | 1 | 1.118",1.375" & 1.50" Input | K-2120/K-7029 |
| 3 | 235418 | Bearing Cone | | 1 | 1.75" Input | K-2129/K-7029 |
| 4 | 235414 | Bearing | | 14 | | K-2120/K-2129/K-7029 |
| 5 | 235415 | Washer | | 1 | | K-2144 |
| 6 | 235416 | Snap Ring | | 1 | | K-2144 |

### Reverse Idler Gear Assy

| Item | Current Part | Description | Replaced Part | Qty | Notes | Kits / Assys Where Used |
|---|---|---|---|---|---|---|
| 20 | 240023 | Washer | | 2 | | K-2144 |
| 21 | 240024 | Spacer | | 1 | | K-2144 |
| 22 | 4301592 | Idler Gear | | 1 | | |
| 23 | 240022 | Idler Shaft | | 1 | | |
| 24 | 201929 | Shaft Lock | | 1 | | |
| 25 | 239611 | Capscrew | | 1 | 3/8"-16X7/8" | |
| 26 | 235376 | Bearing | | 52 | | K-2120/K-2129/K-7029 |

**Kits and Assemblies**

| | |
|---|---|
| K-2120 | Basic Rebuild Kit |
| K-2129 | Basic Rebuild Kit |
| K-2144 | Small Parts Kit |
| K-7029 | Rebuilder Kit |

# TRANSMISSION MAINTENANCE SCHEDULE
## McL 48/54

| DATE/HRS | SERVICE PERFORMED | BY |
|---|---|---|
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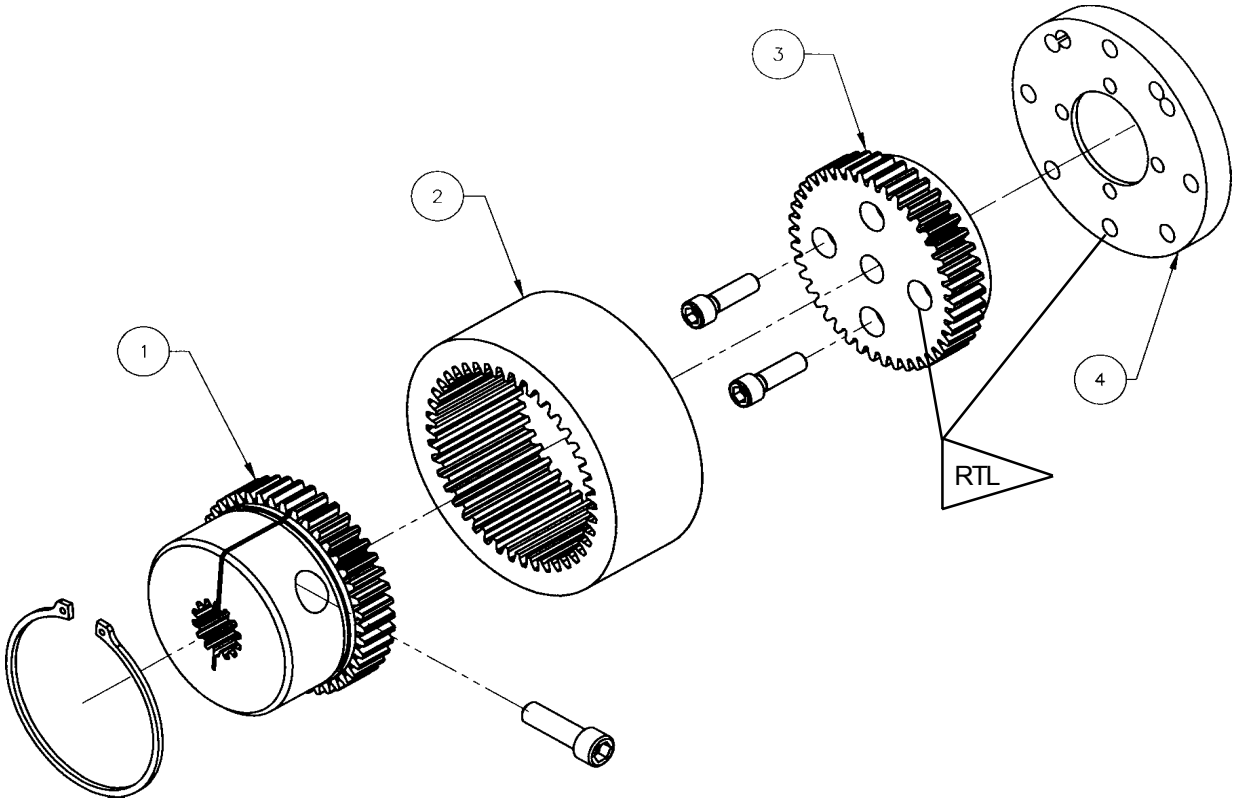
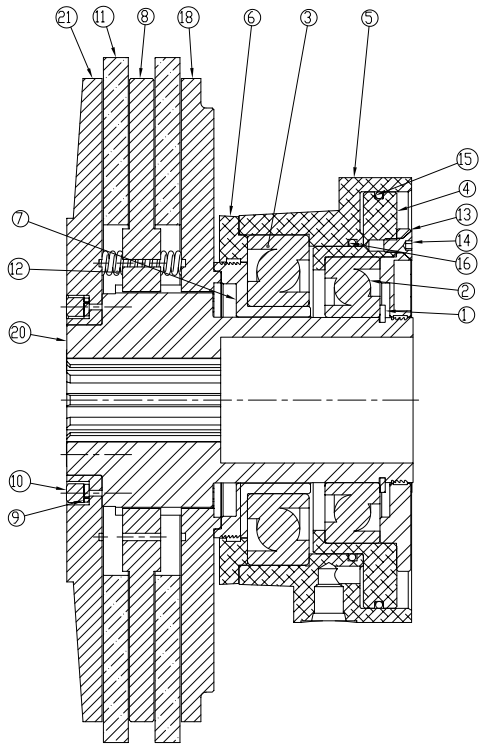
# HYDRAULIC PUMP COUPLING
## McL 48/54




# HYDRAULIC PUMP COUPLING
## McL 48/54

| ITEM # | QTY | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800355 | Coupling Hub |
| | 1 | 4800389 | Snap Ring |
| | 1 | U010220 | Screw, HSH .438-14x1.50" |
| 2 | 1 | 4800357 | Nylon Sleeve |
| 3 | 1 | 4800358 | Pully Hub |
| | 4 | U010085 | Screw, HSH .375-16x1.25" |
| 4 | 1 | 4800359 | Pully Flange |
| | 8 | U030900 | Screw, Soc 8mm x 30mm |

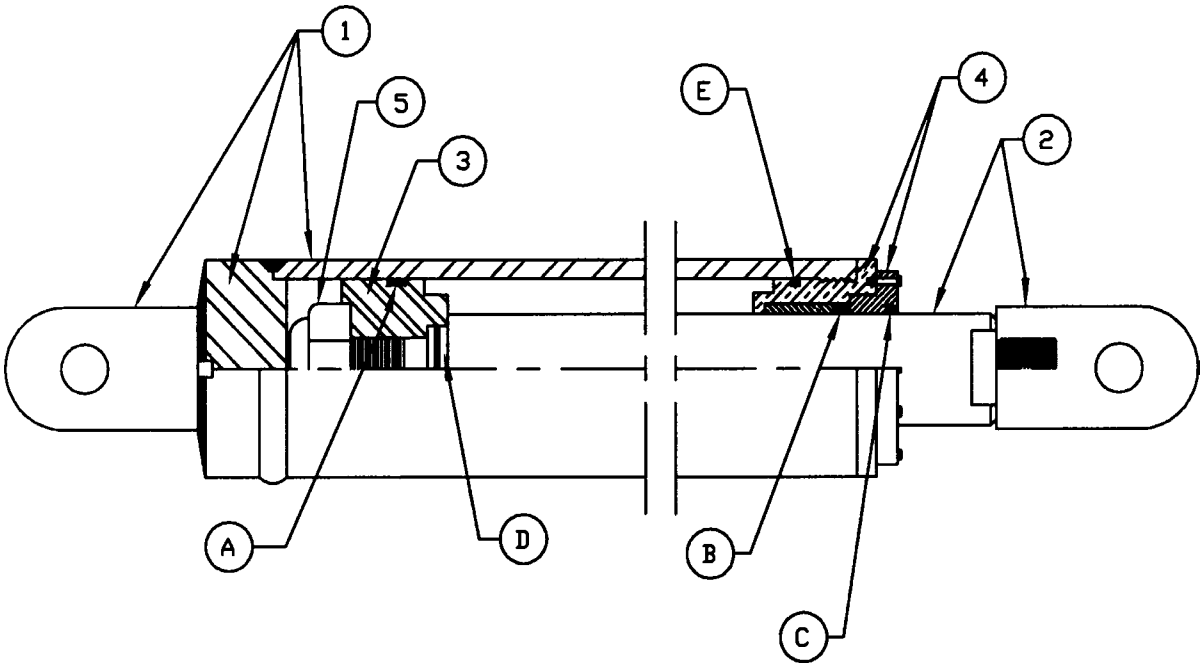
# HYDRAULIC CLUTCH ASSEMBLY
## McL 48/54




# HYDRAULIC CLUTCH ASSEMBLY

| ITEM# | QTY | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 481039901 | RETAINING RING |
| 2 | 1 | 481039902 | ANGULAR CONTACT BEARING (7215) |
| 3 | 1 | 481039903 | ANGULAR CONTACT BEARING (7217) |
| 4 | 1 | 481039904 | CYLINDER ASSEMBLY |
| 5 | 1 | 481039905 | PISTON |
| 6 | 1 | 481039906 | SPACER |
| 7 | 1 | 481039907 | BEARING HUB |
| 8 | 1 | 481039908 | SEPARATOR PLATE |
| 9 | 6 | 481039909 | HIGH COLLAR LOCK WASHER |
| 10 | 6 | 481039910 | 5/16-18 UNC X 0.75 LG SHCS |
| 11 | 2 | 481039911 | FRICTION DISC |
| 12 | 6 | 481039912 | COMPRESSION SPRING |
| 13 | 1 | 481039913 | SPACER |
| 14 | 3 | 481039914 | 1/4-20 UNC X 0.50 LG FHSCS |
| 15 | 1 | 481039915 | O-RING |
| 16 | 1 | 481039916 | O-RING |
| 17 | 3 | 481039917 | 5/16-18 UNC X 0.625 LG FHSCS |
| 18 | 1 | 481039918 | PRESSURE PLATE |
| 19 | 2 | 481039919 | #10-24 X 0.75 LG SHCS |
| 20 | 1 | 481039920 | HUB |
| 21 | 1 | 481039921 | BACKPLATE |

# HYDRAULIC THRUST CYLINDER COMPONENTS
## McL 48/54



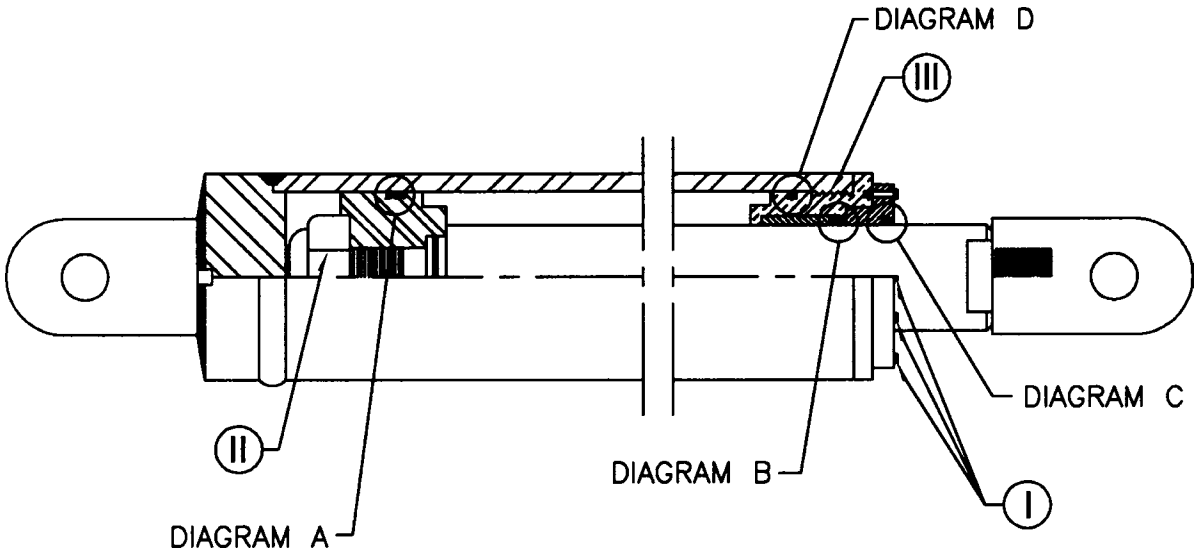

# HYDRAULIC CYLINDER
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 480072901 | Tube Assembly |
| 2 | 1 | 480072902 | Rod Assembly |
| 3 | 1 | 480072903 | Piston |
| 4 | 1 | 480072904 | Rod Gland Assembly |
| 5 | 1 | 480072905 | Lock Nut |
| 6 | 1 | 480072906 | Seal Kit |

Complete Seal Kit to include:

| ITEM # | QTY. | DESCRIPTION |
|---|---|---|
| A | 1 | Piston Seal |
| B | 1 | Rod Seal |
| C | 1 | Wiper |
| D | 1 | O-Ring |
| E | 1 | O-Ring & Back Up |

# HYDRAULIC THRUST CYLINDER SEAL DETAILS
## McL 48/54




**Torque Specifications:**

I. For 1/2"-13 thread socket head cap screws, torque to 300ft/lbs with impact gun in field.

II. For 2 1/2"-12 thread lock nut, torque to 600 ft/lbs.

III. For gland, torque to 100ft/lbs.

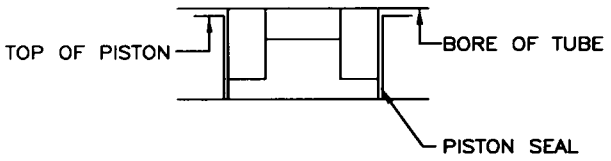



DIAGRAM A

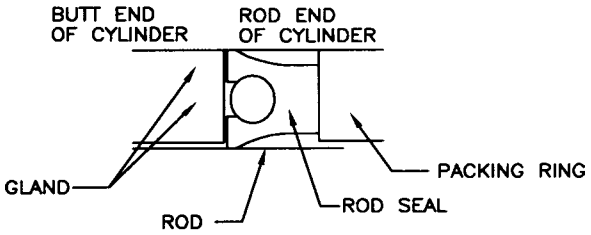



DIAGRAM B

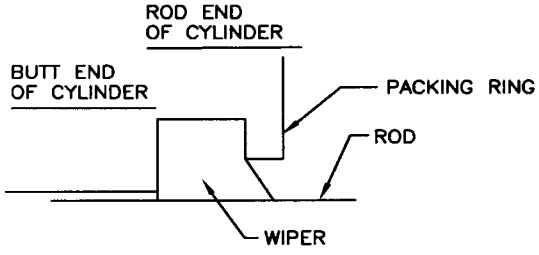



DIAGRAM C

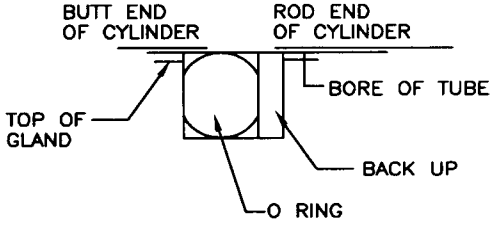
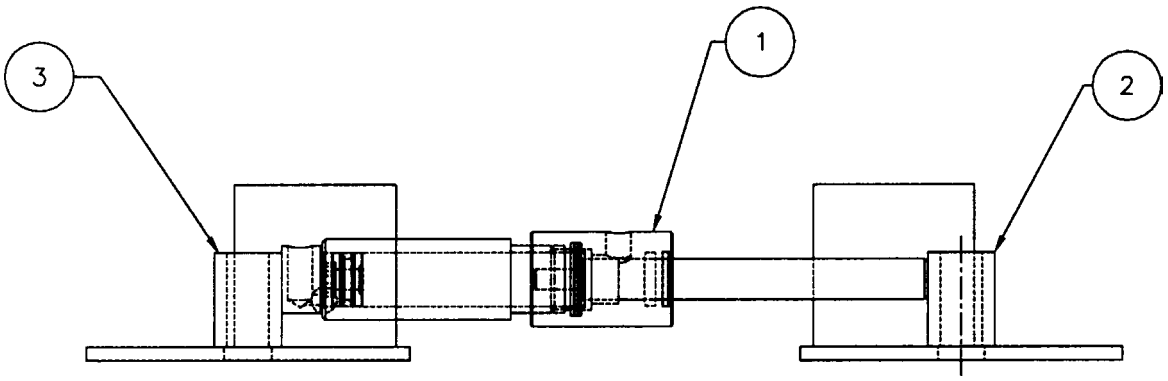



DIAGRAM D

# HYDRAULIC DOG PLATE CYLINDER
## McL 48/54

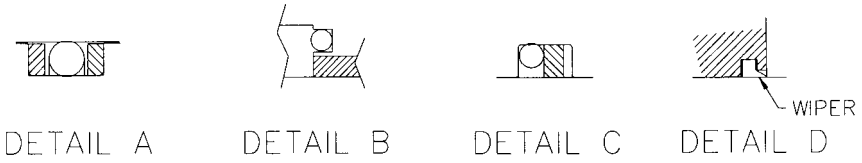


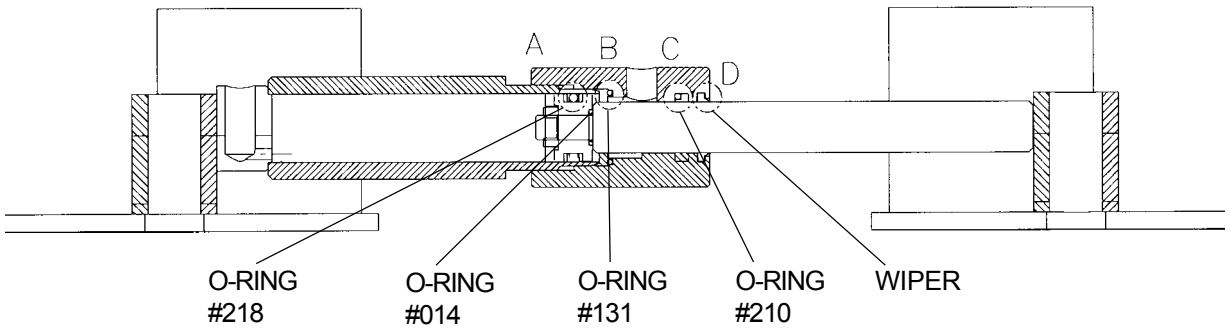

| ITEM# | QTY | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4801710-05 | Threaded Cap |
| 2 | 1 | 4801710-15 | Rod/Clevis Weldment |
| 3 | 1 | 4801710-10 | Barrel/Clevis Weldment |
| 4 | 1 | 4801710-20 | Seal Kit |

# HYDRAULIC DOG PLATE CYLINDER
## McL 48/54

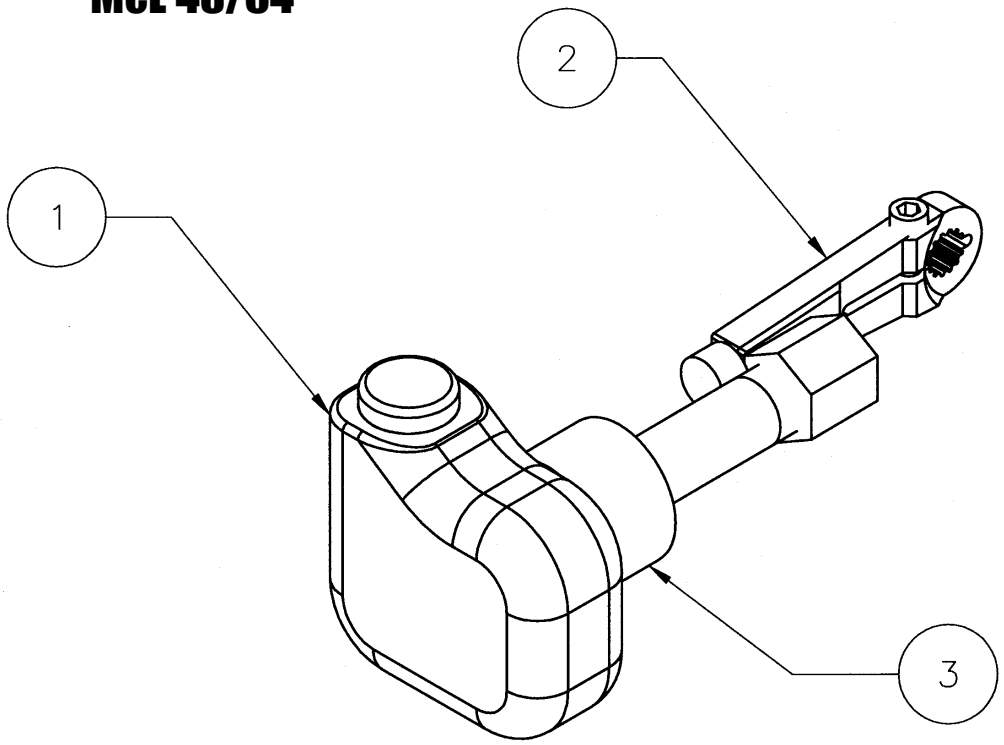
# SEAL KIT ASSEMBLY

New Seal Kit Reference Print



# HYDRAULIC VALVE PARTS
## McL 48/54




# VALVE HANDLE - MAIN THRUST VALVE
## McL 48/54

| ITEM # | QTY. | NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 4800810 | Grip with Switch |
| 2 | 1 | 3610713 | Valve Lever Adapter |
| 3 | 1 | 4800854 | Switch Adapter |

# HYDRAULIC CLUTCH
## McL 48/54

## 6.1 OPERATING

**NOTE:**
**1. Engaging the clutch against an immovable load, will cause premature failure of the clutch. Do not cycle the clutch (on/off/on/off etc.) with augers under-load.**

**COLD WEATHER OPERATION**

Cold weather affects the operation 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 the oil temperature increases before boring. The apply time can be monitored by the pressure gauge on the console panel. 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.

The hydraulic clutch operating system has 2 switches.

1. O.P.C. Switch
2. Clutch Switch

Both the O.P.C. switch and the Clutch switch must be in the “ON” position before the clutch will operate. If the clutch does not operate, make sure that both of these switchs are “ON”.
The hydraulic pressure is set at the factory for 225 psi. This pressure must be maintained for proper operation. DO NOT operate the clutch if the clutch pressure gauge is reading below 150 psi. Too low an operating pressure will result in premature clutch failure.

# HYDRAULIC CLUTCH

## McL 48/54

**COLD WEATHER OPERATION**

**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 for more information.

# HYDRAULIC CLUTCH
## McL 48/54

## 6.2 TROUBLESHOOTING

**DANGER: DO NOT OPERATE MACHINE IF CLUTCH IS NOT OPERATING PROPERLY. DEATH OR SERIOUS INJURY WILL RESULT.**

The hydraulic clutch supplied with this machine is a dry-running, self-adjusting, twin-disk clutch. The clutch requires very little maintenance. Following is a list of symptoms which may require servicing the clutch.

**1. Contamination**
The clutch is designed to run in a dry environment. However, the clutch housing can become contaminated. Contamination can result from dirt or sandy grit, oils, or water (which causes rust) entering the clutch housing.

Clean the disc pack kit with kerosene to restore to normal condition.

**2. Drag in Neutral**
It is natural for a twin-disc clutch to have a small amount of drag in the disengaged state. The drag should be more noticeable at low engine speeds and in low transmission gears.

A. New machines or rebuilt clutches
There is an indeterminate break-in time required for new clutches. Once a clutch has been working for a while, it should seat itself and neutral drag should be at a minimum.

B. Abrupt changes in clutch drag
If the drag in the clutch abruptly increases, it may be due to insufficient spring tension between the clutch discs. Weaker springs cause more drag between the discs of the clutch. Excessive heat, generated in the clutch by cycling the clutch or by applying the clutch against locked augers, will weaken the springs and cause excessive nuetral drag.

Replace disc pack kit and inspect all other components for damage and replace as necessary.

Refer to the Clutch Components and Disassembly/Assembly section of this manual for components and proper clutch service procedures.

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# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

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

**DANGER:**
Crushing weight will cause serious injury. Place machine on solid surface to prevent rollover or falling.

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

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

## 7.1 Machine Split Instructions

### A. Removing the Carriage

**Important Note:** If the jacking station is to be removed from the track, then do the following, in sequence, before removing, the carriage:

1.) Fully retract dog pins.
2.) Close dog pin valve while pins are retracted.
3.) Turn OFF dog pin switch.
4.) Fully retract thrust cylinders.

1.) With the engine OFF, and the key in the OFF position, cycle the thrust valve handle up and down a few times to release any pressure in the system. Disconnect all hydraulic and electrical connections. There are a total of five hydraulic connections and one electrical connection. Use Figures 1 a-d to identify connection points.

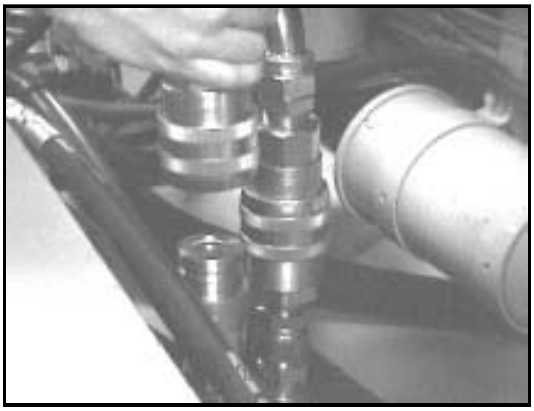
- Main Thrust Valve - 2 hydraulic connec tions. (Figure 1a)
- Track Brake - 1 hydraulic connection (Figure 1b)
- Dog Plate - 1 hydraulic connection, 1 electrical connection. (Figure 1c)
- Fast Feed Valve - 1 hydraulic connections (Figure 1d)

Install all caps on disconnects.

2.) There are eight bolted connection between the jacking station and carriage. Four bolts fasten vertically and four bolts fasten horizontally. Loosen and rotate the carriage hold down bolts out of their carriage slots.. (Figure 2)

3.) Use the four lifting eyes on the roll bars to raise the carriage out of the jacking station. DO NOT LIFT THE CARRIAGE AT ANY OTHER POINT EXCEPT BY ALL

1a

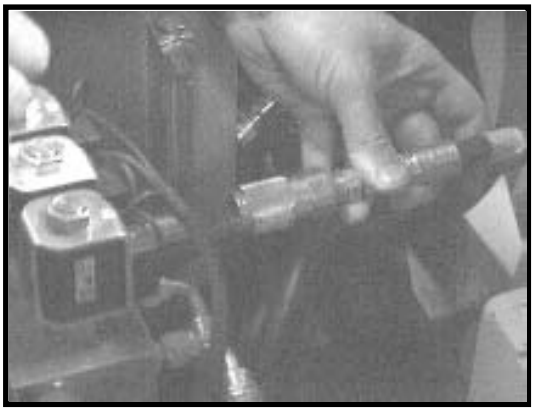


1b

1c

FOUR LIFTING EYES. The weight of the carriage is not evenly distributed. Use caution when lifting. Make sure all hoses and wires are free from machine components before separating the machine. Place the carriage on a flat and stable surface.

1d



## B. Removing the Casing Pusher

1.) The casing pusher has four bolted connections. Loosen, but do not remove the bolts. Rotate the bolts out of the carriage slots.

2.) The casing pusher must be moved far enough horizontally in order to clear the chuck before it can be lifted vertically from the machine.

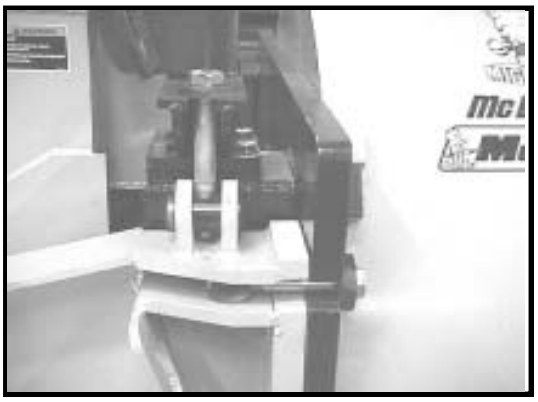
### C. Removing the Jacking Station from Track

1.) The procedures from “Section I - Important Note” must be followed prior to removing the jacking station from the track.

2.) Raise and pin the track hold downs in the retracted position. (Figure 3)

3.) Use the four lifting eyes in the jacking station to lift the jacking station out of the track. The weight of the jacking station is not evenly distributed. Use caution when lifting.

2



4.) Place the jacking station on a flat and stable surface.

### D. Assemble Carriage to Jacking Station

1.) Verify all hoses and wires are free from being pinched or crushed when placing the carriage into the jacking station. Be careful not to damage machine components when placing the carriage.

2.) Once the carriage is resting in the jacking station, fasten the four horizontal bolts first. This will secure the carriage front plate against the jacking station’s thrust wall. Now fasten the four vertical bolts.

3.) Make the six hydraulic and one electrical connection.

4.) Fully open dog pin valve.

3

## 7.2 Coupling Instructions

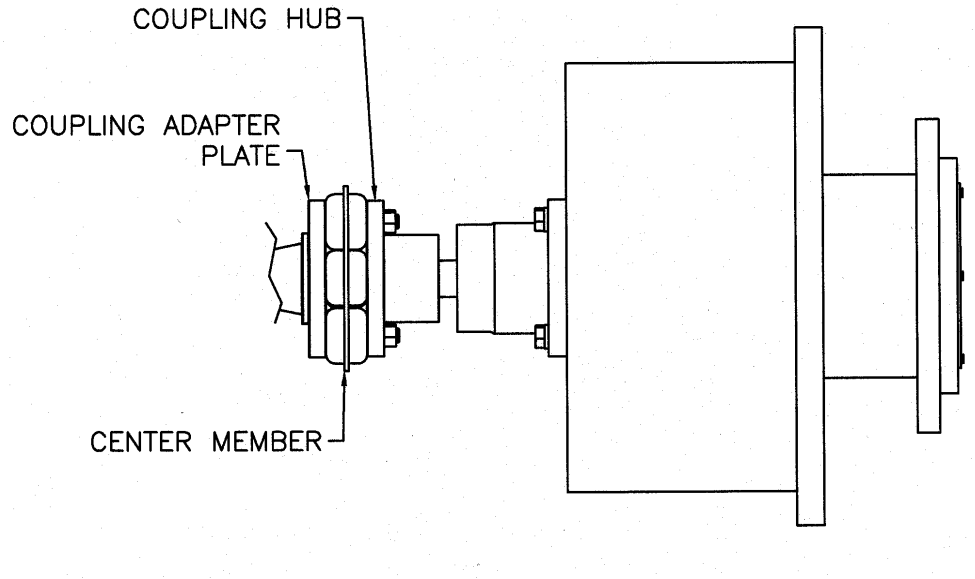
**Tools Required: - 5/8" hex bit socket and ratchet**
**- 1 1/8" socket or wrench**
**- 3/16" Allen-head T-handle wrench**
**- McLaughlin Tool #4810321**

### 1. REMOVAL

- Remove the coupling guard from mounted position on the transmission.
- Remove the two bolts that fasten the coupling hub to the coupling. Loosen the set screw over the key in the coupling hub. Slide the coupling hub up the input adapter shaft to create enough clearance for removing the coupling center member.
- Next, fit McLaughlin tool #4810321 onto the companion flange. Use this tool to prevent the transmission form rotating when removing the last two bolts of the coupling center member.

### II. INSTALLATION

- Install the coupling hub onto the input adapter shaft.
- Install the coupling center member into its' respective pilot holes on the coupling adapter plate. Fit McLaughlin tool #4810321 onto the companion flange and then tighten the two botls to 225 ft-lbs.
- Slide coupling hub onto the pilots of the coupling center member. Tighten the two bolts to 225 ft.lbs.
- Tighten the set screw over the key.
- Install the coupling guard.



## 7.3 Hydraulic Pump Coupling

**Alignment**

Loosen, but do not remove the 4 screws that attach the pump adapter plate to the pump mount. Adjust the pump plate until the nylon sleeve on the coupling slides freely. Tighten the 4 screws.
(Fig. 1-c)

**Disassembly/Assembly**

D1. Remove the screw for the pump and pull the pump out of the adapter plate. Do not remove the 4 screws which attach the adapter plate to the pump mount.

D2. Loosen the coupling cross-clamp and remove the coupling from the pump shaft.

D3. Remove the nylon sleeve.

D4. Remove the screws that attach the coupling hub to the adapter plate and remove the coupling hub.

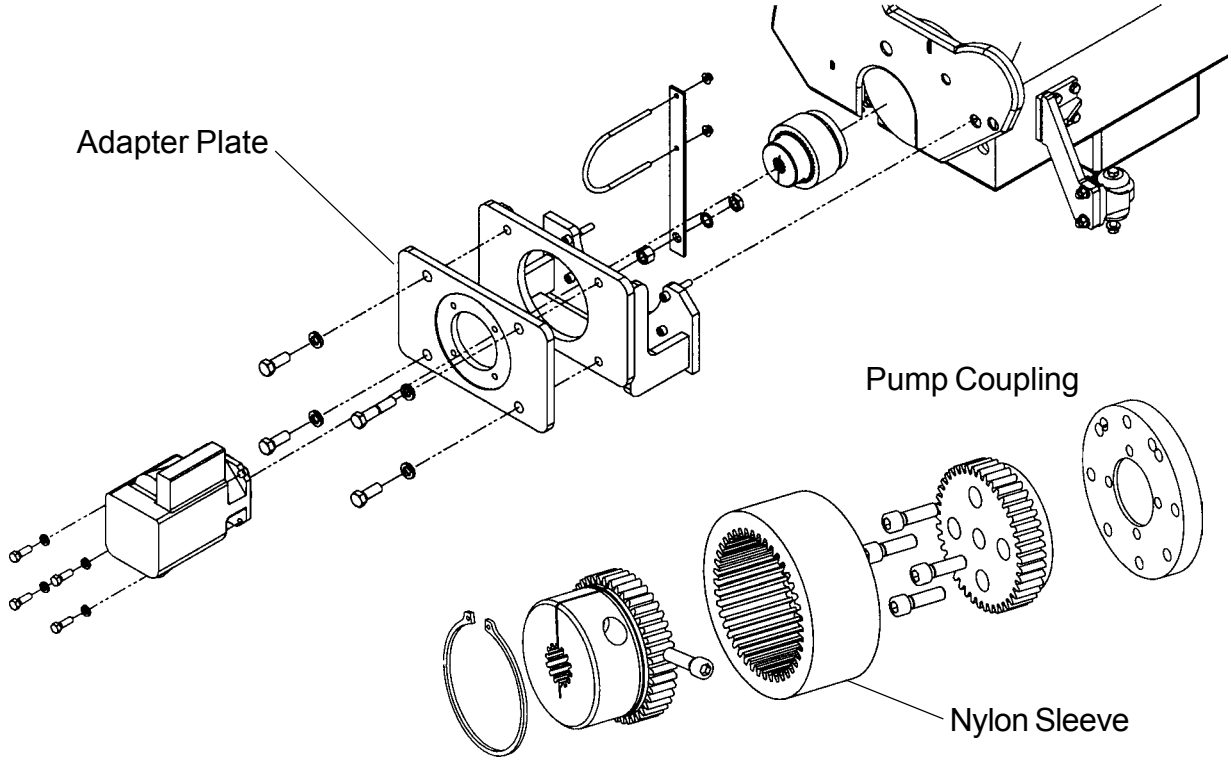
**Assembly**

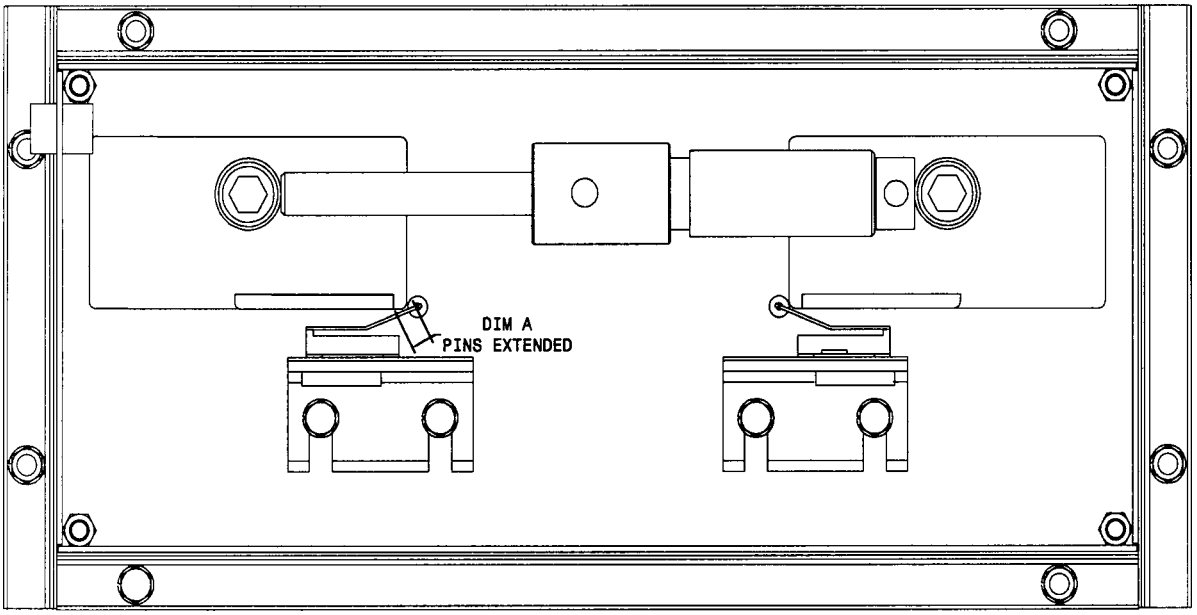
A1. Pilot the adapter plate to the engine crankshaft pulley. Make sure that all hoses are properly lined up and that the adapter is sitting flush against the pulley. Apply Loctitie #271 to the screws and tighten the screws in an alternating circular pattern.

A2. Pilot the coupling hub into the adapter. Make sure that the coupling is sittling properly on the face of the adapter. Apply loctite #271 to the screws andtighting the screws in an alternating pattern.

A3. Install the nylon sleeve onto the coupling.

A4. Install the pump coupling onto the pump






**Dog Pin Indicator Detail**
Some items not shown for clarity.

## 7.4 DOG PLATE

**Dog Pin Indicators -** The dog pin indicator lights should come on when the dog pins are retracted and go off when the dog pins are fully extended. Adjust the switches so the lights give an accurate indication of the dog pin position. Sometimes the dog pin may be in a bind and may not be able to extend fully. Check that the dog pins are working freely before making any adjustments. Make sure that the dog pin valve is open enough (5-6 turns) for the pins to move freely.

**Dog Pin Indicator Switch Adjustment**

1. Extend the dog pins.

2. Remove the top plate on the dog plate cover box.

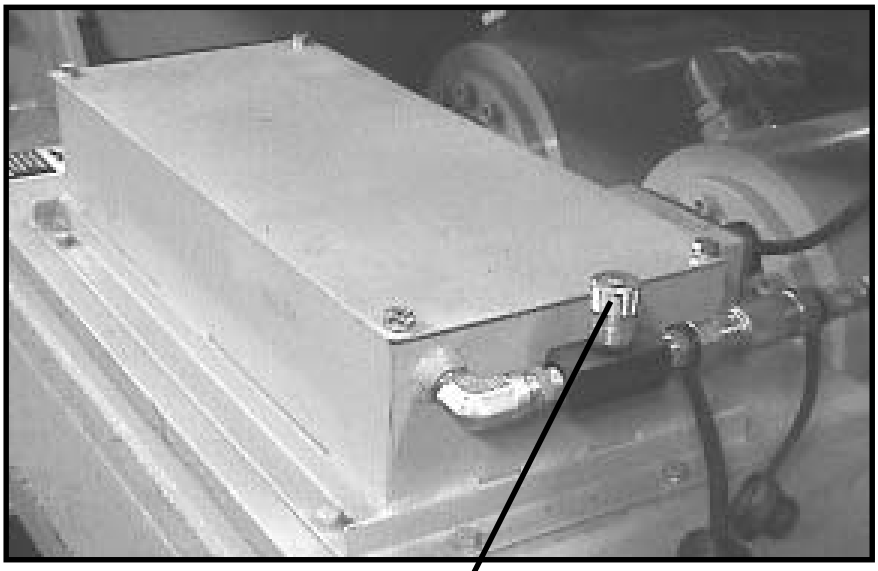
2. Turn the ignition switch to the “ON” position and note dog pin positions and dog pin indicator lights.

3. The switch brackets allow for adjustment forward and backward, and side to side. Loosen, but do not remove the screws which will allow movement in the required direction for proper switch placement.

Note: The switch should be positioned with “DIM A” = 1/4”-3/8” air gap between the switch arm and the hydraulic dog plate cylinder. Refer to the illustration above.

4. Tighten the screws and test the operation by repeatedly extending and retracting the dog pins. Repeat these steps if further adjustments are necessary.

# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54



**Dog Plate Adjustable Valve**

**Dog Plate Cylinder Replacement**

D1. Open the dog pin valve completely.

D2. Remove the top plate of dog plate box.

D3. Disconnect and cap the hydraulic hose at the cylinder swivel fitting.

D4. Remove the two screws that attach the cylinder to the dog pins. The dog pins are spring loaded, so there will be pressure on the screws when they are removed. Note: Be careful not to damage machine components still in place, wires, switches, etc.

D5. It is recommended that the dog plate be thoroughly cleaned whenever the dog plate cylinder is removed.

D6. Remove the dog pins and dog pin springs. Clean the dog pins and remove any rust or corrosion on the pins. Clean any mud or dirt out of the springs. Replace springs if necessary. Clean the dog plate housing. Make sure the dog pins can slide freely in and out by hand, before reassembling.

A1. The dog pin has a top and a bottom. The top of the dog pin is determined by the depth of the set screw in the tapped hole. The top of the dog pin has a set screw depth of ~ 5/16". If this dimension is not correct, adjust the set screw. Remove the set screw and clean off any residual thread lock. Clean the tapped hole in the dog pin. Apply Loctite #243 to the set screw and insert it into the dog pin to the proper depth. Allow the thread lock to cure before reassembling.

A2. Insert the dog pin springs into the dog plate. Make sure the springs slide over the center pin and are seated on the stop in the center of the housing.

A3. After the dog plate and pins have been cleaned, apply a thin film of oil to the pins and insert them into the dog plate. **Do not use grease or heavy oils**. These heavier lubricants tend to attract dirt more than lighter oils.

A4. Press the dog pins into the housing until the tapped holes in the dog pins are accessable in the slots in the top plate.

A5. Put the cylinder screws through the cylinder end lugs and thread the screws into the dog pins. Tighten the screws until they bottom out on the set screws in the dog pins. Once tight, there should be a small gap between the base of the cylinder and the dog plate. The gap keeps the cylinder from pulling the dog pins against the top of the dog plate. Note: The cylinder must be positioned properly to match up with the dog pin indicator switches.

A6. Connect the hose to the dog plate cylinder swivel fitting.

A7. Operate machine and check for leaks.

A8. Replace the top plate.

**Dog Plate Cylinder Seal Kit Replacement**

D1. Remove cylinder as described in the above section.

D2. Remove the swivel fitting and unscrew the threaded cap.

**NOTE:** FLUID UNDER PRESSURE. THERE MAY BE REMAINING HYDRAULIC FUILD IN THE CYLINDER. EXTENDING OR RETRACTING THE CYLINDER CAN FORCE FLUID OUT OF THE CYLINDER. FLUID UNDER PRESSURE CAN CAUSE SERIOUS INJURY.

D3. Pull the rod assembly out of the barrrel.

D4. Remove the piston from the end of the rod assembly.

D5. Remove the threaded cap from the rod assembly.

D6 Remove and discard all seals, o-rings, back-up washers and wipers. Visually note the placement and orientation of all seals before removal.

A1. Clean all components with brake cleaner and let dry.

A2. Refer to the Dog Plate Cylinder Components section of this manual for proper seal placement and orientation. Lube all seals and wipers with a thin coat of oil before assembly.

A3. Install the threaded cap onto the rod assembly, note proper orientation.

A4. Install the piston onto the rod assembly.

A5. Insert the rod assemlby into the barrel.

A6. Tighten the threaded cap.

A7. Refer to Dog Plate Cylinder Replacement instructions for assemlby procedure.

# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

## THRUST CYLINDER

### Removal:

D1. Remove the carriage from the jacking station.

D2. Disconnect and cap the hydraulic hoses and cylinder ports.

D3. Disconnect the hydraulic and electrical connections at the dog plate.

D4. Remove the 3 cylinder pins in the dog plate and slide the dog plate away from the cylinders.

D5. Remove the cylinder from the jacking station. Note: Be careful not to damage machine components already in place.

### Thrust Cylinder Seal Kit Replacement:

D1. Remove the rod clevis.

D2. Remove the rod-end base plate.

D3. Unscrew the rod end cap.

D4. Pull the rod assembly out of the barrel.

D5. Remove the piston from the end of the rod assembly.

D6. Remove and discard all seal and wipers. Visually note the placement and orientation of all seals before removal.

A1. Clean all components with brake cleaner and let dry.

A2. Refer to the Thrust Cylinder Components section of this manual for proper seal placement and orientation and torque requirements for fasteners. Lube all seals with a light coat of oil before assembly.

A3. Install the piston on the rod assembly and torque the retaining nut to the proper specifications.

A4. Insert the rod assembly into the barrel.

A5. Install the rod end cap and torque to the proper specifications.

A6. Install the rod end plate and torque screws to the proper specifications.

A7. Position the cylinder in the jacking station and reinsert the cylinder pin.

A8. Position the dog plate on the cylinders and insert the dog plate cylinder pins.

A9. Connect the hoses.

A10. Connect the hydraulic and electrical connections at the dog plate.

A11. Install the carriage.

A12. Operate the machine and check for leaks.

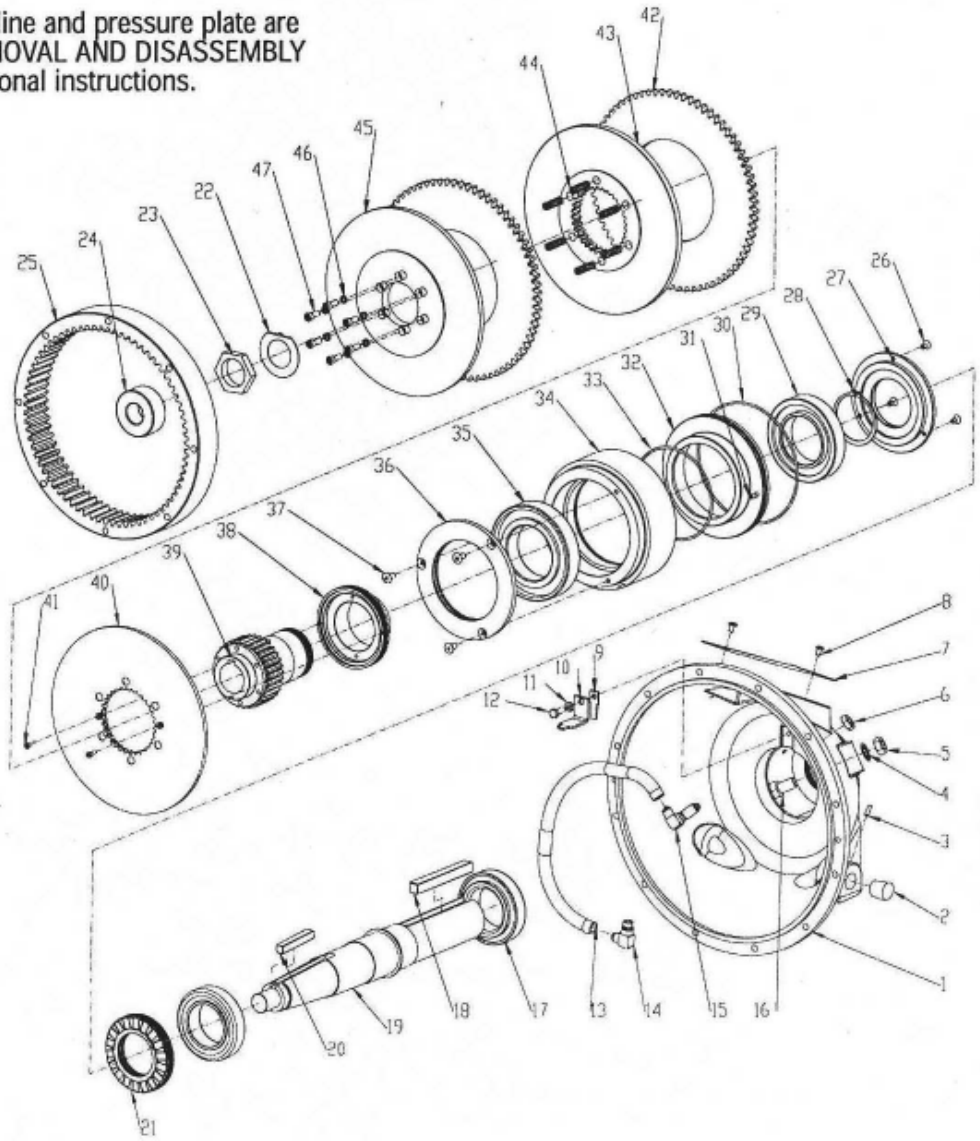
# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

### 7.6 CLUTCH SERVICE

**Disassemble for Disc Change:**

1. Remove sheaves, keys, belts, etc. from the output end of the clutch shaft and remove the instruction cover plate (#7).
2. Remove hydraulic connection (#15) to clutch housing.
3. Remove cap screws that secure the clutch housing to the flywheel housing.
   (Note: There are two 3/8-16 tapped holes in the housing to be used for pusher bolts to assist in removing the clutch from engine.)
4. Remove pilot bearing (#24) from end of shaft (#19) using a standard bearing puller.
5. Remove six socket head screws ( #47) from clutch back plate (#45). Remove back plate(#45), friction discs (#42), and separator plate (#43).
6. Check for heat damage to springs (#44), pressure plate (#40), back plate (#45), and hub spline (#39).

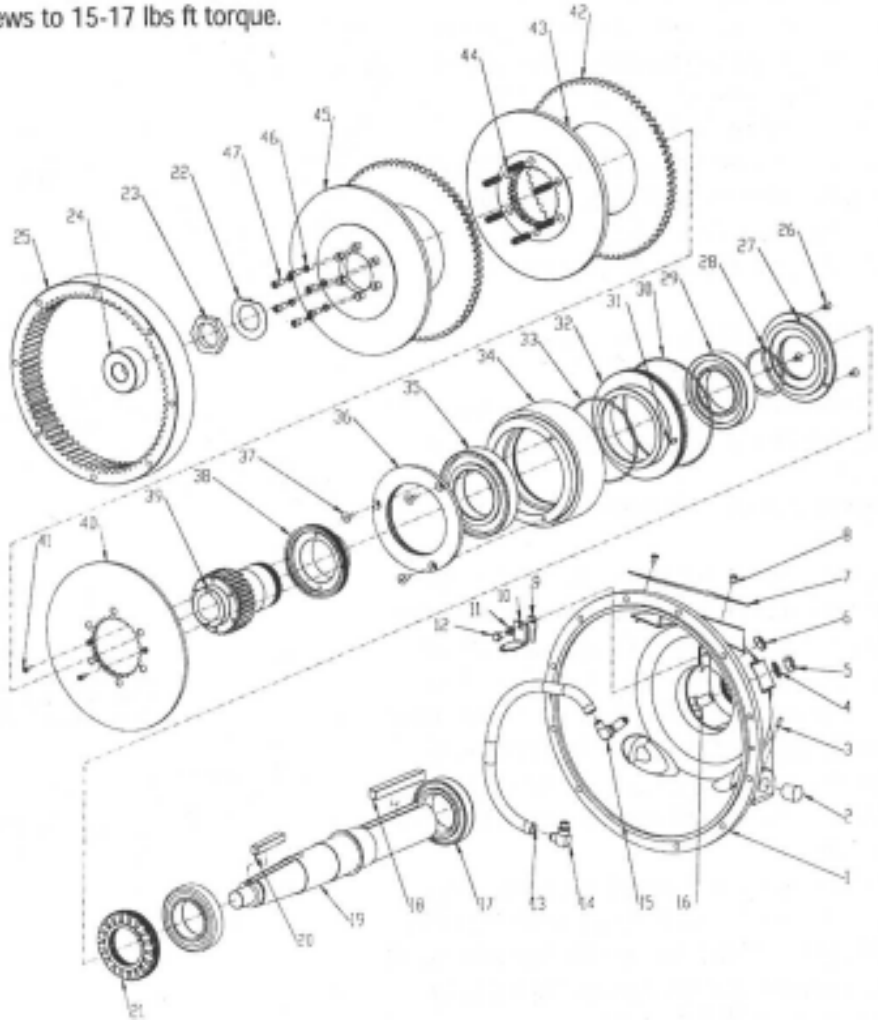
Note: If the hub spline and pressure plate are worn, refer to "REMOVAL AND DISASSEMBLY on page 4 for additional instructions.



# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

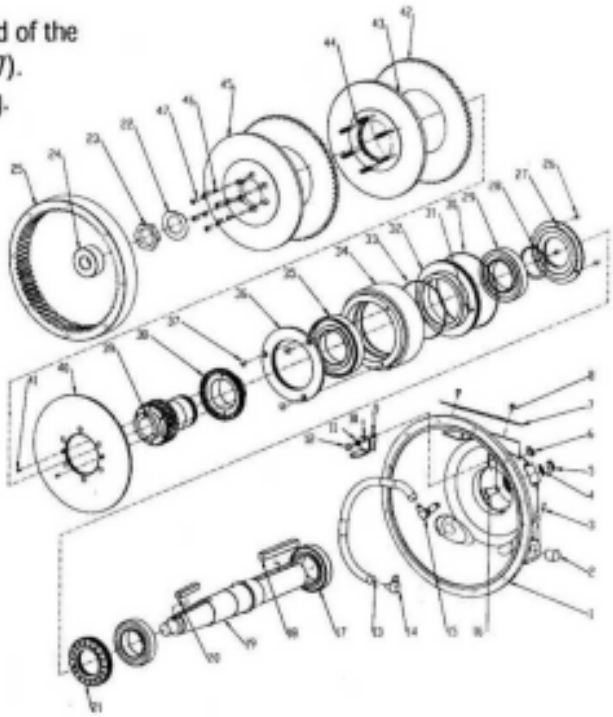
**Assemble for Disc Change:**

1. Position bell housing clutch assembly in vertical position with input side up.
2. Position friction discs (#42) and separator plate (#43)on to pressure plate (#40).
3. Carefully position back plate (#45) over springs in line with center pilot. Reinstall socket cap screws (#47) and lockwashers (#46) to complete the clutch assembly.
4. Torque screws to 15-17 lbs ft torque.

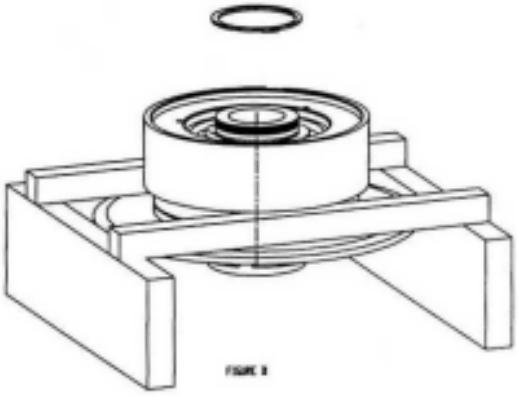


# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

**Disassemble Clutch:**



1. Remove sheaves, keys, belts, etc. from the output end of the clutch shaft and remove the instruction cover plate(#7).
2. Remove hydraulic connection (#15) to clutch housing.
3. Remove cap screws that secure the clutch housing to the flywheel housing. There are two 3/8-16 tapped holes in the housing to be used for pusher bolts to assist in removing the clutch from engine.
4. Remove pilot bearing (#24) from end of shaft (#19) using a standard bearing puller.
5. Remove six socket head screws (#47) from clutch back plate (#45). Remove back plate (#45) friction discs (#42), separator plate (#43).
6. Remove the shaft nut (#23) and lock washer (#22).
7. Remove the bulkhead fitting (#15), and fitting nut (#6) from side of housing (#1).
8. Remove clutch and key (#20) from tapered shaft (#19) using standard "T" bar wheel puller with two 5/16-18 bolts.
9. Remove hydraulic hose (#13) from fitting on piston body (#34).
10. Turn clutch face down and remove back retainer plate (#27) by removing three 1/4-20 flat head screws (#26).
11. Remove external snap ring (#28) from hub (#39) and press hub (#39) out of clutch body assembly. Note: Clutch body can be supported with two 1" square bars as shown in Figure B (for disassembly of hub (#39).

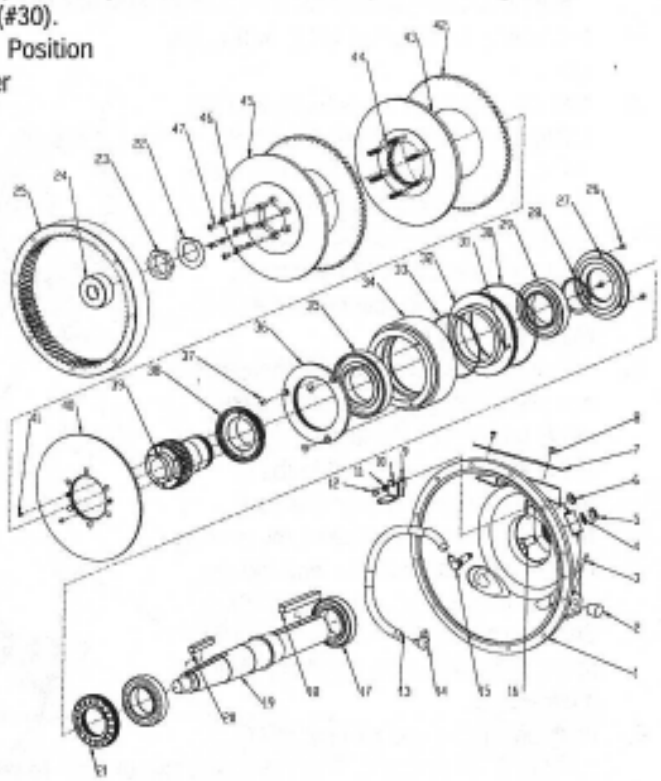


12. Remove cylinder assembly (#32) from piston (#34) by inserting an air hose into the actuation port and providing a blast of air.
13. Check cylinder bearing. If bearing (#29) turns freely and shows no signs of wear, leave assembled in cylinder assembly (#32). If not, set cylinder assembly (#32) face down on spacers and remove bearing (#29) by taping on outer race with flat punch.
14. Turn clutch face up and remove pressure plate (#40) by removing two #10-24 cap screws (#41).
15. Remove front retainer plate (#36) and three 5/16-18 flat head screws (#37).
16. Check piston bearing (#35). If bearing turns freely and shows no signs of wear leave assembled in piston body (#34) and on spacer (#38). If not, turn piston (#34) assembly face down and remove front bearing (#35) and spacer (#38) assembly by taping on outer race with flat punch.
17. Remove bearing (#35) from spacer (#38) using two 1/4-20 screws in holes provided.

# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

**Assemble Clutch:**

1. Position cylinder (#32) with three holes up. Position bearing (#29) in cylinder bore with thick side of outer race facing down. Apply Loctite #609 (or equiv.) compound to outer race and press bearing (#29) to seat. Apply oil to o'ring groove and install o'ring (#30).
2. Position piston (#34) with bearing bore up. Position bearing (#35) in bore with thick side of outer race facing down, apply Loctite #609 (or equiv.) compound to outer race and press to seat. Position spacer (#38) in bearing bore, apply retaining compound to spacer and press bearing to seat.
3. Apply Mobil #SHC 100 grease to bearing balls. Position retainer spacer (#36) on piston assembly (#34) and seat securely with three 5/16-18 flat head screws (#37). Torque to 15 to 17 lbs.-ft.
4. Position pressure plate (#40) on assembly, align with two #10-24 holes and install two cap screws (#41) to prescribed torque.
5. Turn assembly with pressure plate face down. Apply oil to o'ring groove and install o'ring (#33). Position cylinder assembly (#32) in bore aligning dowel pin (#31) with anti rotation hole in piston and press the assembly to seat. ( Note: the hole intersecting the fitting is the WRONG hole)

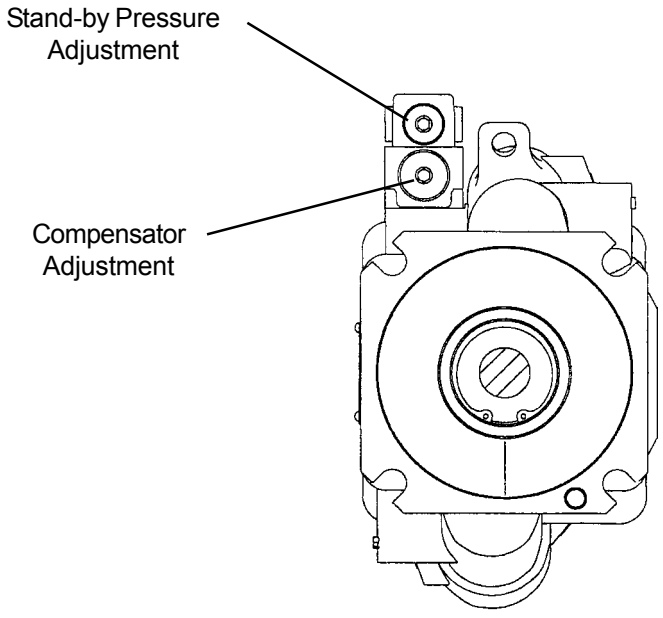


6. Position assembly over hub (#39), align gear teeth in pressure plate (#40) with gear teeth in hub (#39) and press to seat.
7. Install external snap ring (#28) on hub (#39).
8. Apply Mobil #SHC 100 grease to bearing balls. Position retainer spacer (#27) on cylinder (#32) and seat securely with three 1/4"-20 flat head screws (#26).
9. Position assembly with pressure plate (#40) face up. Position one friction disc (#42) on pressure plate (#40).
10. Position the separator plate (#43) over the hub (#39), aligning the six thru holes in the separator plate with the six spot faced holes in the pressure plate.
11. Position the six springs (#44) through the holes of the separator plate (#43) and on to the spot faced holes of the pressure plate (#40). The six springs should be flat and square to the pressure plate (40).
12. Position the backplate (#45) so that the six spot-faced holes fit over the six springs.
13. Install six socket head cap screws (#47) and lock washers (#46) to complete the clutch assembly.
14. Attach and tighten hydraulic hose (#13) and (#14) to clutch body.

## 7.7 PUMP SETTINGS AND ADJUSTMENTS

This machine is equiped with a pressure compensated, hydraulic piston pump with load sense. It has two adjustable settings, Compensator pressure setting and Stand-by pressure setting. Refer to the Specifications and Settings section of this manual for those settings. The case ports are identified by the following marks:

Inlet Port (suction) : Right side of pump (facing the front of the machine)
Outlet Port (pressure) : Left side of pump (facing the front of the machine)
Load Sense Port: Top center of pump, marked “X”.
Case Drain Port: Top center of pump, marked “L2”.
Gauge Port (system pressure) : Bottom side of pump, marked “M2”.




**Pump Setting Detail**

# SERVICE AND REPAIR INSTRUCTIONS
## McL-48/54

**Setting the Stand-by Pressure ~ 250-300 psi (17.5 - 20.7 bar)**

***Remove and cap 2nd system to read only pump stand-by pressure.**

The Stand-by pressure setting, is set by adjusting the top set screw on the top-center of the pump case.

1. Install a 0-5000 psi minimum pressure gauge into the gauge port on the pump.

2. Start the engine. The pressure on the gauge is the current stand-by pressure setting.

3. Loosen, but do not remove, the locking set screw in the side of the adjustment housing.

4. Adjust the set screw in the center of the adjustment housing until the desired pressure is acheived.

5. Tighten the locking set screw.

6. Check pressure setting.

**Setting the Compensator ~ 5000 psi (344.8 bar)**

The Compensator pressure setting is set by adjusting the bottom set screw on the top-center of the pump case.

1. Install a 0-5000 psi minimum pressure gauge into the gauge port on the pump.

2. Start the engine and retract the cylinders using the manual lever on the thrust control valve.

3. Dead-head the cylinder in the retracted position and the pressure on the gauge is the compensator setting.

4. Loosen, but do not remove, the locking set screw in the side of the adjustment housing.

5. Adjust the set screw in the center of the adjustment housing until the desired pressure is acheived. Dead-head the cylinders and make an adjustment. Release the cylinders and allow the pump to drop to stand-by pressure before making more adjustments. Do not try to adjust the pump all at one time.

6. Tighten the locking set screw.

7. Check pressure setting.

NOTE: There are no other adjustable functions on this pump. If the pump requires more service, consult the McLaughlin Manufacturing Co. for pump service and repair instructions.

## 7.8 Main Thrust Valve Adjustment

The main thrust valve has both a manual control lever, and an electric solenoid control. The electrical control portion is covered under the Autobore section. The valve has an adjustable relief valve built in. It is preset at the factory and should not require adjustment in the field. Reference the Components section for valve handles.

**Relief Valve Adjustment ~ 5100+ psi (351.7 + bar)**

The relief valve is located just below the instrument panel. Raise the instrument panel to access the relief valve.

1. Install a 0-5000 psi minimum pressure gauge into the gauge port on the pump.

2. Start the engine and confirm that the compensator is set at the proper setting. Note: the relief valve is set 100-200 psi (6.9 - 13.8 bar) above the compensator setting. If the compensator setting is wrong, the relief valve setting will be wrong.

3. Remove the locking cap.

4. Loosen, but do not remove the locking nut on the relief valve.

5. Loosen the relief valve threaded stud 1-2 turns.

6. Run the machine and collapse the thrust cylinders using the manual lever on the valve.

7. Dead-head the cylinders in the retract position and adjust the relief valve until the engine relieves its self. Adjustment of this valve is an audible determination. When the pump goes over relief it continues to pump oil which lugs the engine down. When the pump reaches proper compensator setting and de-strokes, the relief valve is set properly.

8. After the pump de-strokes, turn the relief valve threaded stud 1/4 of a turn and tighten the lock nut.

9. Install the locking cap.

10. Replace and secure the instrument panel.

# WARRANTY & RETURN GOODS POLICY

## 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. Hole Hammer pistons, bodies, and nose pieces are warranted to be free from defects in material and workmanship for a period of three years 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 extend to Buyer.

Claims for 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 goods 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 the manufacturer, free from all charges except authorized transportation. Buyer shall be responsible for all maintenance services consisting of lubrication and cleaning of equipment, replacing expandable 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 OR 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 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.

**GENERAL RETURNS OF MERCHANDISE**

1. All returns must be pre-authorized
   A. Please call our parts department for an RGA number
   B. Please include RGA number on the outside of box
   C. Include any required paper work or special instructions
   D. Items returned without an RGA number will not be accepted
2. All returns are subject to a 20% restock charge.
3. Special items are non-returnable
   A. Non-stock parts
   B. Custom parts
   C. If you are unsure about a parts status when ordering, ask your McLaughlin representative if the item fits on of the above conditions.
4. Items must be returned within thirty days of original order date.
5. Items not returned within 30 days from the date of RGA is issued will not be accepted.
6. The item(s) must be in new condition. Used item(s) are not returnable.

# END OF MANUAL