MIDLAND
MIDLAND MACHINERY CO., INC.

MODEL SP-6
SELF-PROPELLED ROADWIDENER
OWNERS MANUAL
SERIAL # _____

03/07

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Phone: (716) 692-1200 Fax: (716) 692-1206
WWW.ROADWIDENER.COM

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

S/N 101 & 102 HAD:

SP-1135 ENGINE ENCLOSURE
SP-1076 GRILLE FILLER
SP-1077 GRILLE
SP-639 ENGINE CONTROL STATION
EXHAUST OUT UNDERSIDE OF CHASSIS (SEE OBS BOM)
SP-670 BLADE & COLUMN ASSY
DUMP HOPPER /W SEPARATE PIVOTING PAN (WITH SMALL STOPS)
SHOP FAB FUEL TANK
1-1/4" RAILINGS
SP-1090 OPERATOR CONSOLE (SMALL POST W/ HOSE TO DECK)
MASTER CYLINDER W/ BANJO FITTINGS
S/N 101 ONLY TRACTION DRIVE MOTOR W/ ADAPTER PLATE & DIN SHAFT
S/N 101 ONLY TRAVEL CONTROL WAS SHOP REWORKED TO ADD (2) MICRO SWITCHES
S/N 102 WAS REWORKED IN FIELD TO ADD PRESSURE SWITCH

S/N 103 & 104 HAD:

ENGINE W/ PURCHASED ENCLOSURE & JD EXHAUST
FIRST USE OF MUFFLER GUARD SP-1239
SP-666 BLADE & COLUMN ASSY
DUMP HOPPER /W SEPARATE PIVOTING PAN (WITH LARGE STOPS)
TRAVEL CONTROL W/ 1 MICRO SWITCH (STOCK)
ADDED PRESSURE SWITCH FOR BACKUP ALARM
STILL W/ SHOP FAB FUEL TANK
STILL W/ 1-1/4" RAILINGS
ADDED BULKHEAD FITTINGS @ RIGHT SIDE PANEL
FIRST TO USE SP-1211 OPERATOR CONSOLE W/ LARGE POST
MASTER CYLINDER W/ 1/8" PIPE FITTINGS

S/N 105 106 & 107 HAD:

OPTION SET- END GATE & CRANK
ELIMINATED BULKHEAD FITTINGS @ SIDE PANEL
4" SQ HOLE ON OLD LOCATION
FIRST TO USE 1" RAILINGS\
FIRST TO USE PURCHASED FUEL TANK
NEW FUEL GAUGE (TOP OF TANK)
FIRST TO USE NEW DUMP HOPPER W/ INTEGRAL PAN & SHOP FAB HINGES
& TORSION SPRINGS

S/N 108 109 & 110 HAD:

4" SQ HOLE (HOSE ACCESS) MOVED TO UNDERSIDE OF OPERATOR CONSOLE TUBE
NEW HOSE LENGTHS TBD @ 108
S/N 110 ONLY TRACTION DRIVE MOTOR W/ ADAPTER PLATE & DIN SHAFT

S/N 111 THRU 116 QCI

S/N 122 REV-A

NEW REAR BUMPER
REMOVABLE FENDER PANELS
SEPARATE HYD TANK
FLAT PUMP ACCESS PANEL
R/S CENTER DOOR MADE BOLT ON PANEL
REVISED CHAIN GUIDE WAS FAB Z SHAPE AR 400 NOW L SHAPE A36 GRADE STEEL

MACHINE SAFETY PRECAUTIONS

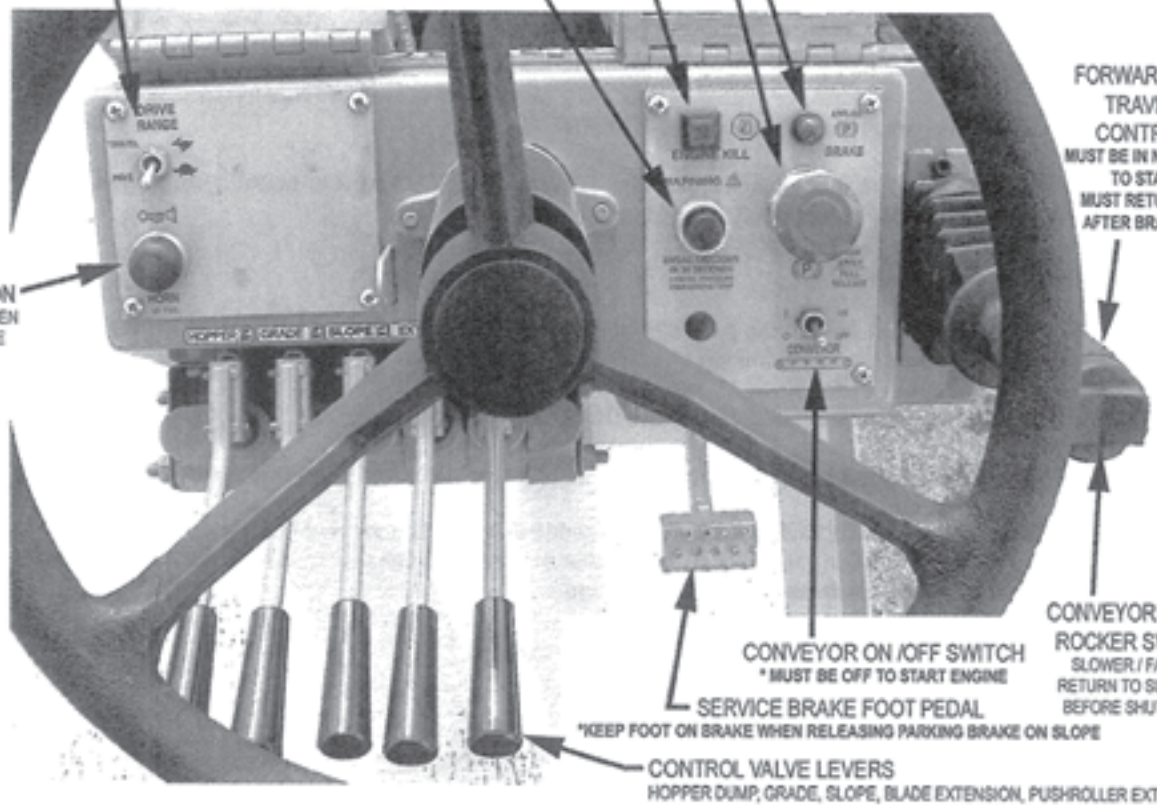
WARNING !

ALL PERSONNEL TO BE INVOLVED IN THE OPERATION OR MAINTENANCE OF THE MACHINE, MUST READ THESE PRECAUTIONS AND UNDERSTAND ALL THE WARNING LABELS.

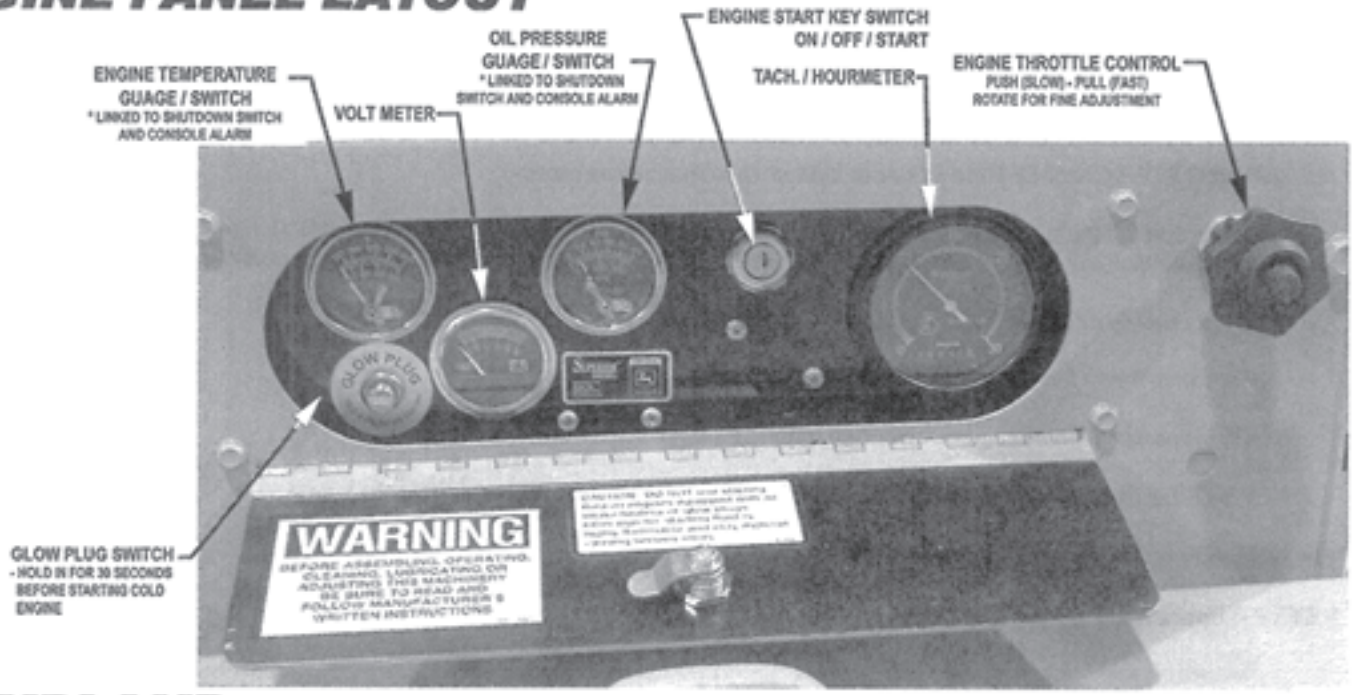
- Midland Road Wideners must be operated only by trained personnel.
- At no time should there be any riders on the SP WIDENER.
- Use the FOOT BRAKE for normal stopping (and return TRAVEL SPEED LEVER to neutral), Applying the EMERGENCY BRAKE will lock up the wheels and the machine will come to an abrupt stop.
- ALWAYS wear the SEAT BELT.
- When stopping or parking for an extended period of time, lower the STRIKE OFF BLADE to the ground, or in the blade restraint when engine is not running.
- NEVER perform maintenance or inspection while the ENGINE IS RUNNING.
- Check HOPPER for tools, machine components or PERSONNEL and material from the last use before starting the engine.
- Perform walk around, CHECK WIDENER FOR: - Damaged or worn parts. (conveyor belt, casters)
  - Obstructions to proper operation (i.e. Rocks jammed in conveyor sideboards, or belt wiper; material build up in the blade pivot, etc.) - Material remaining in the hopper
- ALWAYS use the ladder at the rear of the widener to get on or off.
- Alert ALL personnel that you will be STARTING the MACHINE.
- DO NOT STAND IN FRONT OF MACHINE OR IN THE MATERIAL HOPPER while the engine is running.
- DO NOT PULL OUT PUSH ROLLERS BEYOND LAST PINHOLE. (6th HOLE)
  – Push roller mount will fall out of tubes and cause injury.
- STAY CLEAR of the widener BLADE and CONVEYOR
  - Extension, Grade and Slope cylinders and conveyor drive are operated by remote control.
- DO NOT STAND in between BLADE and PUSH TUBE when operating.
- NEVER STEP ON or OFF the Widener ladder while machine is moving.
- ALWAYS apply the brakes when you return the drive stick to neutral (center position). AND whenever the machine is parked with the engine is running. - Machine may roll in neutral when brakes are in release position and engine is running.
- Do not operate machine if back up alarm is not working.
- Use low gear when traveling up or down steep grades.
- NEVER perform maintenance or operate machine alone in case of personal injury.
- NEVER LIFT the MACHINE with hydraulic cylinders - Use proper jacking equipment.
- NEVER leave the machine running unattended.

NEVER operate ANY machine under the influence of any drugs or alcohol.

OPERATOR CONSOLE LAYOUT



ENGINE PANEL LAYOUT



OPERATING PROCEDURES

READ MACHINE SAFETY PRECAUTIONS BEFORE STARTING OPERATION

CHECK BEFORE STARTING: Fuel Level, Engine Oil, Coolant, (see ENGINE Operation Manual), Hydraulic fluid level, Rear Wheel Hub Oil and Grease the Bearings (SEE LUBE CHART)

START-UP *SEE CONSOLE DIAGRAM previous page

1. Turn ENGINE KEY clockwise to the ON position, **DO NOT CRANK OVER - YET**
   - Check the OPERATOR PANEL and make sure the EMERG. STOP button light is not on (square, push button switch should be in the out position),
   - CONVEYOR switch is in the OFF position and the BRAKE switch in the DOWN (off) position. The Brakes are automatically applied when the engine is turned off (check brake light on panel).
   - Set the TRAVEL SPEED CONTROL LEVER in neutral (center).

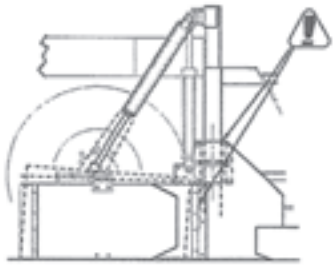
NOTE: The ENGINE WILL NOT START IF:
- TRAVEL SPEED CONTROL LEVER is not in NEUTRAL (center) - ENGINE KILL SWITCH is not RESET (UP)
- CONVEYOR SWITCH is in the ON position. - BRAKE MUSHROOM SWITCH is NOT in the DOWN position (ON)
- DRIVE RANGE SWITCH IS IN TRAVEL

2. Turn the key to Start the ENGINE and run at a high idle (1100 rpm.) for approx. 5 min. to WARM UP.
   *FOR COLD WEATHER START Hold down the GLOW PLUG BUTTON for 30 seconds, then turn the key
   - Longer warm up time may be needed in colder temperatures.

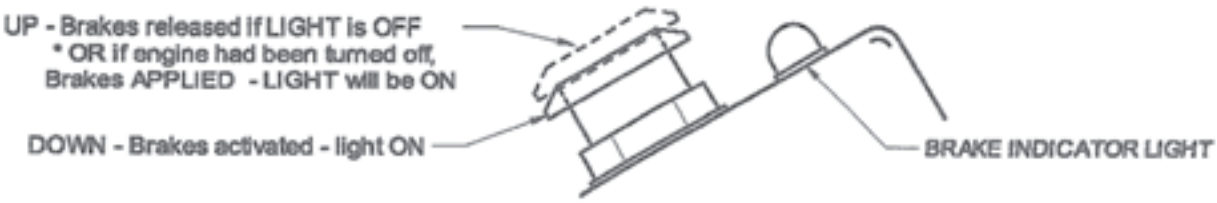
CAUTION: DAMAGE may occur in the hydraulic system at low temperatures if the unit is throttled up and moved at low operating temperature.

3. After the warm-up period, increase to 1/2 throttle. CHECK the conveyor belt at the dump hopper end by running the conveyor slowly and inspect for rips, missing chain bolts, or splice problems.
   - Raise the strike-off blade (GRADE UP lever), secure using the blade restraint. Raise inner deflector plate and secure with the chain to obtain ground clearance.

WARNING: DO NOT MOVE SLOPE CYLINDER CONTROL LEVER WITH THE BLADE PARALLEL TO THE SP SIDE! (SWUNG BACK IN TRAVEL POSITION) - BLADE MOUNT WILL NOT PIVOT IN THIS POSITION and the BLADE HINGE, MOUNT and COLUNM WILL BE DAMAGED



4. Sound horn before moving to alert anyone near the SP. Set DRIVE RANGE SWITCH in PAVE. Increase engine speed to 2000 RPM (at least) or MAXIMUM. Release the parking brake (PULL UP on CAP - indicator light will take APPROX. 20 seconds to go out - as system pressure is built up).



5. SLOWLY move drive control stick in forward (or reverse) to move the machine into position.

CAUTION: MACHINE WILL ROLL ON A SLOPE when brake is released - Use FOOT BRAKE PEDAL until you engage the TRAVEL crontroller - FORWARD OR REVERSE

OPERATING PROCEDURES

6. Drive the SP in low gear to unload from a trailer and moving into Position. For traveling greater distances return drive control stick to neutral and shift to TRAVEL - high gear (0 to 14 mph).

CAUTION: USE LOW GEAR WHEN TRAVELING UP OR DOWN STEEP GRADES

When in position at the start point return drive control to neutral, apply brakes and shift transmission back to low gear. Reduce RPM's to idle.

STRIKE OFF BLADE SET UP (See blade diagrams # 1 & 2)

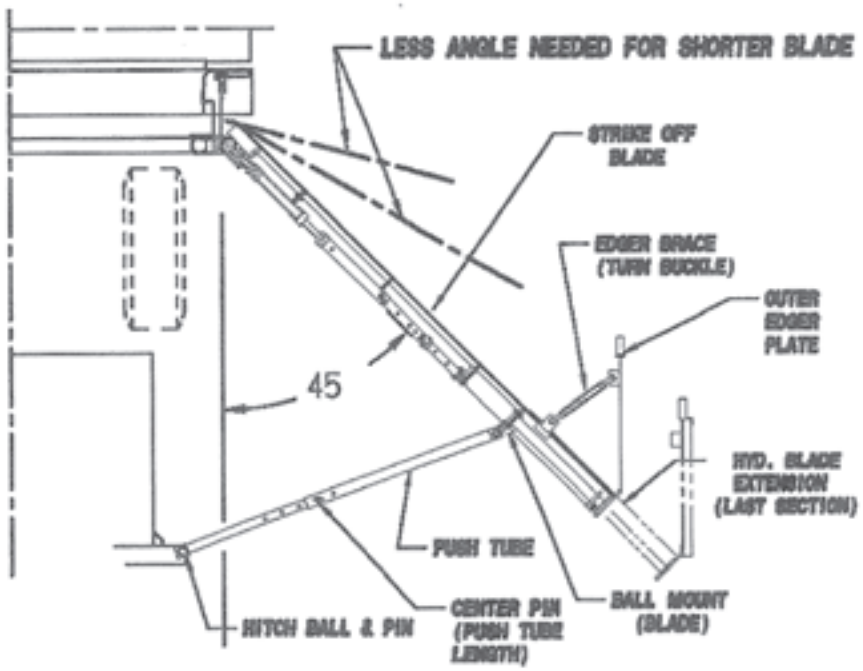
1. DISCONNECT the BLADE RESTRAINT and SWING the BLADE out from the SP body.
   - DO NOT MOVE the SLOPE CONTROL LEVER until you swing the blade out from the chassis.
2. Set BLADE ANGLE to approx. 45° and adjust the length for the appropriate spreading width
   Set the blade length with the HYD. EXTENSION half extended for adjustment of your spread width - in or out .
   Pin the PUSH TUBE on the hitch balls and at the closest adjustment pin hole. PUSH TUBE MOUNT ON THE BLADE SHOULD BE AT LEASED 2/3 BLADE LENGTH.

NOTE: Depending on the material you are applying, a greater blade angle may be needed to fill the entire spread width. Narrower spread widths do not require as much blade angle.

3. Move the SLOPE CYLINDER MOUNTING LUG on the blade, when changing blade lengths, to at least 2/3 the length of the STRIKE-OFF BLADE.
4. Adjust the EDGER BRACE (turnbuckle) and pin in place so the OUTER EDGER PLATE is parallel to the lane edge.
5. Set the GRADE & SLOPE angle for the desired shoulder profile. Keep in mind material compaction if the job will be rolled.

Blade Diagram # 1

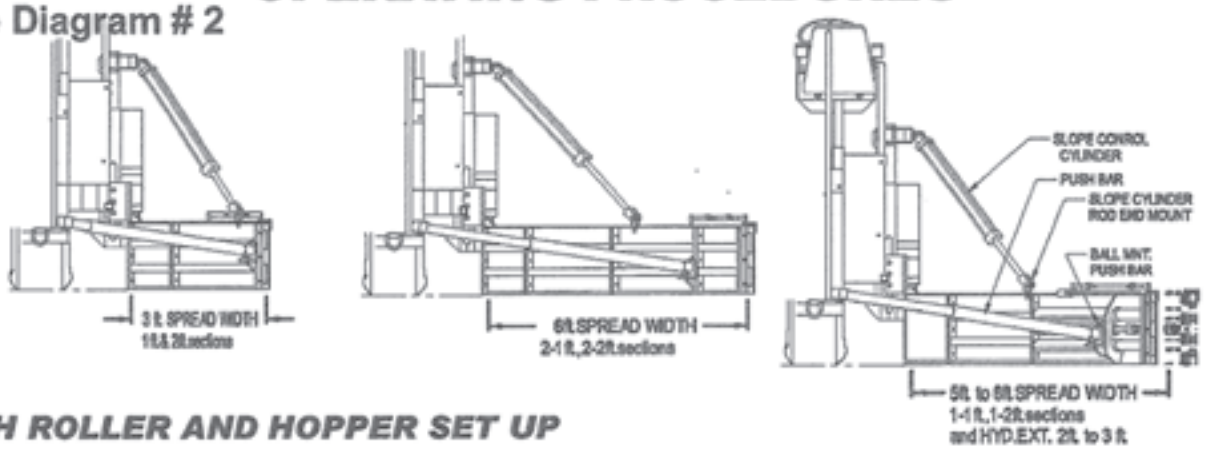
STRIKE-OFF WIDTH can be adjusted by:
- Adding or removing BLADE SECTIONS for large changes *see BladeDiagram #2
- Extending the Hydraulic Blade Extension for changing up to 1 ft.,
- Adjusting the length of the PUSH TUBE and changing the blade angle (Depending on the material flow)



CAUTION: When changing blade sections the HYDRAULIC EXTENSION must be the outer most section with the BALL MOUNT and SLOPE CYLINDER MOUNT positioned inboard, or the spread width and profile will change and the blade and push tube can be damaged.

OPERATING PROCEDURES

Blade Diagram # 2



PUSH ROLLER AND HOPPER SET UP

1. Remove CENTER PIN (beam pivot) from the travel position (left side if standing in front of the hopper) and slide the PUSH ROLLER BEAM to line up with the center hole. the push roller beam is now centered with the open hopper. Return Push Roller to the left hand position for transport on a trailer.

WARNING: Make sure the push roller LOCK PINS are disenguaged (under the front of the hopper) before moving the HYDRAULIC PUSH ROLLER VALVE LEVER - LOCK PINS and EXTENSION TUBES MAY BE DAMAGED

2. Set the PUSH ROLLERS at the proper distance for the trucks being used, so that the material does not spill on the road or dump on the hopper back.
   - Release the lock pins at the mount tubes (under the hopper) and move the PUSH ROLLERS out *Without hyd.extension pull to the last pin hole (6TH. hole, 5 holes will show out past the mount tube)

WARNING: (IF YOU DO NOT HAVE HYD. ROLLER EXTENSION) DO NOT PULL OUT PUSH ROLLER BEYOND LAST (6TH) HOLE - PUSH ROLLER MOUNT WILL FALL OUT OF TUBES AND MAY CAUSE INJURY.

3. Lower the DUMP HOPPER with the valve lever. MAKE SURE there is nothing on the belt or in the way.

4. Back the truck up (or move the SP forward) pushing the rollers back to the proper distance. With the TAILGATE LOCKED, Lift the truck body to dump level and check clearance (at least 6 in. above belt) and dumping position.

WARNING: DO NOT ALLOW TAILGATE TO CONTACT THE CONVEYOR BELT - SERIOUS DAMAGE WILL RESULT ON BELT AND ROLLERS!

   - Lower the truck body, Pull truck forward and CHAIN the TRUCK TAILGATE to restrict the opening to 12" - 18" (adjust as necessary to regulate flow depending on material).
   - Replace the pins in the nearest mount tube holes (on units without hydraulic push roller extension)

5. - Run ENGINE at 3/4 to FULL throttle, set CONVEYOR speed to less than 1/2 and switch conveyor on.
   - Open the tailgate and start a head of material in front of the strike-off blade (approx. 3/4 blade height) before SLOWLY starting forward motion.

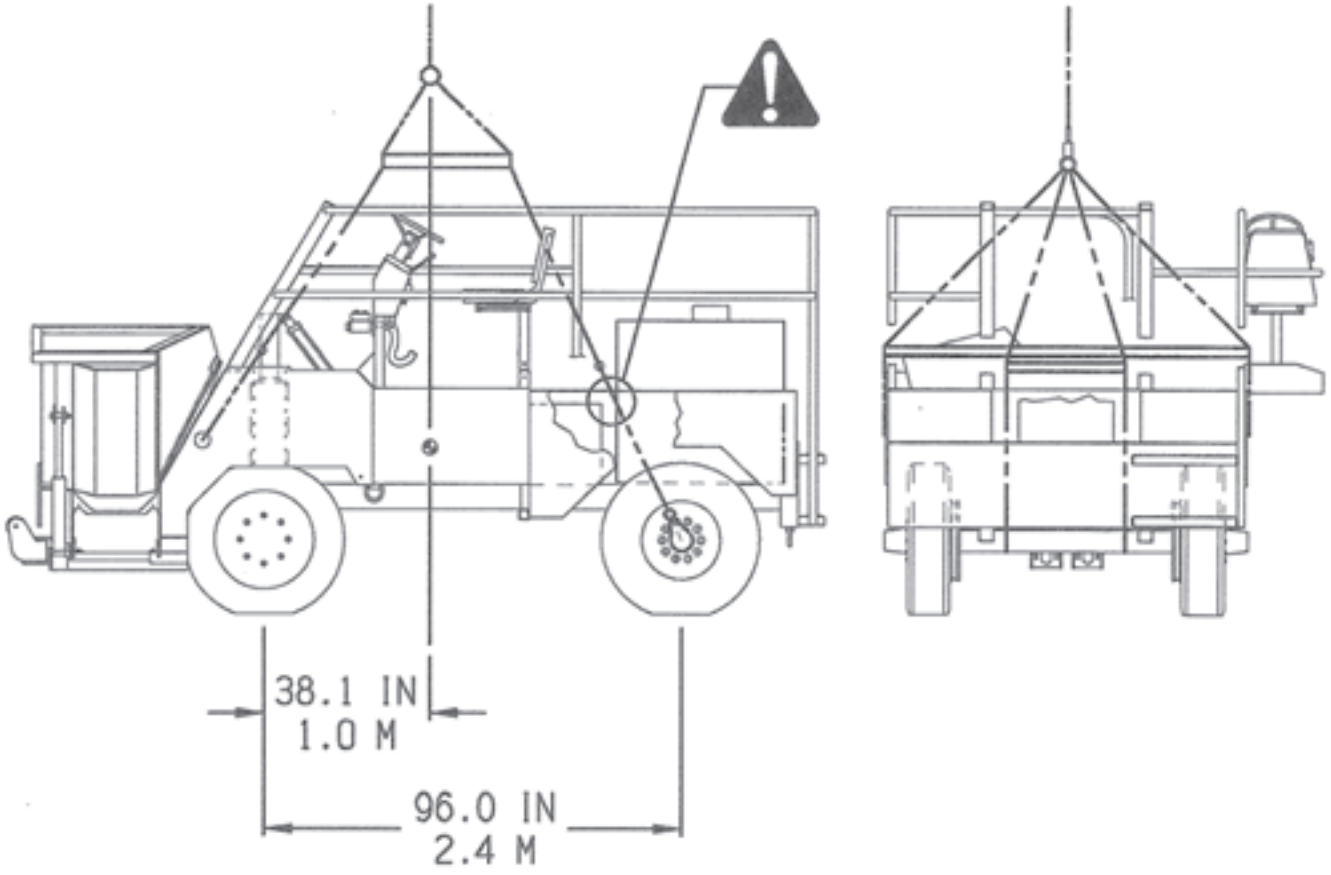
CAUTION: Excessive ON/OFF conveyor operation will cause wear on system.

6. Increase forward speed & material flow as you become comfortable with the operation.
   - WATCH THE SHOULDER AHEAD; look for wash outs, driveways, high spots and holes
   - Anticipate and adjust the amount of material required. This will eliminate overflows and gaps (cleanup and fill-in with shovels)

LIFTING LOCATIONS

SP-6 WIDENER
11,700 LB
5,300 KG

⚠ CAUTION



SERVICE INFORMATION

SERVICE SECTION

MAINTENANCE

READ MACHINE SAFETY PRECAUTIONS BEFORE STARTING

CHECK POINTS:

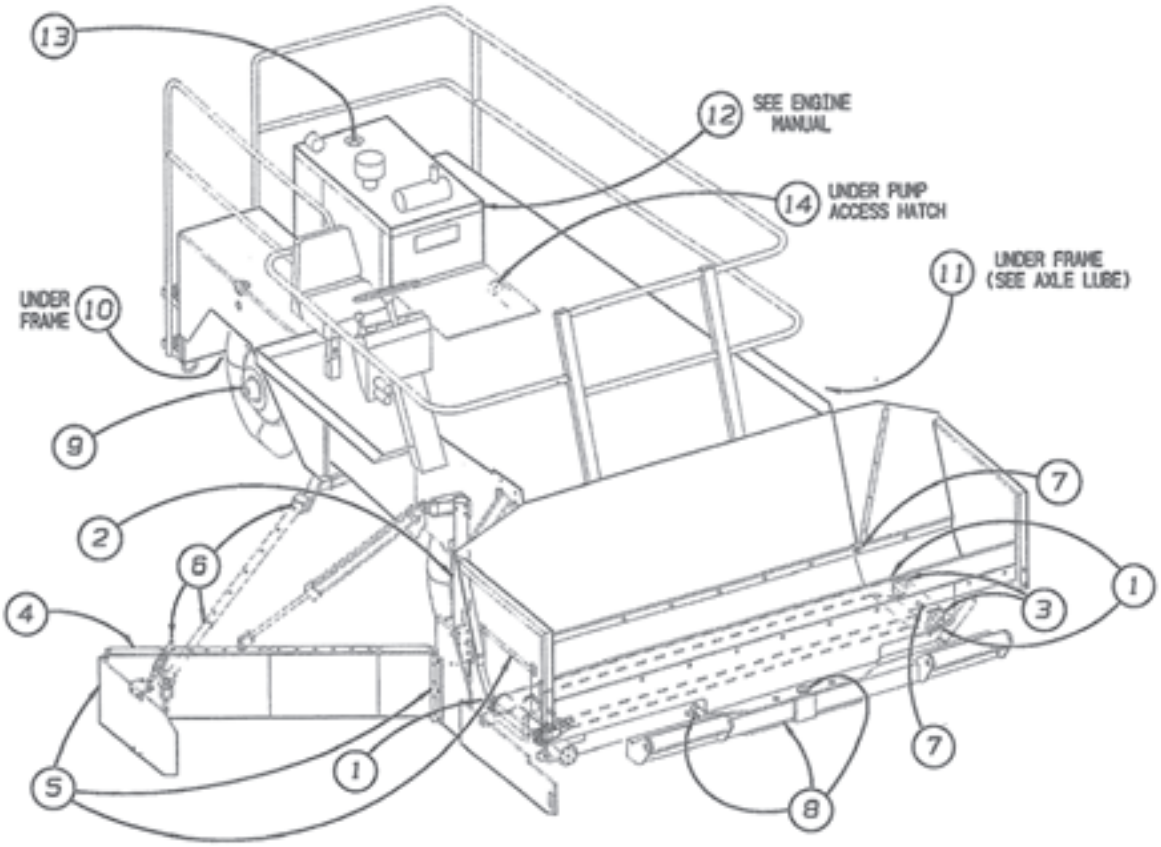
Fuel Level,
Fue/ Water Seperator
Engine Fuel Filter
Engine Oil,
Coolant, J.D COOL GUARD or equal(see ENGINE Operation Manual),
Hydraulic fluid level, ISO GRADE - 68
Rear Wheel Hub Oil and
Grease the Bearings

FILTER LIST:

M6117A HYD SUCTION FILTER
ZENG OIL RE518977 (JD)
FUEL RE508202 (JD)
AIR - DURALITE, ECC085005-DC024WA DONALDSON

MAINTENANCE

LUBE DIAGRAM



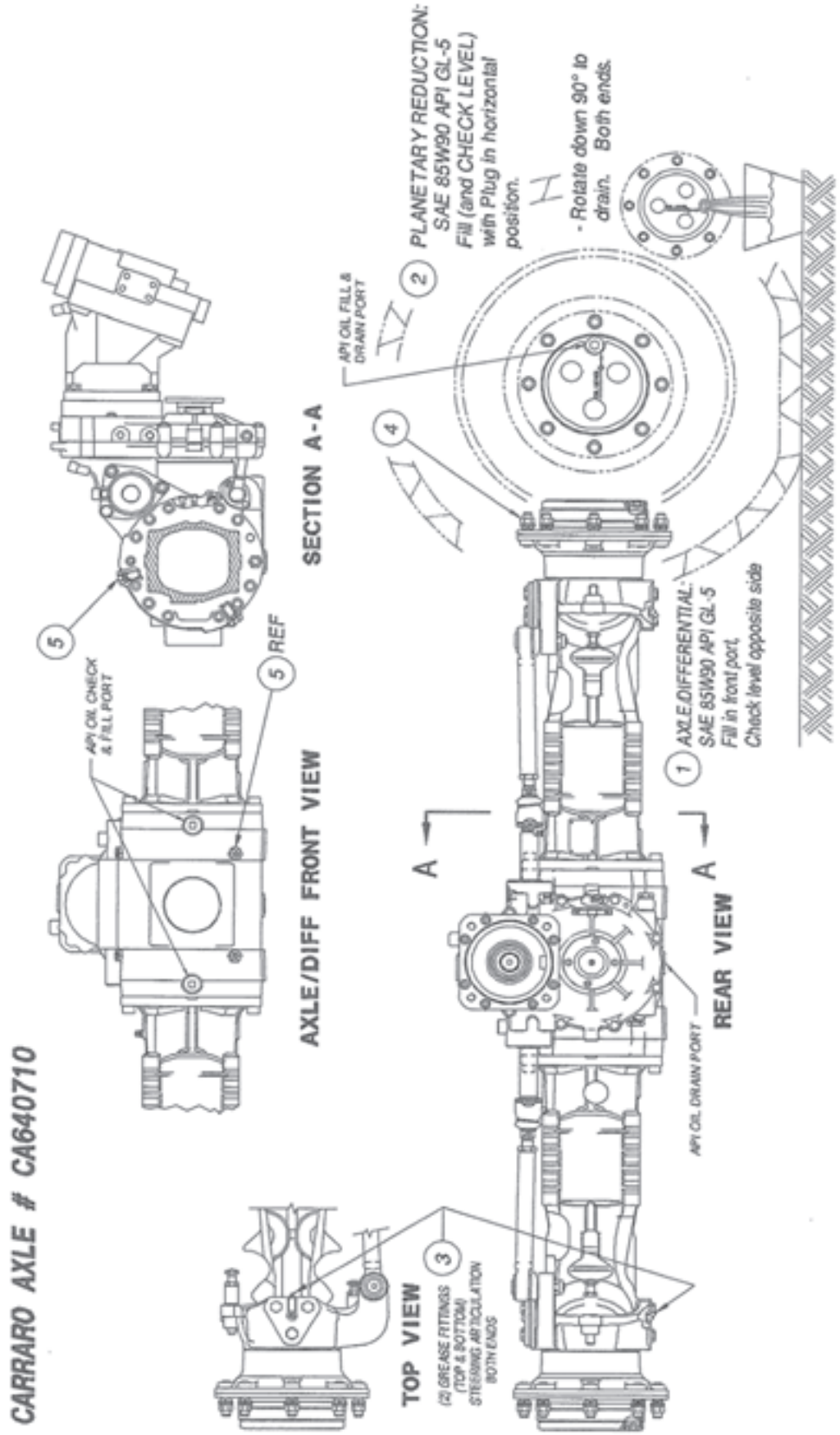
REF. NO.	DESCRIPTION	SERVICE PERIOD	LUBRICANT TYPE	CHANGE PERIOD
1.	TAKE UP BEARINGS (3)	DAILY	HIGH-TEMP GREASE(GUN)	**
2.	COLUMN	DAILY	HIGH-TEMP GREASE(GUN)	**
3.	CONVEYOR CHAIN (2)	100 HOURS	GRAPHITE OR SILICONE SPRAY	**
4.	HYD. BLADE EXTENSION GUIDES	200 HOURS	HIGH-TEMP GREASE	**
5.	BLADE HINGES AND HOPPER SPILL DOOR	200 HOURS	HIGH-TEMP GREASE	**
6.	PUSH TUBE AND OUTER EDGER TURNBUCKLE	200 HOURS	HIGH-TEMP GREASE	**
7.	HOPPER PINS AND CYLINDER PIVOTS	200 HOURS	HIGH-TEMP GREASE(GUN)	**
8.	PUSH ROLLER (EXTENSION TUBES & PIN)	AS REQ'D	HIGH-TEMP GREASE	**
9.	REAR AXLE HUBS CHECK SIGHT GAGE	DAILY	GEAR LUBE SAE 80W/85W/140	ANNUAL
10.	REAR BRAKE MECHANISM	50 HOURS	HIGH-TEMP GREASE(GUN)	**
11.	DRIVE AXLE * CHECK OIL LEVEL & GREASE ALL FITTINGS	MONTHLY	SAE 85W90 API GL5 / HIGH-TEMP GREASE (GUN)	1500 HOURS
12.	ENGINE OIL SEE ENGINE MANUAL FOR DETAILED SPECIFICATIONS	AS REQ'D	SAE 5W-30 OR 10W-30	250 HOURS
13.	ENGINE COOLANT		50/50 ANTIFREEZE/WATER	ANNUAL
14.	HYDRAULIC OIL CHECK SIGHT GAGE BEFORE RUNNING	DAILY	ISO GRADE - 68	ANNUAL

* REFER TO CARRARO LUBE POINTS ON NEXT PAGE

** CLEAN, INSPECT AND REGREASE ANNUALLY or WHEN WORKING CONDITIONS MAY CAUSE WEAR DAMAGE.

AXLE LUBE DIAGRAM

SS-0032



	SECTION DESCRIPTION	LUBRICANT	CHECK FREQUENCY	CHANGE FREQUENCY
1	AXLE/DIFFERENTIAL	SAE 85W90 API GL-5	MONTHLY	EVERY 700 HOURS
2	PLANETARY REDUCTION-AXLE ENDS	SAE 85W90 API GL-5	EVERY 200 HOURS	EVERY 1000 HOURS
3	STEERING ARTICULATION/BRAKE ACTUATOR	GREASE, MULTIPURPOSE LITHIUM BASE	GREASE MONTHLY (4 GREASE FITTINGS)	
4	TIGHTEN SCREWS, BOLTS and LUG NUTS EVERY 200 HOURS			
5	CHECK and ADJUST SAFETY BRAKE EVERY 1000 HOURS		SEE OWNER'S MANUAL FOR ADJUSTMENT DIRECTIONS	

CONVEYOR BELT ADJUSTMENT

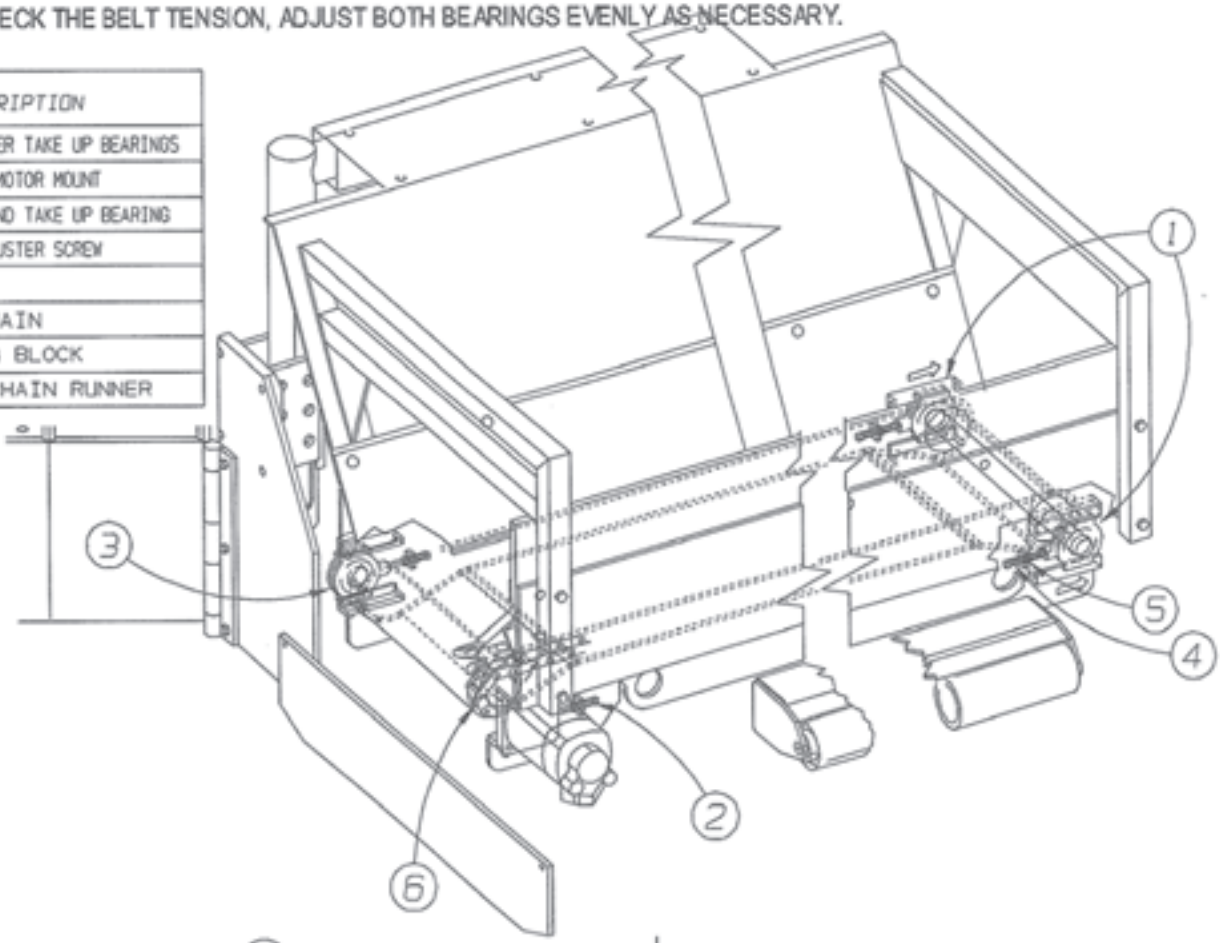
BEFORE FILLING HOPPER, RUN THE CONVEYOR BELT EMPTY AND WATCH THE DRIVE CHAIN TRAVEL OVER THE RETURN END SPROCKETS. IF THE CHAINS APPEAR LOOSE ON THE SPROCKETS:

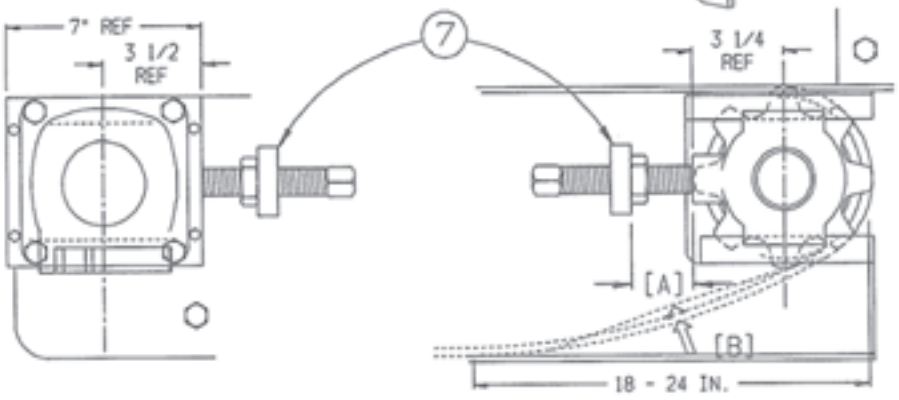
- TURN OFF THE BELT AND ENGINE, MAKE SURE DUMP HOPPER SAFETY CHAIN IS SECURED.
- MEASURE THE DISTANCE [A] BETWEEN THE BEARING [1] AND THE MOUNTING BLOCK [8] ON BOTH SIDES TO MAKE SURE THE BEARINGS ARE ALIGNED. - LOOSEN BOTH LOCK NUTS [5]
- PUSH UP ON THE BELT AT [B]. THE BELT SHOULD DEFLECT APPROX. 1 in. AND THE BELT SHOULD CONTACT WITH CHAIN BOTTOM RUNNERS [8] 18 TO 24 in. FROM END ROLLER

IF THERE IS MORE FLEX IN THE BELT (LESS THAN 18 in. TO WHERE IT CONTACTS RUNNERS [8]:

- TIGHTEN BOTH LOCK NUTS [5] AGAINST THE MOUNTING BLOCK.
- ADJUST THE TAKE UP BEARINGS [1] OUTWARD BY TURNING THE SQUARE HEAD BOLT [4].
- CHECK THE BELT TENSION, ADJUST BOTH BEARINGS EVENLY AS NECESSARY.

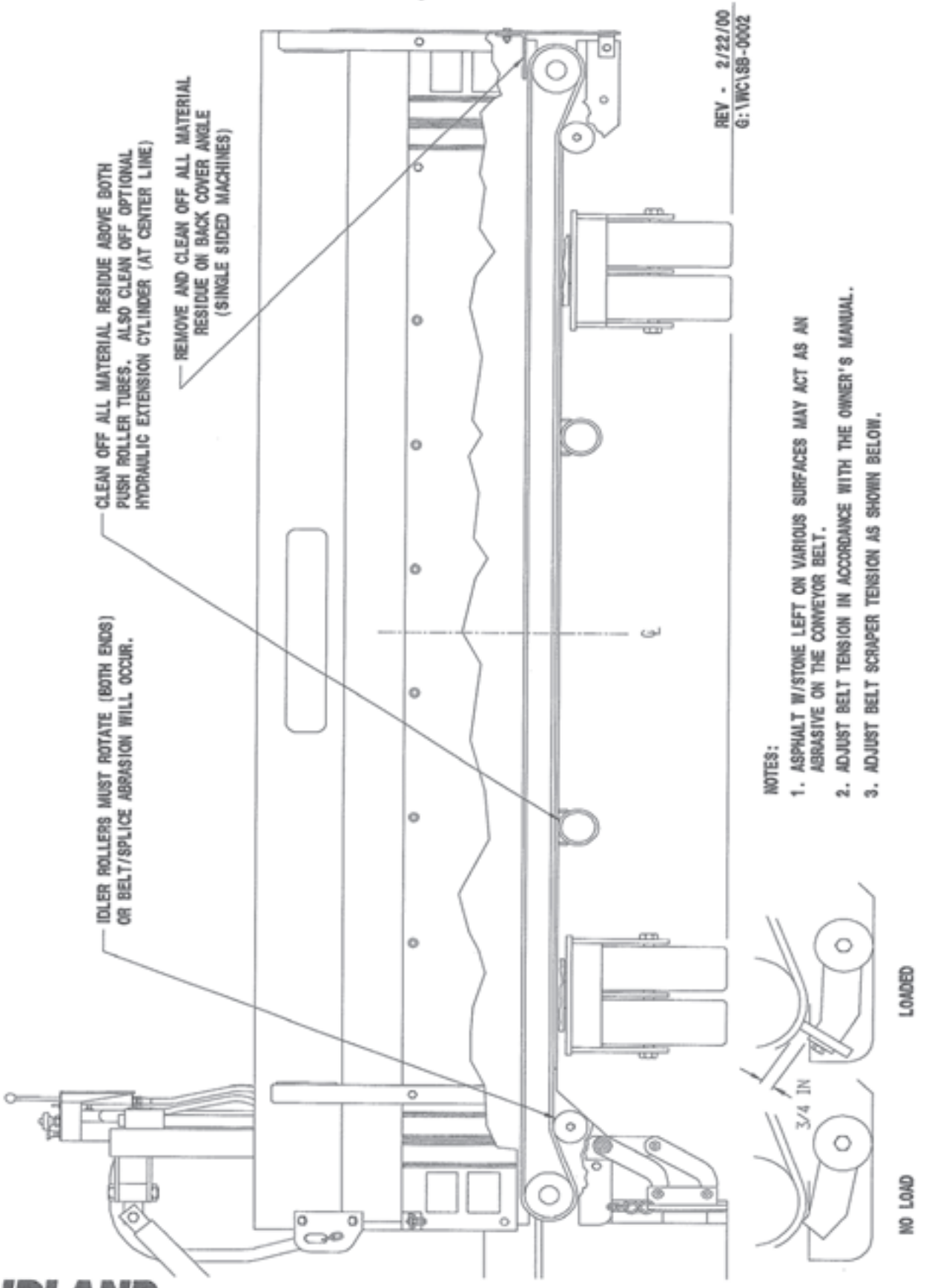
REF. NO.	DESCRIPTION
1.	RETURN ROLLER TAKE UP BEARINGS
2.	ADJUSTABLE MOTOR MOUNT
3.	DISCHARGE END TAKE UP BEARING
4.	BEARING ADJUSTER SCREW
5.	LOCK NUT
6.	DRIVE CHAIN
7.	MOUNTING BLOCK
8.	BOTTOM CHAIN RUNNER





INSPECTION & CLEANUP PRIOR TO NEW CONVEYOR BELT INSTALLATION

SERVICE BULLETIN, SB-0002



SERVICE BULLETIN, SB-0005

CONVEYOR BELT MAINTENANCE:

A FEW CUSTOMERS HAVE COMMENTED ABOUT LOW BELT LIFE WHEN USING ASPHALT. AFTER EXTENSIVE REVIEW OF CONTRACTOR'S EQUIPMENT, MIDLAND IS PROVIDING THE FOLLOWING GUIDELINES:

1. MANY BELTS ARE INSTALLED TOO TIGHT. THE STONES IN THE ASPHALT CAN PRODUCE SMALL CUTS IN THE BELT DURING PAVING. HOWEVER, IF THE BELT IS TOO TIGHT A TEAR AND SUBSEQUENT PEEL OFF OF THE TOP SURFACE MAY OCCUR.
   SPECIFIC INSTRUCTIONS FOR CONSISTENT BELT TENSION FOLLOW:

   THERE ARE TWO METHODS:

A. WHEN THE SIDEBOARD RUBBERS ARE REMOVED AND THE CHAIN IS ACCESSIBLE:

   AFTER INSTALLING THE CONVEYOR BELT, ADJUST THE TAKE UP BEARINGS ON BOTH SIDES UNTIL THE CHAIN CAN BE LIFTED UP APPROX 1 3/4 INCHES AT THE CENTER OF THE MACHINE. THEN TIGHTEN THE JAM NUTS.

B. WHEN THE SIDEBOARD RUBBERS ARE LEFT IN PLACE:

   ADJUST THE TAKE UP BEARINGS EVENLY ON BOTH SIDES TO APPROX. 30 FT-LBS TORQUE. THE TORQUE WILL INCREASE RAPIDLY WHEN THE CHAIN IS FULLY SEATED IN THE SPROCKET ("BOTTOMED OUT") THEN BACK OFF ON THE BOLT 1/2 TURN ON BOTH SIDES (APPROX 1/16 INCH). THEN TIGHTEN THE JAM NUTS. NOTE THAT THE CONVEYOR BELT MAY STILL CONTACT THE PUSH ROLLER TUBES UNDER THE MACHINE. HOWEVER, ANY WEAR DUE TO THIS CONTACT IS MINIMAL COMPARED TO LOW LIFE DUE TO TOO TIGHT A BELT TENSION.

2. THE CONVEYOR BELT SCRAPER IS CRITICAL TO BELT WEAR. THE SCRAPER MOUNTS HAVE RUBBER TORSION SPRINGS INSIDE SO IT WILL SPRING OUT AND BACK WHEN THE SPLICE COMES AROUND. THE SCRAPER MUST BE ADJUSTED SO THAT A SHEET OF PAPER JUST SLIDES BETWEEN THE BELT AND SCRAPER. HOWEVER, IF CONTACT IS DESIRED, ADJUST FOR ABSOLUTE MINIMUM CONTACT PRESSURE.
3. ON DUAL SIDED SP MACHINES, THE CONVEYOR BELT SCRAPER ON THE NON DISCHARGE SIDE MUST BE LOOSENED AND ROTATED OUT OF POSITION. WHEN REVERSING THE DISCHARGE SIDE, POSITION THE DISCHARGE SCRAPER AS NOTED IN #2 AND ROTATE THE NON DISCHARGE SCRAPER OUT OF POSITION. THE NON DISCHARGE SCRAPER MAY PICK UP STONES ON THE UNDERSIDE AND ACT AS A CUTTING EDGE.
4. THE SCRAPER MUST BE CLEANED TO REMOVE ACCUMULATED STONES AND GRIT AT THE END OF EACH DAY WHILE IT IS STILL SOFT. THIS INCLUDES THE UNDERSIDE EDGE WHICH CAN ACT LIKE A CUTTING EDGE WITH STONE BUILDUP. THE SAME IS TRUE WITH THE ADJUSTABLE END GATE SEAL.
5. DOUBLE SIDED MACHINES HAVE ADJUSTABLE END GATES ON BOTH SIDES. ON THE DISCHARGE SIDE, THE GATE MUST BE OPENED ALL THE WAY. IF NOT, THE MATERIAL FLOW IS RESTRICTED AND THE MATERIAL SLIPPAGE ON THE BELT WILL INCREASE. THE MATERIAL SLIPPAGE ON THE BELT WILL RESULT IN HIGH BELT WEAR.
6. MACHINES WITH ADJUSTABLE END GATES (TYPICALLY ON DUAL SIDED SP UNITS) HAVE A CONVEYOR BELT STRIP (SEAL) BOLTED TO THE LOWER EDGE OF THE GATE. THIS SEAL MUST BE CUT BACK TO ENSURE A 1/4 INCH GAP WHEN THE GATE IS PHYSICALLY BOTTOMED OUT IN THE HOPPER. THE SEAL IN CONTACT WITH THE CONVEYOR BELT WILL RESULT IN HIGH WEAR AND POSSIBLE CUTS FROM STONES. NEWER SP MACHINES NOW HAVE THIS 1/4 GAP BETWEEN THE SEAL AND AND BELT.
7. AT THE END OF THE DAY, INSPECT BOTH RETURN ROLLERS (ADJACENT TO THE DRIVE ROLLERS). IF THESE ROLLERS DO NOT ROTATE, CLEAN OFF ALL ASPHALT OR OTHER DEBRIS. A NON ROTATING RETURN ROLLER WILL CUT UP THE UNDERSIDE OF THE BELT.
8. THE SIDE BOARD RUBBERS MUST JUST TOUCH THE BELT. A GAP WILL ALLOW ASPHALT TO ENTER THE ROLLER CHAIN AREA. IF THE SIDEBOARD RUBBERS ARE PRELOADED AGAINST THE BELT, RAPID WEAR WILL OCCUR.
9. A FEW CUSTOMERS HAVE NOTED THAT, AFTER ASPHALT USAGE, IF A BELT IS LEFT STANDING FOR A FEW DAYS,IMMEDIATE START UP WILL INVARIABLY RESULT IN LOW BELT LIFE. A RELEASE AGENT PRIOR TO AND AFTER EVERY USE WILL LENGTHEN BELT LIFE. TWO RECOMMENDED RELEASE AGENTS ARE:

   1. ZEP SLIDE (972) 228-3388 2. TEC SHIELD (800) 700-2530

RETURNS FOR WARRANTY CLAIMS ON BELTS WILL BE REVIEWED TO DETERMINE IF THE ABOVE GUIDELINES WERE USED DURING BELT INSTALLATION.

SERVICE BULLETIN SB-0017

SPR-6 FUEL SHUTOFF RELAY KIT, S/N 103-113

THIS FUEL SHUTOFF RELAY KIT IS PROVIDED TO CORRECT THE INTERMITTENT NO START CONDITION FOUND ON SOME MACHINES. A LARGER GAGE WIRE WILL INCREASE THE VOLTAGE ACROSS THE FUEL SHUTOFF SOLENOID TO ENSURE ACTUATION.
REFER TO THE TWO ELECTRICAL SCHEMATICS ON THE NEXT PAGE.
THE KIT INCLUDES:

IT NO	QTY	DESC
1	1	M4066 RELAY
2	1	18 GA RED WIRE, 8 IN-1/8 FEM SPADE-1/4 FLANGE SPADE
3	1	18 GA BLK WIRE, 20 IN-1/4 FEM SPADE-RING
4	1	14 GA RED WIRE, 10 IN-1/4 FEM SPADE-RING
5	1	14 GA RED WIRE, 10 IN-1/4 FEM SPADE-BUTT
6	1	18 GA BLK WIRE #12, 15 IN-1/4 FEM SPADE-BUTT

1. REMOVE THE (4) BOLTS FROM THE ENGINE CONTROL PANEL TO GAIN ACCESS TO THE REAR OF THE PANEL.

2. REMOVE THE RED WIRE FROM THE IGNITION SWITCH TERMINAL AT THE GLOW PLUG BUTTON SWITCH, AND CONNECT TO THE "B" TERMINAL AT THE MURPHY SWITCH (THE RED WIRE MAY BE #1 & #15 ON EARLIER MODELS).

3. REMOVE RED/YEL WIRE FROM THE "B" TERMINAL AT THE MURPHY SWITCH AND CONNECT TO THE IGNITION SWITCH TERMINAL AT THE GLOW PLUG PUSH BUTTON SWITCH.

4. REMOVE (4) SCREWS FROM THE OPERATOR CONSOLE RIGHT PANEL TO GAIN ACCESS TO THE ENGINE KILL SWITCH AND REMOVE WIRE #11 FROM THE SWITCH. ALSO REMOVE WIRE #11 FROM THE NC TERMINAL AT THE MURPHY SWITCH. WIRE #11 IS NOW A SPARE WIRE.

5. CONNECT THE 18 GA RED JUMPER WIRE, ITEM 2, BETWEEN ENGINE KILL SWITCH TERMINAL AND POSITIVE 12 VOLTS TERMINAL AT THE CONVEYOR ON/OFF SWITCH.

6. MOUNT THE M4066 RELAY TO THE ENGINE CONTROL PANEL STUD BELOW THE ENGINE TACHOMETER.

7. CUT WIRE #12 AT THE CONNECTION WITH THE HEAVY GA PINK WIRE (FROM THE FUEL SHUT OFF SOLENOID). CONNECT WIRE #12 TO TERMINAL #86 OF THE RELAY USING THE 18 GA BLK EXTENSION WIRE #12, ITEM 6. CONNECT THE PINK WIRE TO TERMINAL #87 OF THE RELAY USING THE 14 GA RED EXTENSION WIRE, ITEM 5.

8. CONNECT THE I8 GA BLACK GROUND WIRE, ITEM 3 TO TERMINAL #85 OF THE RELAY AND CONNECT TO A GOOD GROUND.

9. CONNECT THE 14 GA RED JUMPER WIRE TO THE NC TERMINAL AT THE MURPHY SWITCH AND TO TERMINAL #30 OF THE RELAY.

10. TEST THE STARTING SYSTEM OPERATION INCLUDING THE ENGINE KILL SWITCH AT THE OPERATOR CONSOLE. SECURE ALL WIRING AND REINSTALL THE PANELS.

11. INSERT PAGE 3 INTO THE MANUAL TO UPDATE THE ELECTRICAL SCHEMATIC. DISCARD THE OLD PAGE.

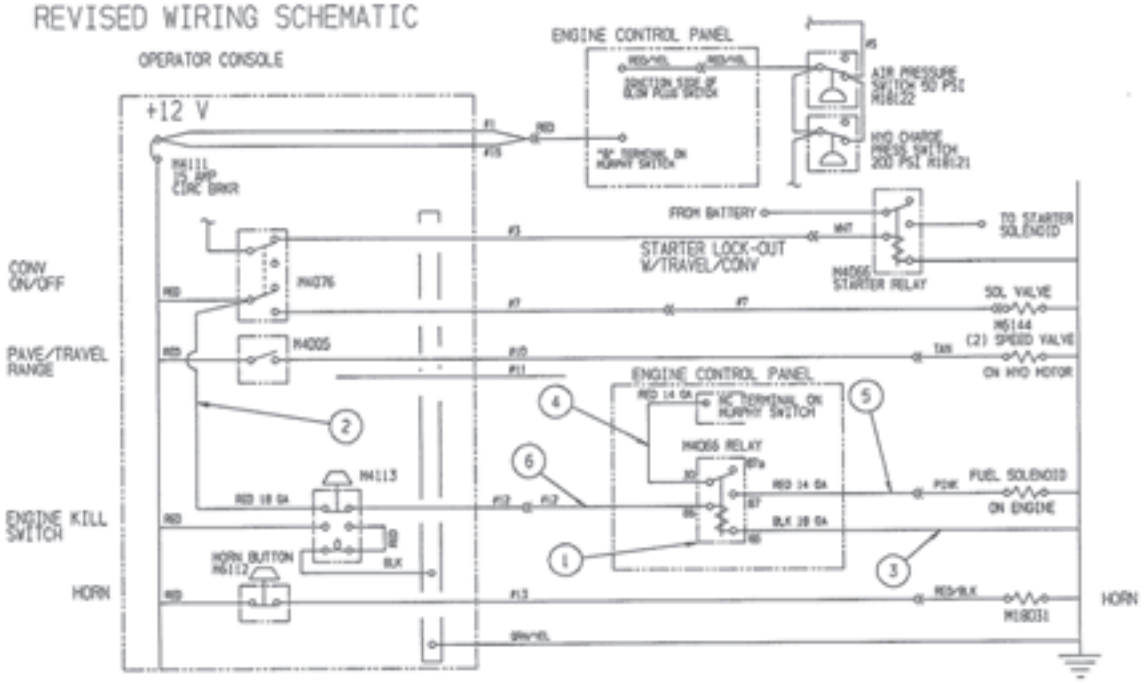
INTERNAL INFORMATION FOR FABRICATION OF WIRE ASSEMBLIES:

ITEM #2 18 GA RED WIRE 8 IN , 1/8 FEM SPADE CONNECTOR, 1/4 FLANGE SPADE TERMINAL
ITEM #3 18 GA BLK WIRE 20 IN, 1/4 FEM SPADE CONNECTOR, #10 RING TERMINAL
ITEM #4 14 GA RED WIRE 10 IN, 1/4 FEM SPADE CONNECTOR, #10 RING TERMINAL
ITEM #5 14 GA RED WIRE 10 IN, 1/4 FEM SPADE CONNECTOR, 14-16 GA BUTT CONNECTOR
ITEM #6 18 GA BLK WIRE #12, 15 IN, 1/4 FEM SPADE CONNECTOR, 14-16 GA BUTT CONNECTOR

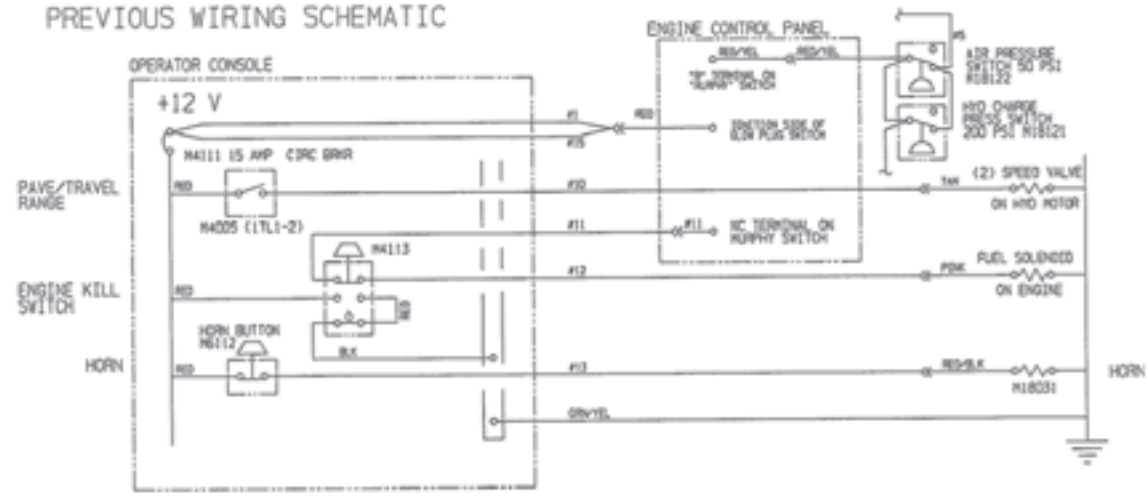
SERVICE BULLETIN SB-0017

SPR-6 FUEL SHUTOFF RELAY KIT, S/N 103-113

REVISED WIRING SCHEMATIC



PREVIOUS WIRING SCHEMATIC



SERVICE BULLETIN SB-0019

INSTALLATION OF SPR-6 DUMP HOOPER SAFETY CHAIN

INSTRUCTIONS:
1. INSTALL SUPPLIED KIT AS SHOWN BELOW.
2. RAISE DUMP HOPPER AND CONNECT CHAIN.
   CHAIN SHOULD SECURE HOPPER IN A POSITION THAT
   DOES NOT EXCEED TRANSPORTING WIDTH OF 8' 6" (102").

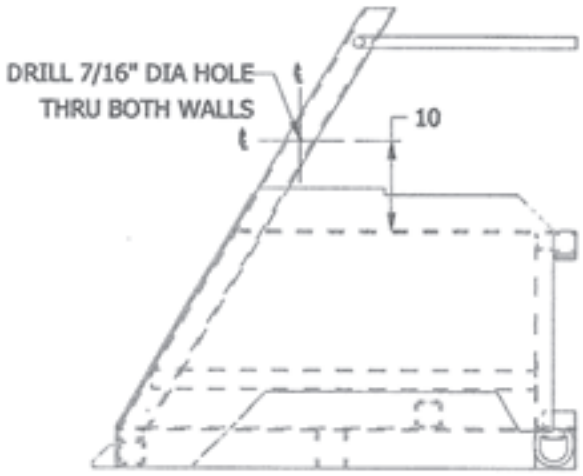


FIGURE 1: LEFT SIDE VIEW

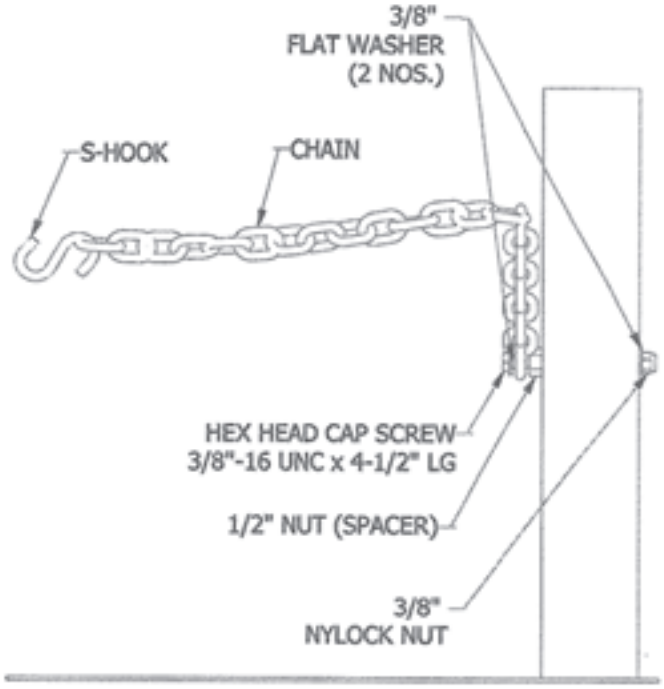


FIGURE 2: AFT VIEW, LOOKING FORWARD

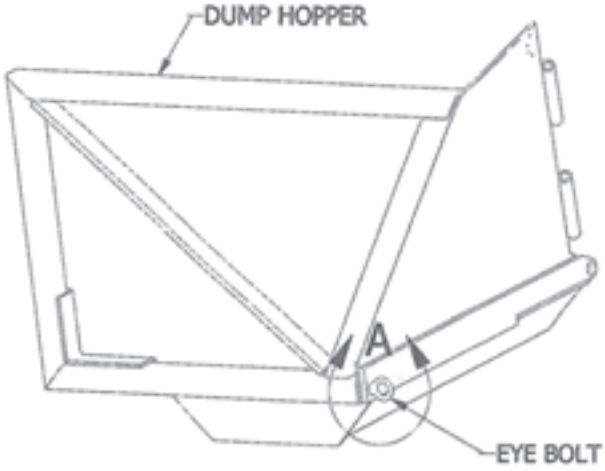


FIGURE 3: DUMP HOPPER VIEW

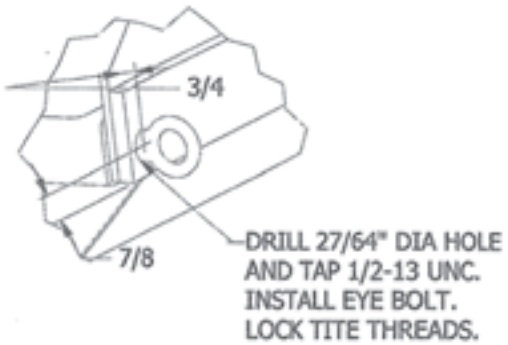


FIGURE 4: DETAIL VIEW A

PARTS ASSEMBLIES

Warning and Caution Lable location

SP-667

ALL PERSONNEL TO BE INVOLVED IN THE OPERATION OR MAINTENANCE OF THE MACHINE, MUST READ THESE PRECAUTIONS AND UNDERSTAND ALL THE WARNING LABELS.

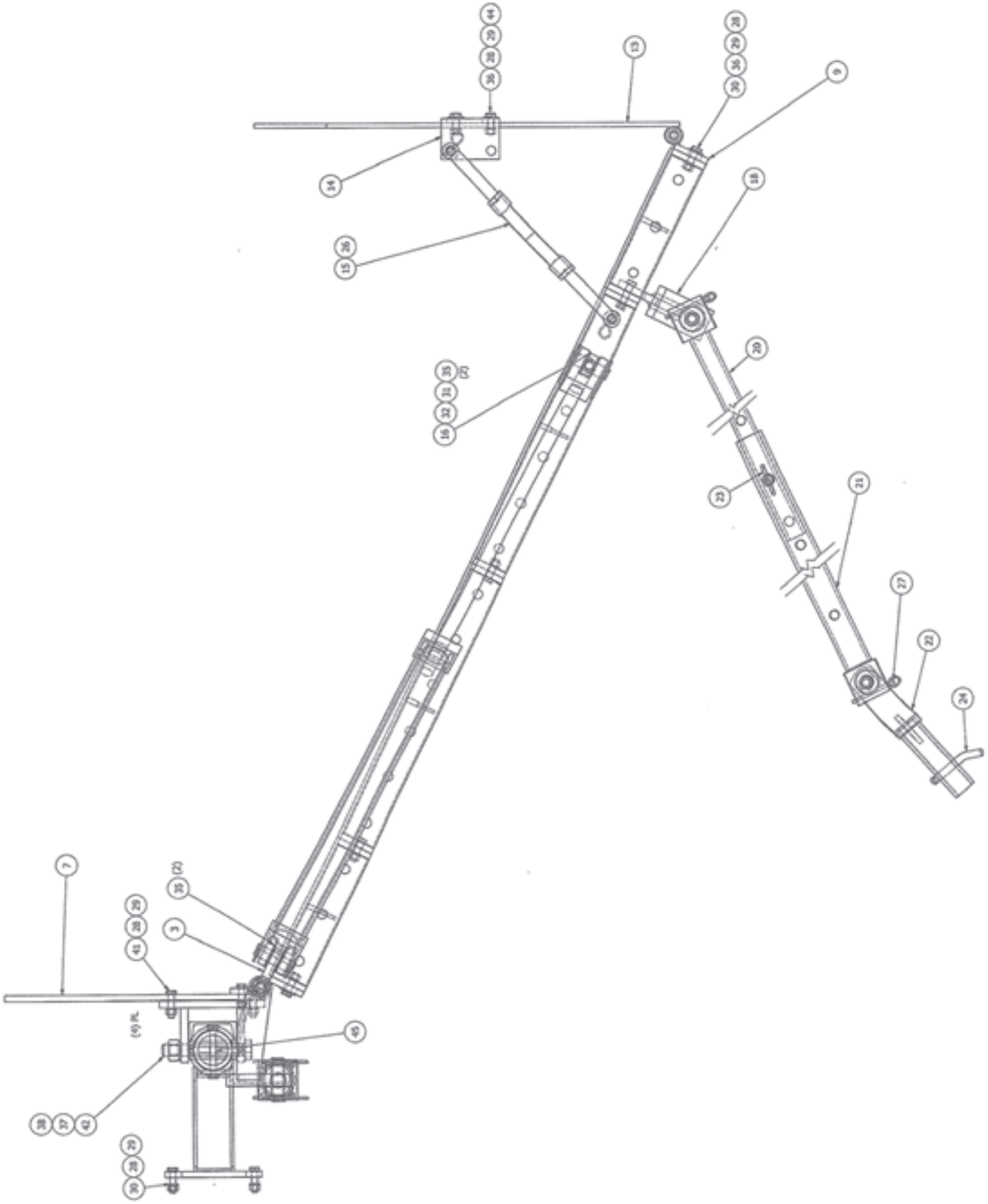
IF ANY CAUTION LABELS ARE DAMAGED OR UNREADABLE, CONTACT MIDLAND MACHINERY PARTS DEPARTMENT FOR REPLACEMENT

Item No.	Qty.	Item ID.	Item Name
1	1	PM-0001B	LABEL-"MIDLAND NAMEPLATE" - FOIL
2	330 IN.	PM-0018	LABEL-"REFLECTIVE TAPE" - 6" WIDE (150 FT/ROLL)
3	102 IN.	PM-0018A	LABEL-"REFLECTIVE TAPE" - 3" WIDE X 1500"/RL
4	1	PM-0037	LABEL-"MIDLAND S.N. PLATE"
5	3	PM-0115	LABEL-"MIDLAND" (SP-8 & 10 LOGO)
6	3	PM-0115-6	LABEL-"MIDLAND" (SP-6) (USE W/ PM-0115)
7	1	PM-0123	LABEL- "NO RIDERS"
8	1	SS-0001A	LABEL- "DIESEL FUEL ONLY"
9	3	SS-0020	LABEL-"HYDRAULIC OIL"
10	1	SS-0022	LABEL-"ENGINE OIL"
11	1	WC-0001	LABEL-"WARNING-BEFORE ASSEMBLING"
12	2	WC-0003	LABEL-"WARNING-DO NOT STAND"
13	1	WC-0004	LABEL-"WARNING-DO NOT STAND IN FRONT"
14	1	WC-0005	SIGN CAUTION STAND CLEAR
15	5	WC-0006	LABEL-"WARNING - DO NOT PERFORM"
16	3	WC-0007	LABEL-"WARNING-PINCH POINT..."
17	1	WC-0012	LABEL-"WARNING-STAND CLEAR"
18	1	WC-0014A	LABEL- "CAUTION: NO SMOKING..."
19	4	WC-0020	LABEL-"CAUTION-MOVING CONVEYOR"
20	1	WC-0022	LABEL-"WARNING - MATERIAL DISCHARGE"
21	1	WC-0036	SIGN: "CAUTION SLOW MOVING VEHICLE"
22	2	WC-0037	LABEL-"WARNING-DO NOT ALLOW TRUCK"
23	1	WC-0047	LABEL- "WARNING-HYD CYLINDER"

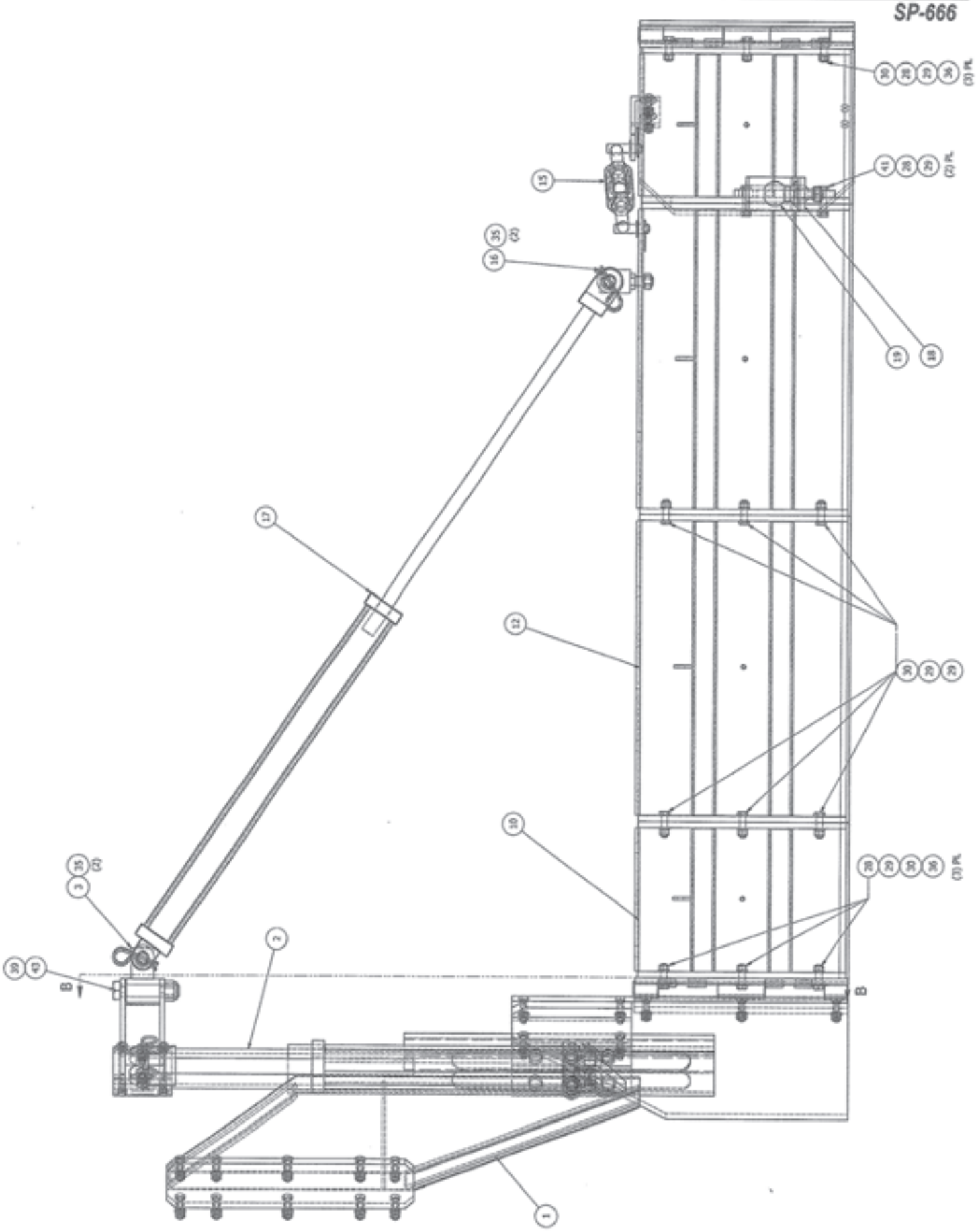
SP-666

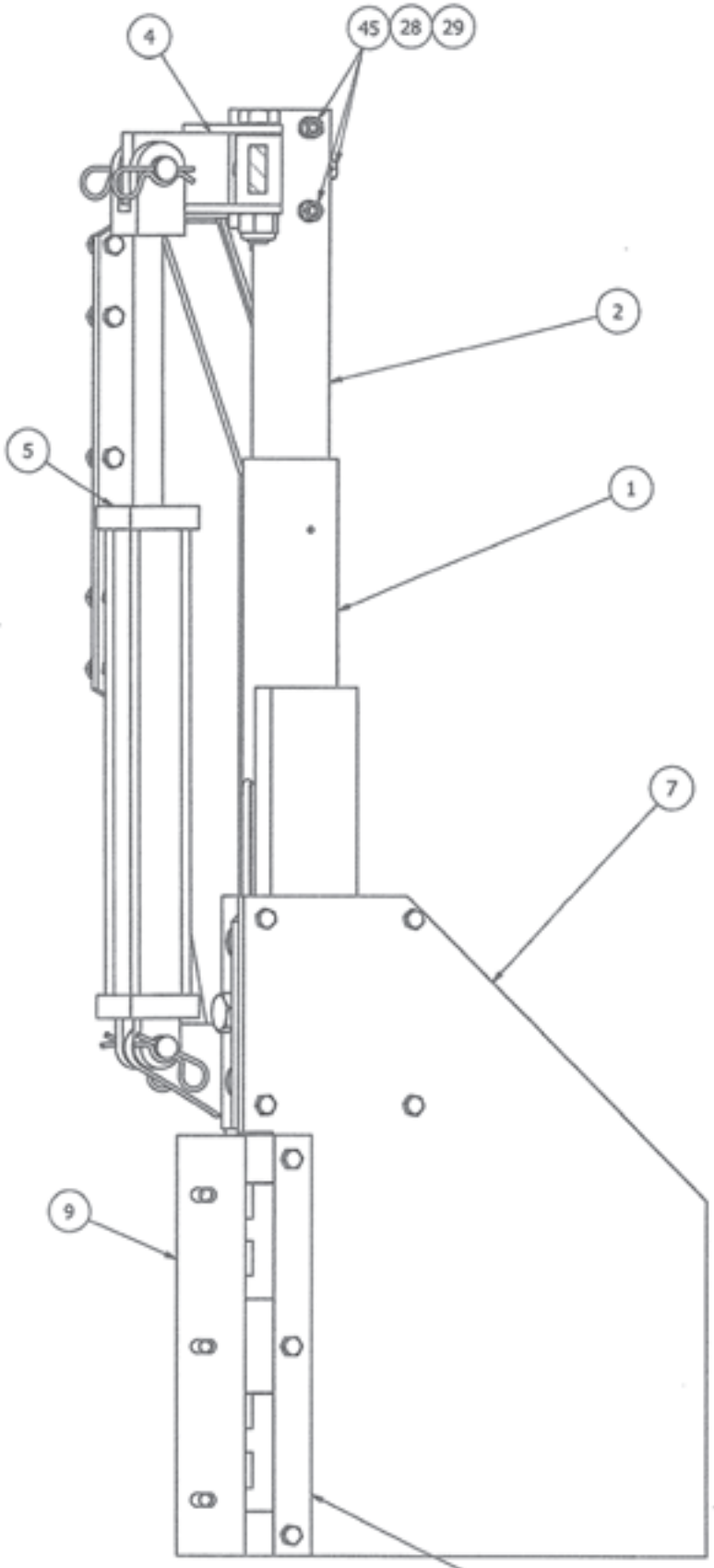
No.	REQ	DESCRIPTION	PART NUMBER
1	1	SA COLUMN MOUNT ON SP-6	SP-1187
2	1	COLUMN	SA-072
3	1	SUPPORT PIVOT	SA-108
4	1	COLUMN TOP	SA-077
5	1	CYLINDER, HYDRAULIC, 3000 PSI, TIE ROD, 2-1/2" x 18"	M1013
6	1	BLADE MOUNT	SA-080
7	1	INNER EDGE PLATE	SA-082
8	1	HINGE HALF (MOUNT)	SA-088
9	2	HINGE HALF (BLADE)	SA-089
10	2	BLADE SECTION - 1 FT	SA-097
11	2	BLADE HINGE PIN	SA-105
12	2	BLADE SECTION - 2 FT	SA-096
13	1	OUTER EDGER	SA-102
14	1	CLIP (OUTER EDGER)	SA-104
15	1	EDGER BRACE	SA-131
16	1	SUPPORT LUG	SA-109
17	1	SLOPE CYLINDER (SAE-9030) 2 X 30	M1019
18	1	BLADE PUSH ANCHOR	SA-902
19	2	BALL HITCH, 2 DIA, ZINC-PLATED	M11005
20	1	PUSH TUBE INNER	SP-887
21	1	PUSH TUBE, OUTER	SP-888
22	1	BALL MOUNT 2" CLASS III	M6104
23	1	HITCH PIN 3/4 X 4 3/4	M11006
24	1	HITCH PIN 5/8" DIA X 3" LG CLASS III	M6105
25	1	SPREADER TUBE	SA-081
26	2	HAIRPIN, COTTER, 0.120 WIRE X 2 3/8	M11024
27	2	HITCH PIN 1/4 X 3 1/2	SA-349-27
28	36	HEX NUT, 1/2-13 UNC	HXN-1/2-13
29	36	LOCK WASHER, 1/2	LKW-1/2
30	25	1/2-13 UNC X 1 3/4 HEX HD CAP SCREW	HCS- 1/2-13-1.75
31	1	LOCK WASHER, 3/4	LKW-3/4
32	1	HEX NUT, 3/4-10 UNC	HXN-3/4-10
35	4	FLAT WASHER 1"	FLW-1
36	8	FLAT WASHER, 1/2	FLW-1/2
37	1	1-8 UNC HEX NUT	HEX-1-8
38	1	1" LOCKWASHER	LKW-1
39	1	ELASTIC STOP NUT, 1-8 UNC	ESN-1-8
40	8	HAIR PIN, COTTER, 0.178 WIRE X 3 9/16	M11013
41	6	1/2-13 UNC X 2 HEX HD CAP SCREW	HCS-1/2-13-2.00
42	1	1-8 UNC X 7 HEX HD CAP SCREW	HCS-1-8-7.00
43	1	1-8 UNC X 5 HEX HD CAP SCREW	HCS-1-8-5.00
44	2	1/2-13 UNC X 1 1/2 HEX HD CAP SCREW	HCS-1/2-13-1.50
45	3	1/2-13 UNC X 1 1/2 HEX HD CAP SCREW	HCS-1/2-13-4.00

SP-666



SP-666





SECTION B-B

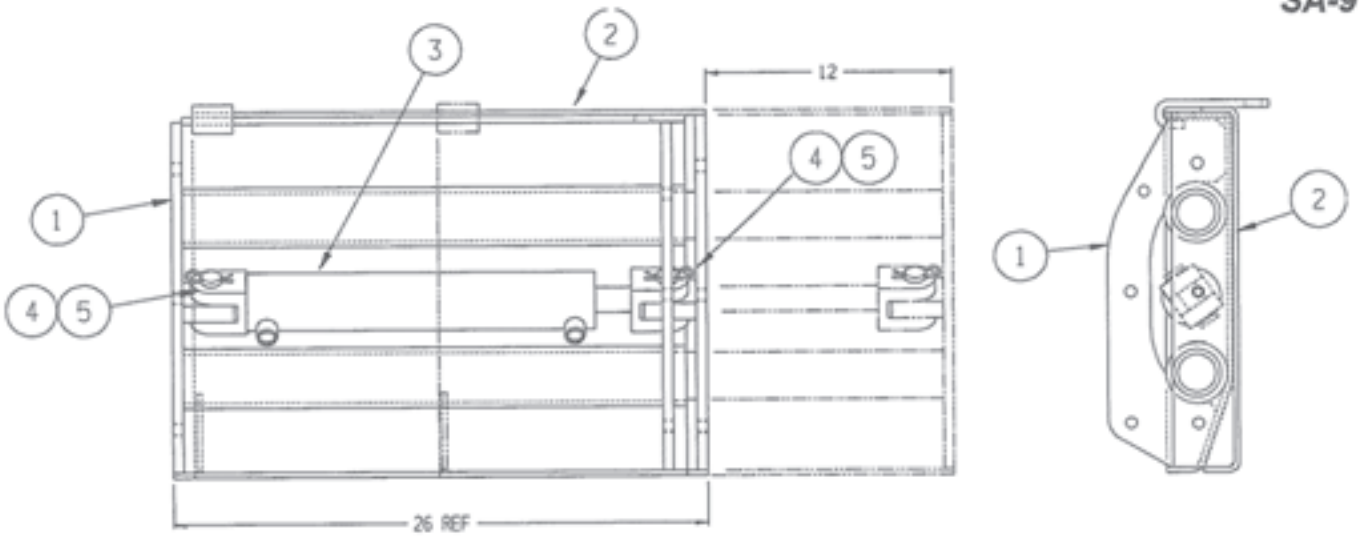
SP-900

Item No.	Qty.	Item ID.	Item Name
1	1	SP-1243	REWORKED CONTROL HANDLE
2	1	SP-1132	LABEL, EXTENSION
3	1	SA-917	HYDRAULIC BLADE EXTENSION ASSY (SEE BELOW)
4	1	M14054B	VALVE SPOOL SECTION, 1 SECTION MANUAL, DIRECTIONAL
5	3	LKW-3/8	LOCK WASHER, 3/8
6	2	HCS-1/2-13-1.50	HEX HD CAP SCREW 1/2-13 UNC x 1-1/2
7	2	HCS-1/2-13-2.00	HEX HD CAP SCREW 1/2-13 UNC x 2
8	4	HXN-1/2-13	HEX NUT, 1/2-13 UNC
9	3	HXN-3/8-16	HEX NUT, 3/8-16 UNC
10	4	LKW-1/2	LOCK WASHER, 1/2
11	6	FLW-1/2	FLAT WASHER, 1/2
12	3	TCD-1	TUBE CLIP, DOUBLE-1 INCH
-	1	SP-900-HK	HOSE KIT FOR SP6 HYDRAULIC VARIABLE STRIKE OFF BLADE ASSY
13	1	SP-900-01	6-100R1AT-6FJS-6FJS90L x 135.0 LG. (EXT BLADE - OUT)
14	1	SP-900-02	6-100R1AT-6FJS-6FJS90S x 148.0 LG. (EXT BLADE - IN)
-	-	SP-900-FK	FITTING KIT, SP-6 HYDRAULIC VARIABLE STRIKE OFF BLADE ASSY
15	2	2024-8-6S	ADAPTER, 90° ELBOW, 1/2 MNPT x 9/16-18 MJIC
16	2	202702-6-6S	ADAPTER, STRAIGHT, 9/16-18 MORB x 9/16-18 MJIC

(**SEE HYDRAULIC SCHEMATIC SCHEMATIC FOR LAYOUT)

HYD. BLADE EXTENSION ASSEMBLY

SA-917



NO.	REQ.	DESCRIPTION	PART NUMBER
5	2	CLEVIS PIN 1" DIA x 2-3/4" COMES W/CYLINDER	M11084
4	4	HAIRPIN, COTTER, ZINC PLATED FOR 7/8" TO 1" DIA	M11013
3	1	HYDRAULIC CYL 2 1/2 X 12.	SA-349-26
2	1	EXTENSION SECTION (OUTER)	SA-126
1	1	EXTENSION BASE	SA-122

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NOTE: SERIAL # 101 TO 121 USE HIGHLIGHTED PART #'S

Item #	Quantity	Item ID	Rev	DISCRIPTION
1	3	M0146		BEARING, TAKE-UP SC 2" BORE
2	1	M2081		CYLINDER, HYD,2500 PSI, 2-1/2" x 12" CHROME PLATED ROD
3	1	M5061		MOTOR, HYDRAULIC, FIXED, 375CC, WHEEL MOUNT
4				
5				
6				
7	19	SA-1147		ROLLER 1.8 X 16-1/8
to #121	19	SP-886	*	CONVEYOR ROLLER INTERROLL
8	1	SP-1012		BUSHING, DUMP CYLINDER
9	1	SP-1013	A	FRONT BIB - SP-6 #122 ->
to #121	1	SP-1013	*	FRONT BIB - SP-6 UP TO #121
10	1	SP-1014		BIB RETAINER, LONG
11	1	SP-1015	A	BIB RETAINER - SHORT
to #121	1	SP-1015	*	BIB RETAINER - SHORT
12				
13	1	SP-1021		HOPPER HINGE PIN WELDMENT, REAR
14	1	SP-1022		HOPPER HINGE PIN, FRONT
15	1	SP-1023		REAR UPPER MOUNTING BRACKET, SIDEBOARD
16	1	SP-1024		FRONT UPPER MOUNTING BRACKET, SIDEBOARD
17	2	SP-1025		RETAINER, RUBBER, UPPER SIDEBOARD
18	4	SP-1026		SIDEBOARD RUBBER
19	2	SP-1027		LOWER MTG BCKT (F & R) SIDEBOARD
20	2	SP-1028		LOWER SIDEBOARD RUBBER RETAINER
21	1	SP-1044	A	DUMP HOPPER, LEFT SIDE
to #121	1	SP-1044	*	DUMP HOPPER, LEFT SIDE
22				
23				
24	1	SP-1071	A	DRIBBLE GATE WELDMENT
to #121	1	SP-1071	*	DRIBBLE GATE WELDMENT
25	2	SP-1075		PANEL MOUNT WELDMENT, DRIBBLE GATE
26	1	SP-1094	A	DEFLECTOR ASSEMBLY
to #121	1	SP-1094	*	DEFLECTOR ASSEMBLY
27	1	SP-1119	A	HINGE PIN
to #121	1	SP-1119	*	HINGE PIN
28				
29				
30				
31				
32	2	SP-1224		REWORKED HOPPER SPRING (CCW)
33	2	SP-1225		REWORKED HOPPER SPRING (CW)
34	1	SP-1226		SPRING RETAINER WELDMENT
35	1	SP-1229	A	WIPER PANEL WELDMENT
to #121	1	SP-1229	*	WIPER PANEL WELDMENT
36	1	SP-1240	A	GUARD WELDMENT, CONVEYOR RETURN
to #121	1	SP-1240	*	GUARD WELDMENT, CONVEYOR RETURN
37	1	SP-1315-PH		CONVEYOR BELT ASSY, W/ ROLLER CHAIN (SERIAL # 122 ->)
37.a	*(1)	SP-1316	A	CONVEYOR BELT W/ END SPLICE AND HOLES (SERIAL # 122 ->)
37.b	*(2)	SP-677		ROLLER CHAIN, CONVEYOR

38	1	SP-692	A	WIPER RETAINER
to #121	1	SP-692	*	WIPER RETAINER
39	1	SP-693	A	WIPER RUBBER
to #121	1	SP-693	*	WIPER RUBBER
40	1	SP-694	A	WIPER FRAME, SP-6
to #121	1	SP-694	*	WIPER FRAME, SP-6
41	1	SP-695		MOTOR COUPLING, SP-6, WHITE
42	1	SP-894	A	DRIVE ROLLER, CONV
to #121	1	SP-894	*	DRIVE ROLLER, CONV
43	1	SP-895	A	IDLER ROLLER, CONV
to #121	1	SP-895	*	IDLER ROLLER, CONV
44				
45	4	SSS-3/4-10-4.50		SQUARE HD SET SCREW 3/4-10 UNC x 4-1/2" LG
46	1	ESN-3/4-10		ELASTIC STOP NUT, 3/4-10 UNC
47	4	FCS-1/2-13-2.00		FLAT SOCKET HD CAP SCREW 1/2-13 UNC x 2
48	6	FCS-1/2-13-2.50		FLAT SOCKET HD CAP SCREW 1/2-13 UNC x 2-1/2
49	1	FCS-1/4-20-0.63		FLAT SOCKET HD CAP SCREW 1/4-20 UNC x 5/8
50				
51	38	FCS-5/16-18-1.00		FLAT SOCKET HD CAP SCREW 5/16-18 UNC x 1
52	1	FCS-5/8-11-4.50		FLAT SOCKET HD CAP SCREW 5/8-11 UNC x 4-1/2
53	1	FLW-1		FLAT WASHER, 1
54	2	FLW-3/4		FLAT WASHER, 3/4
55	1	FLW-3/8		FLAT WASHER, 3/8
56	1	HCS-3/4-10-3.50		HEX HD CAP SCREW 3/4-10 UNC x 3-1/2
57	4	HJN-3/4-10		HEX JAM NUT, 3/4-10 UNC
58	10	HXN-1/2-13		HEX NUT, 1/2-13 UNC
59	10	LKW-1/2		LOCK WASHER, 1/2
60	1	ESN-1-8		ELASTIC STOP NUT, 1-8 UNC
61	2	Z-5029		1/4" DRIVE X 9/16"O/A/L GREASE FTG (#23150)
62	1	HCS-1/4-20-0.75		HEX HD CAP SCREW 1/4-20 UNC x 3/4
63	1	LKW-1/4		LOCK WASHER, 1/4
64	1	FLW-1/4		FLAT WASHER, 1/4
65				
66				
67	19	RLP-5/32-0.75		ROLL PIN 5/32-0.75 (CONV ROLLERS)
68	12	TFS-3/8-16-0.50		WASHER HD THREAD FORMING SCREW 3/8-16 UNC x 1/2
69	16	FTH-5/16-18-0.75		FLAT HEAD THREAD FORMING SCREW 5/16-18 UNC x 3/4

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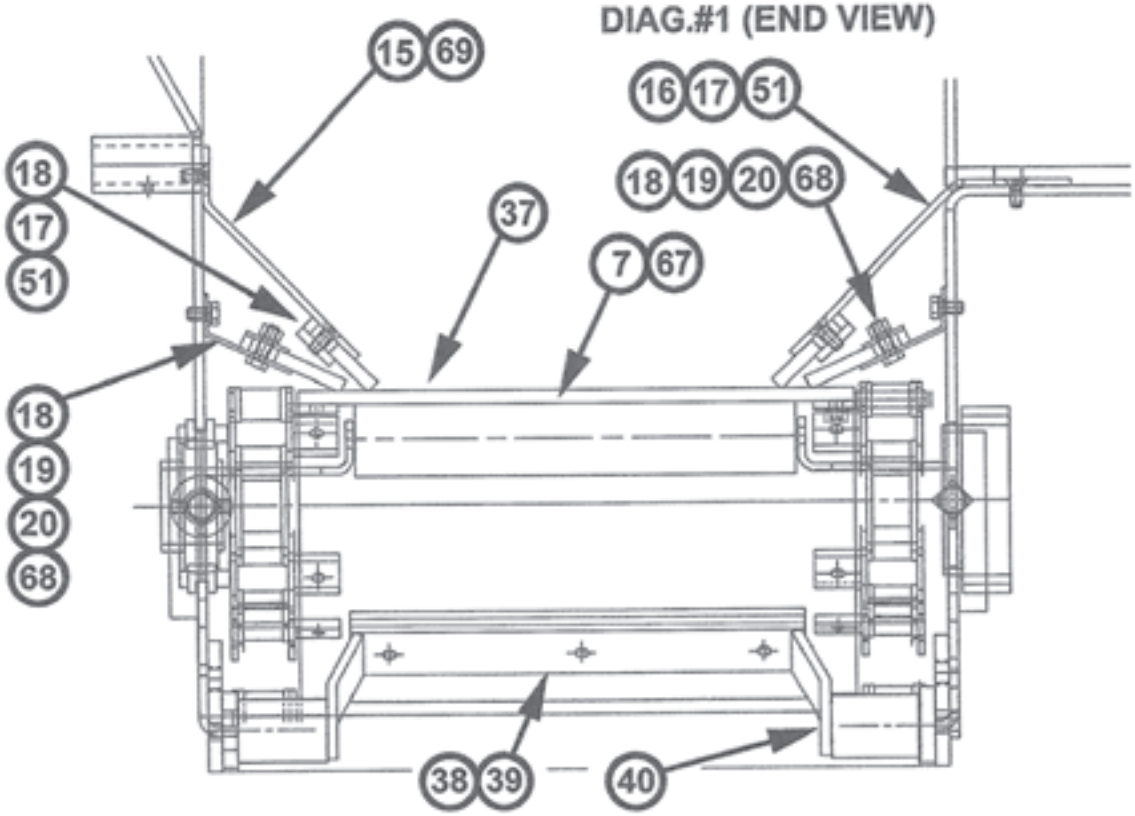
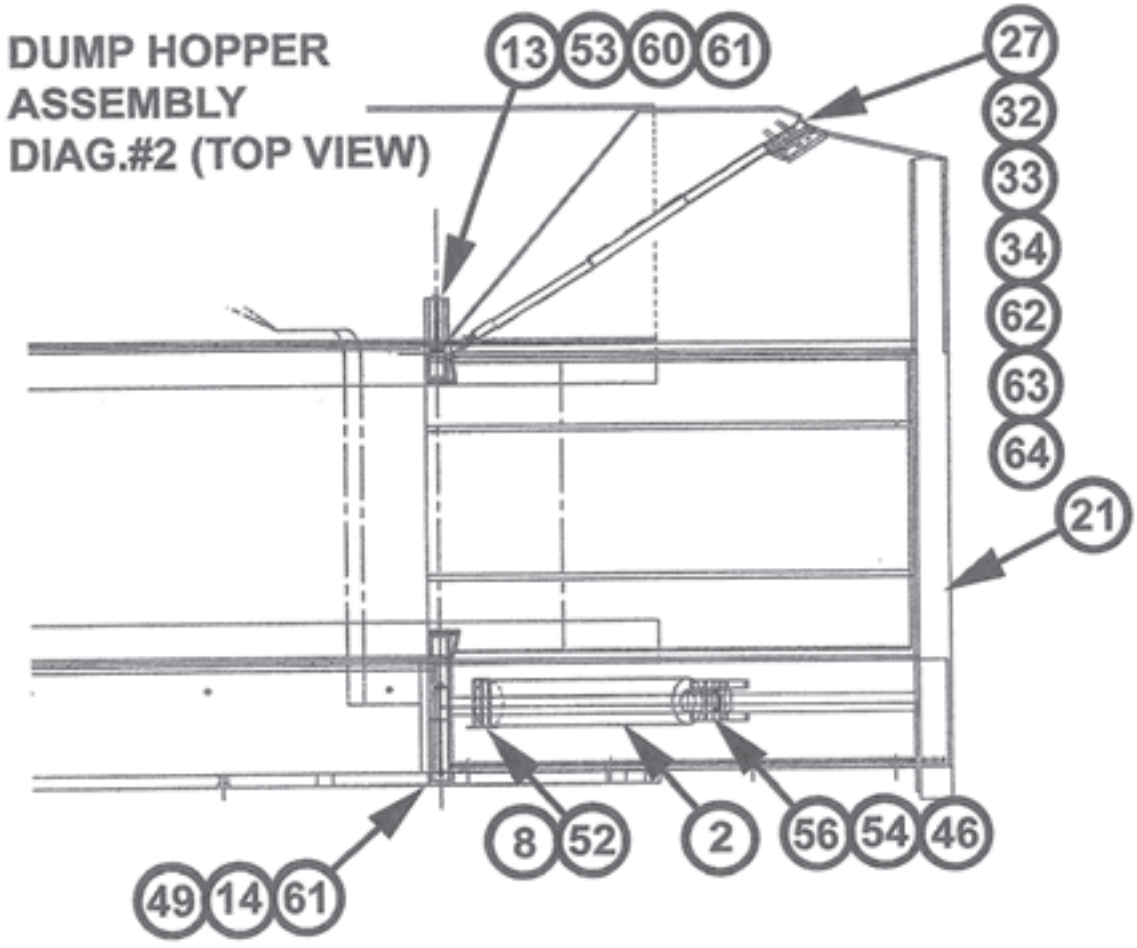
CONV. BELT, ROLLER,SIDEBOARD ASSEMBLY DIAG.#1 (END VIEW)

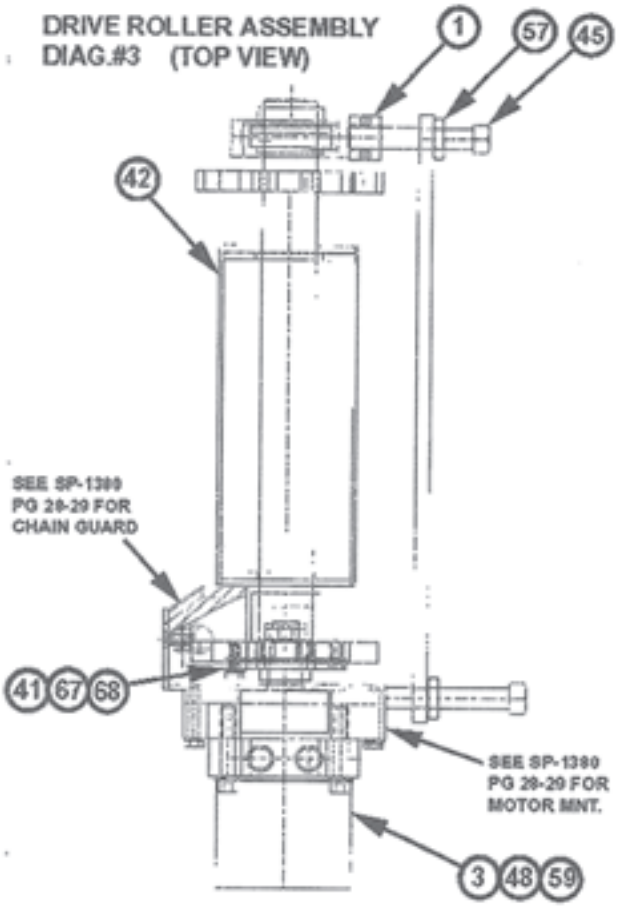


DUMP HOPPER ASSEMBLY DIAG.#2 (TOP VIEW)

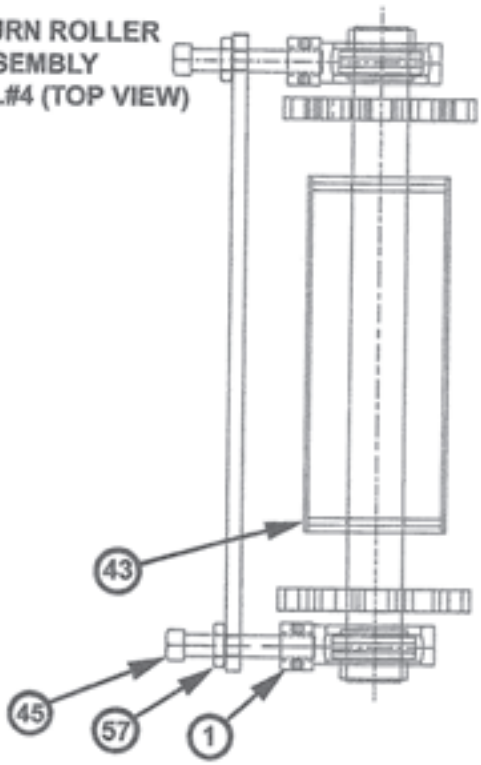


SP-675

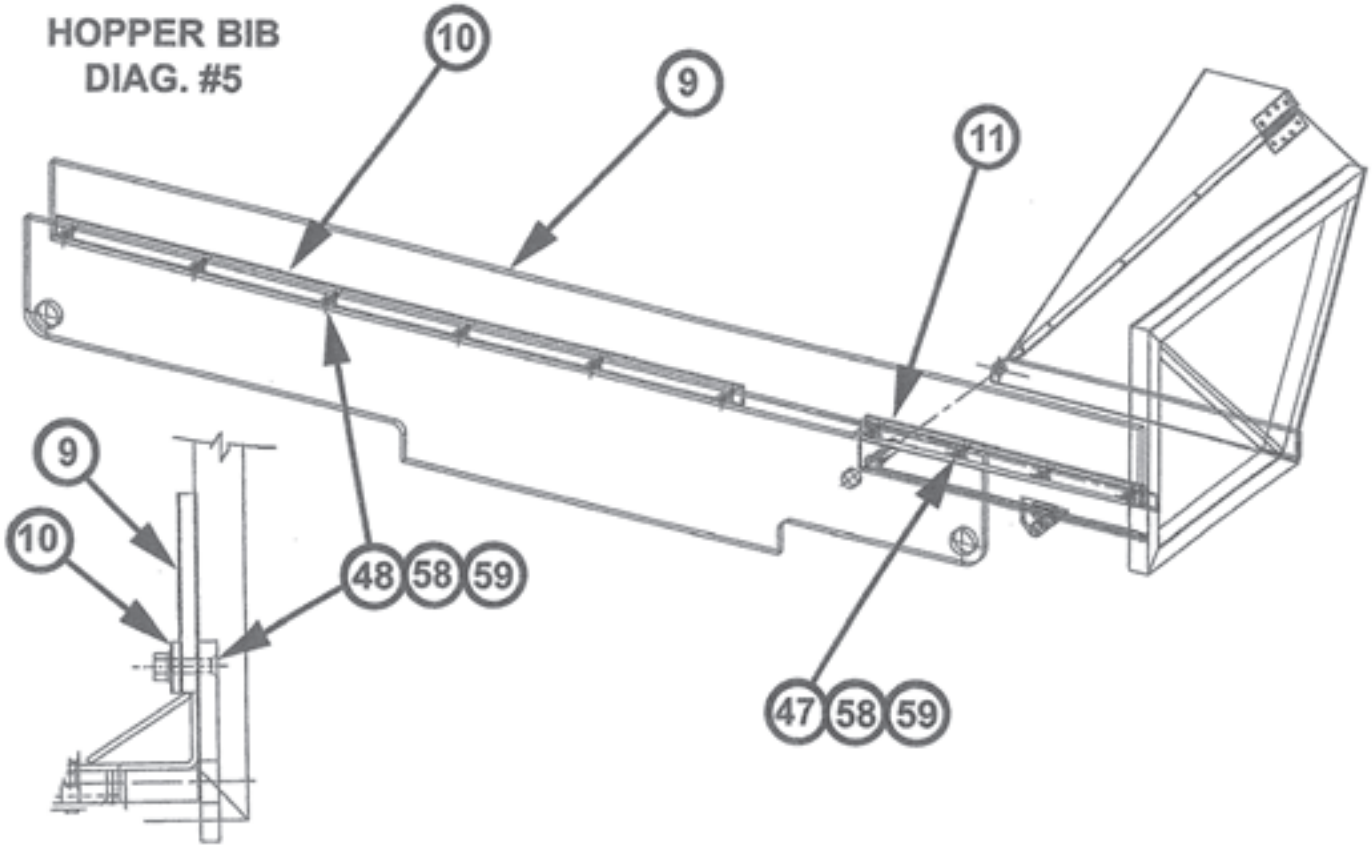
DRIVE ROLLER ASSEMBLY
DIAG.#3 (TOP VIEW)

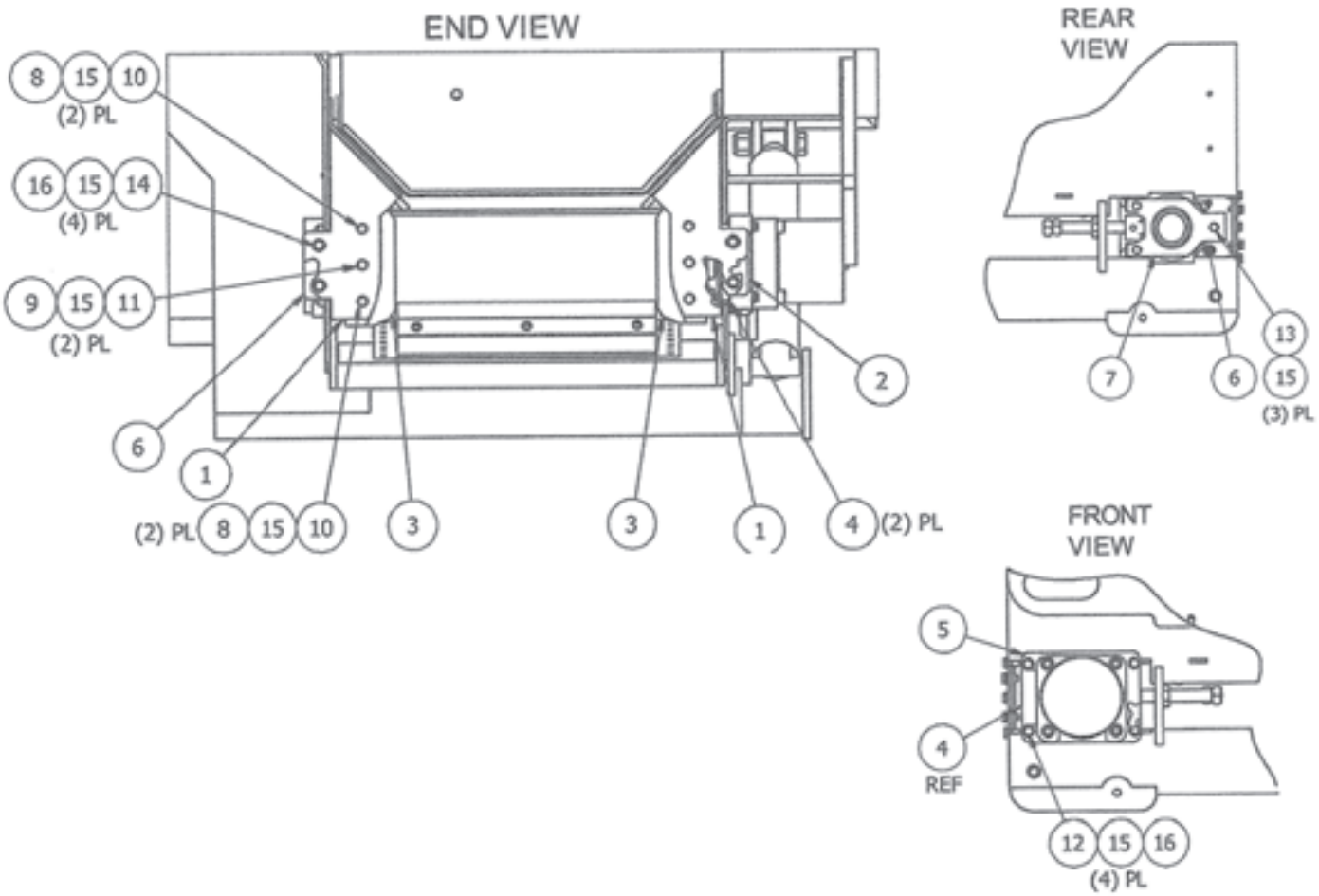


RETURN ROLLER
ASSEMBLY
DIAG.#4 (TOP VIEW)

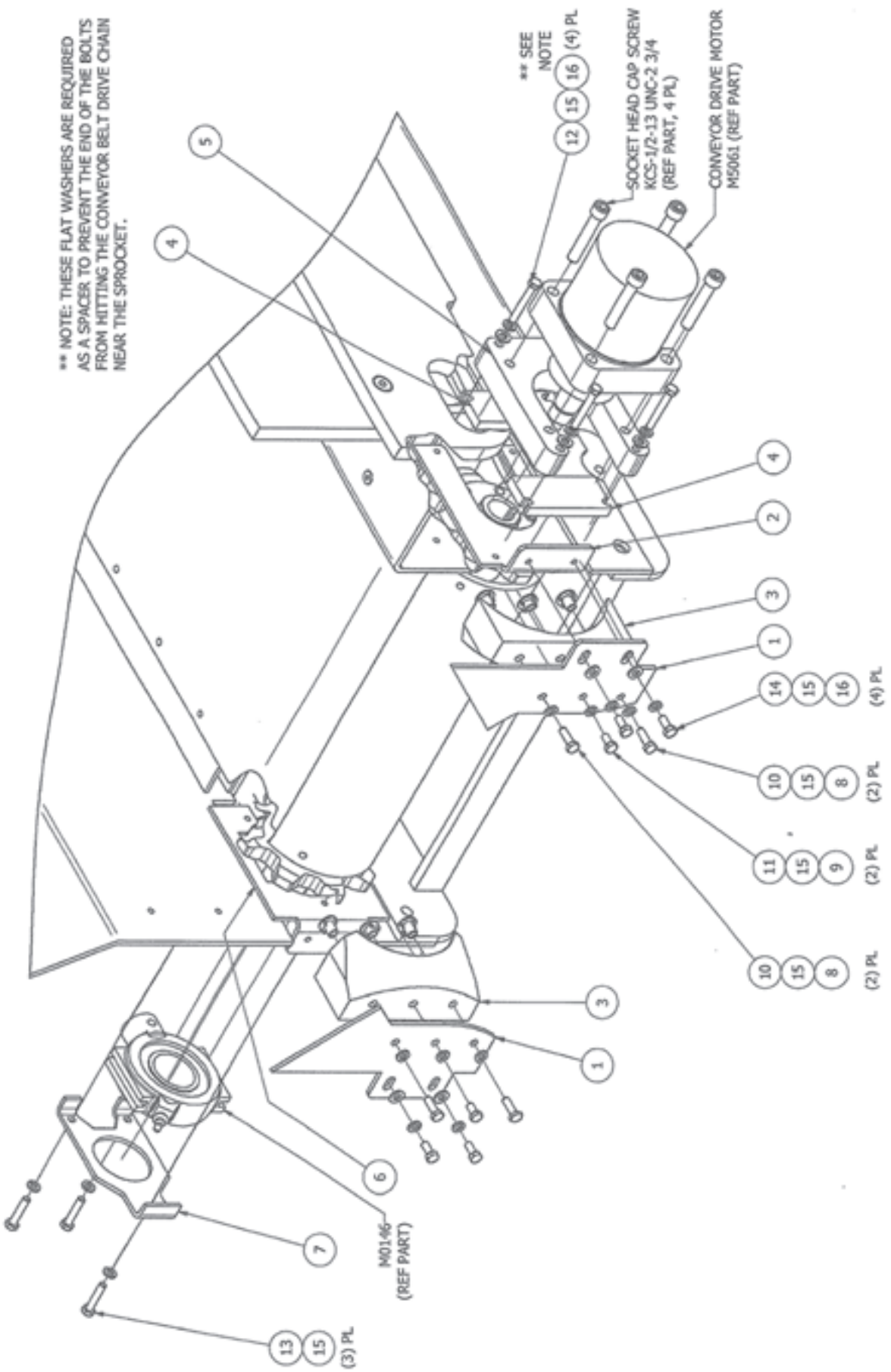


HOPPER BIB
DIAG. #5

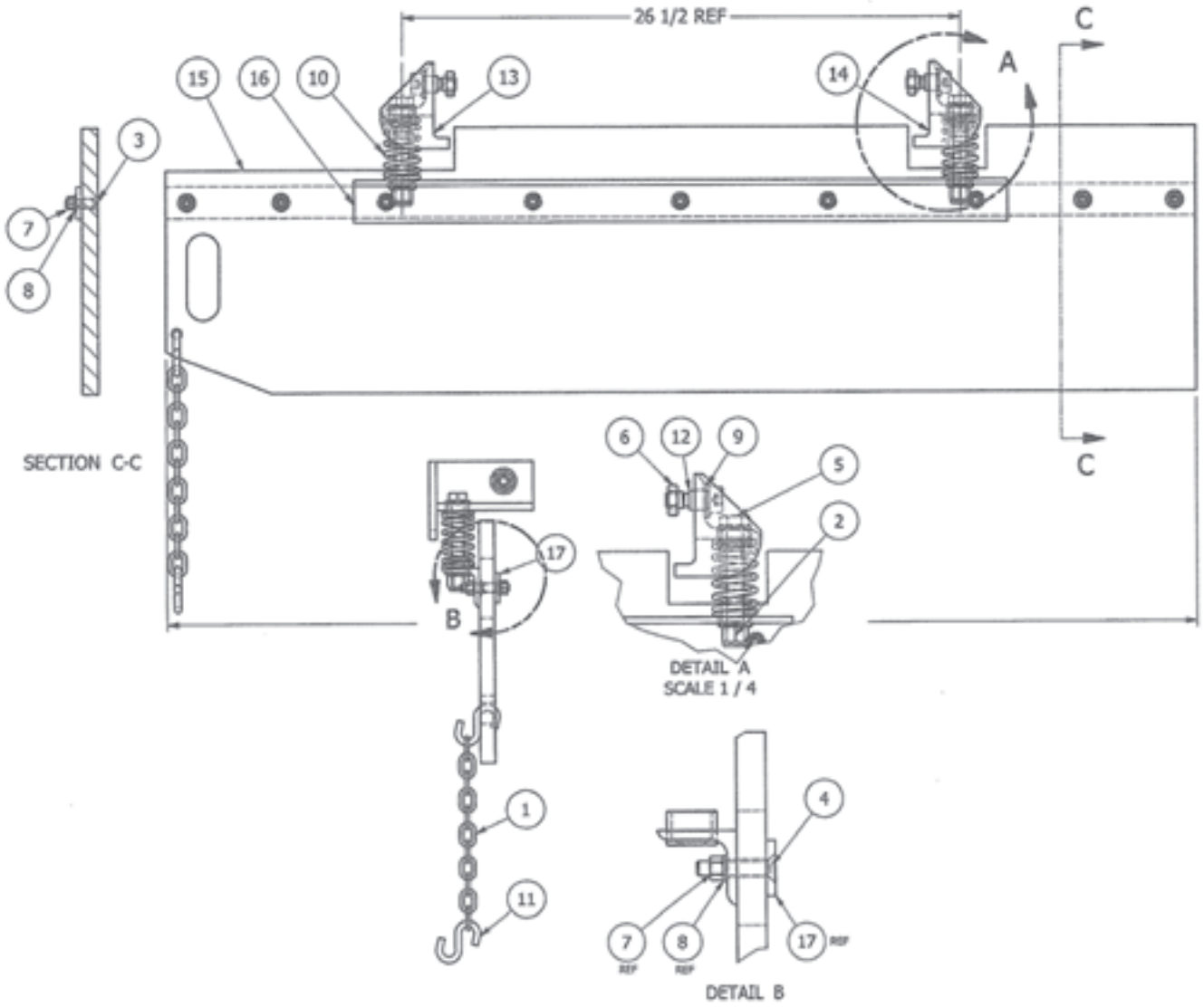




No.	REQ.	DESCRIPTION	PART NUMBER
16	8	FLAT WASHER, 5/16	FLW-5/16
15	17	LOCK WASHER, 5/16	LKW-5/16
14	4	HEX HD CAP SCREW, 5/16-18 UNC x 3/4	HCS-5/16-18-0.75
13	3	HEX HD CAP SCREW, 5/16-18 UNC-1 1/2	HCS-5/16-18-1.50
12	4	HEX HD CAP SCREW, 5/16-18 UNC-2 1/4	HCS-5/16-18-2.25
11	2	HEX HD CAP SCREW, 5/16-18 UNC x 5/8	HCS-5/16-18-0.63
10	4	HEX HD CAP SCREW 5/16-18 UNC x 1	HCS-5/16-18-1.00
9	2	TEE NUT, 5/16-18 UNC, BASE 7/8" x 3/8" HEIGHT	M6343
8	4	TEE NUT, 5/16-18 UNC, BASE 7/8" x 5/8" HEIGHT	M6344
7	1	MOUNTING CLAMP- CHAIN COVER, SP-6	SP-1383
6	1	REAR BASE PLATE, CHAIN COVER, SP-6	SP-1384
5	1	MOTOR MOUNT SP-6	SP-1016
4	2	SPACER, CONV MOTOR MOUNT	SP-998
3	2	CONVEYOR END SEAL	S-955
2	1	BASE PLATE @ MOTOR, CHAIN COVER, SP-6	SP-1382
1	2	MTG PLATE, CHAIN COVER, SP-6	SP-1381


** NOTE: THESE FLAT WASHERS ARE REQUIRED AS A SPACER TO PREVENT THE END OF THE BOLTS FROM HITTING THE CONVEYOR BELT DRIVE CHAIN NEAR THE SPROCKET.
** SEE NOTE
12 15 16 (4) PL
SOCKET HEAD CAP SCREW KCS-1/2-13 UNC-2 3/4 (REF PART, 4 PL)
CONVEYOR DRIVE MOTOR M5061 (REF PART)
5
4
4
2
3
1
14 15 16 (4) PL
10 15 8 (2) PL
11 15 9 (2) PL
10 15 8 (2) PL
3
1
6
7
M0146 (REF PART)
13 15 (3) PL

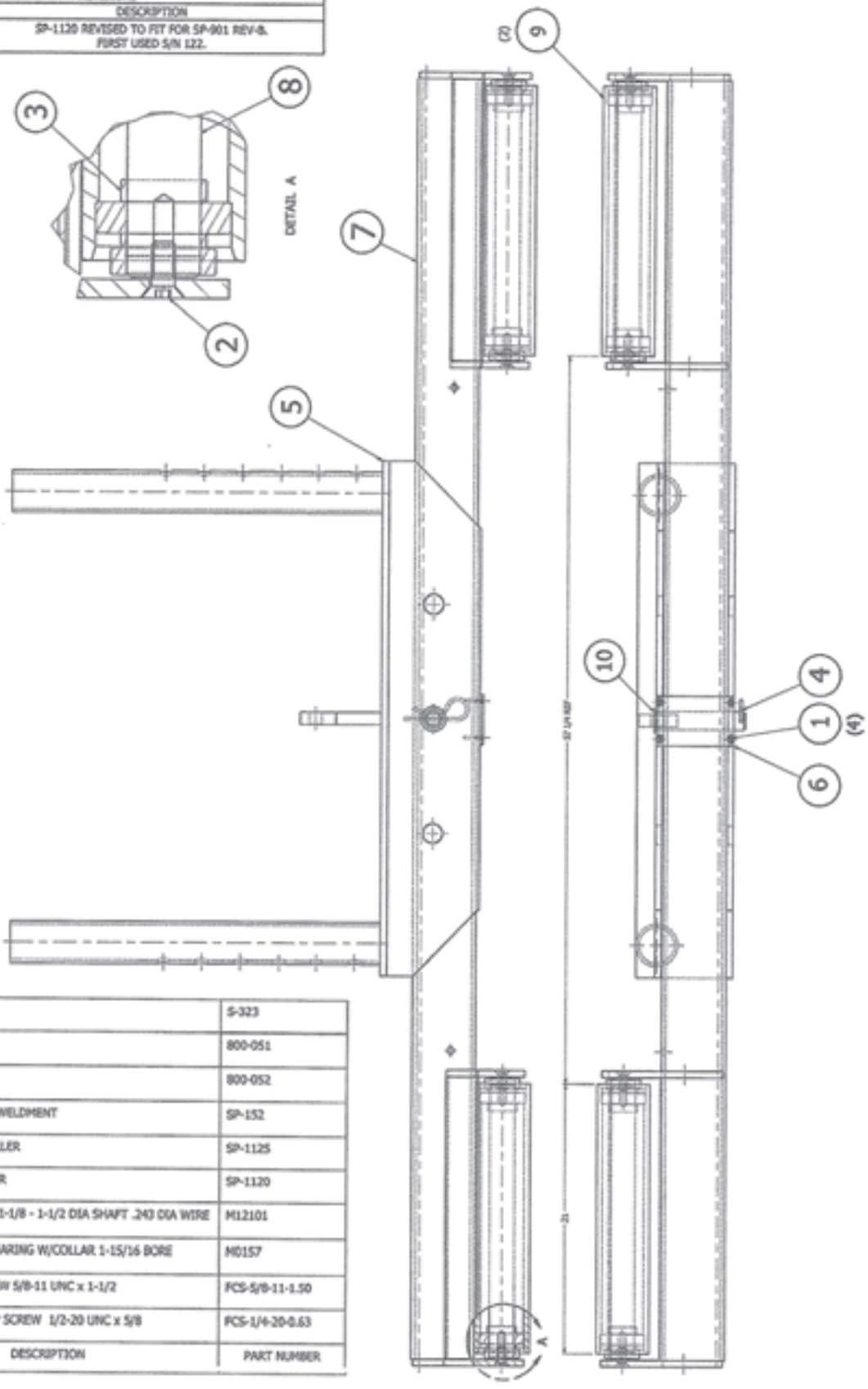
SP-1094



No.	REQ.	DESCRIPTION	PART NUMBER
17	1	DEFLECTOR RETAINER	SP-1104
16	1	DEFLECTOR MOUNT	SP-1102
15	1	DEFLECTOR	SP-1101
14	1	DEFLECTOR ARM, REAR	SP-1100
13	1	DEFLECTOR ARM, FRONT	SP-1095
12	2	SHOULDER SCREW 3/4 x 3/4	SHS-3/4-0.75
11	2	S-HOOK	SA-350-33
10	2	SPRING, COMPRESSION 1-11/16 OD x 3" LG x 7/32 WIRE DIA.	M6143
9	4	FLAT WASHER, 3/4, AN960-C1216, 1.312 OD x .765 ID x .082-.098 THK	M6125
8	9	LOCK WASHER, 3/8	LKW-3/8
7	9	HEX NUT, 3/8-16 UNC	HDN-3/8-16
6	2	HEX JAM NUT, 5/8-11 UNC	HJN-5/8-11
5	2	HEX HD CAP SCREW 5/8-11 UNC x 4-1/2	HCS-5/8-11-4.50
4	5	FLAT SOCKET HD CAP SCREW 3/8-16 UNC x 2	FCS-3/8-16-2.00
3	4	FLAT SOCKET HD CAP SCREW 3/8-16 UNC x 1-1/2	FCS-3/8-16-1.50
2	2	ELASTIC STOP NUT, 5/8-11 UNC	ESN-5/8-11
1	11	CHAIN, MACHINE 2/0	3596T24

SP-689 Rev-A

REVISIONS		
SYM	BY/DATE	DESCRIPTION
A	AGJ 7/25/2006	SP-1120 REVISED TO FIT FOR SP-901 REV-B. FIRST USED S/N 122.



No.	REQ.	DESCRIPTION	PART NUMBER
10	1	PIVOT PIN	S-323
9	2	ROLLER TUBE	800-051
8	2	ROLLER SHAFT	800-052
7	1	PUSH ROLLER BEAM WELDMENT	SP-152
6	1	RETAINER, PUSH ROLLER	SP-1125
5	1	MOUNT, PUSH ROLLER	SP-1120
4	1	HITCH PIN CLIP FOR 1-1/8 - 1-1/2 DIA SHAFT .240 DIA WIRE	M12101
3	4	WIDE INNER RING BEARING W/COLLAR 1-15/16 BORE	M0157
2	4	FLAT HEAD CAP SCREW 5/8-11 UNC x 1-1/2	FCS-5/8-11-1.50
1	4	FLAT HD SOCKET CAP SCREW 1/2-20 UNC x 5/8	FCS-1/4-20-0.63

SP-700

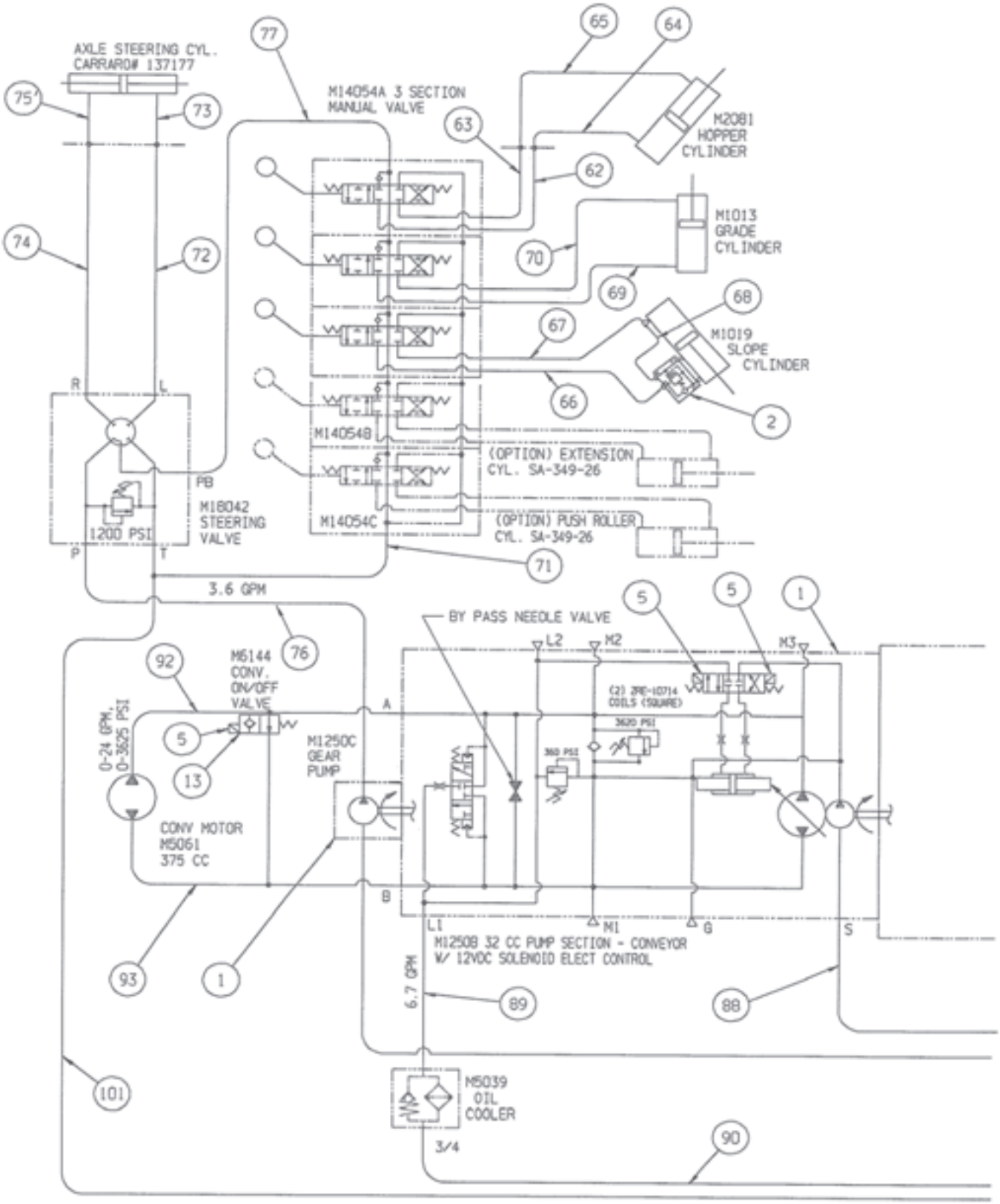
(**SEE HYDRAULIC SCHEMATIC AND SCHEMATIC PARTS LISTS NEXT PAGE)

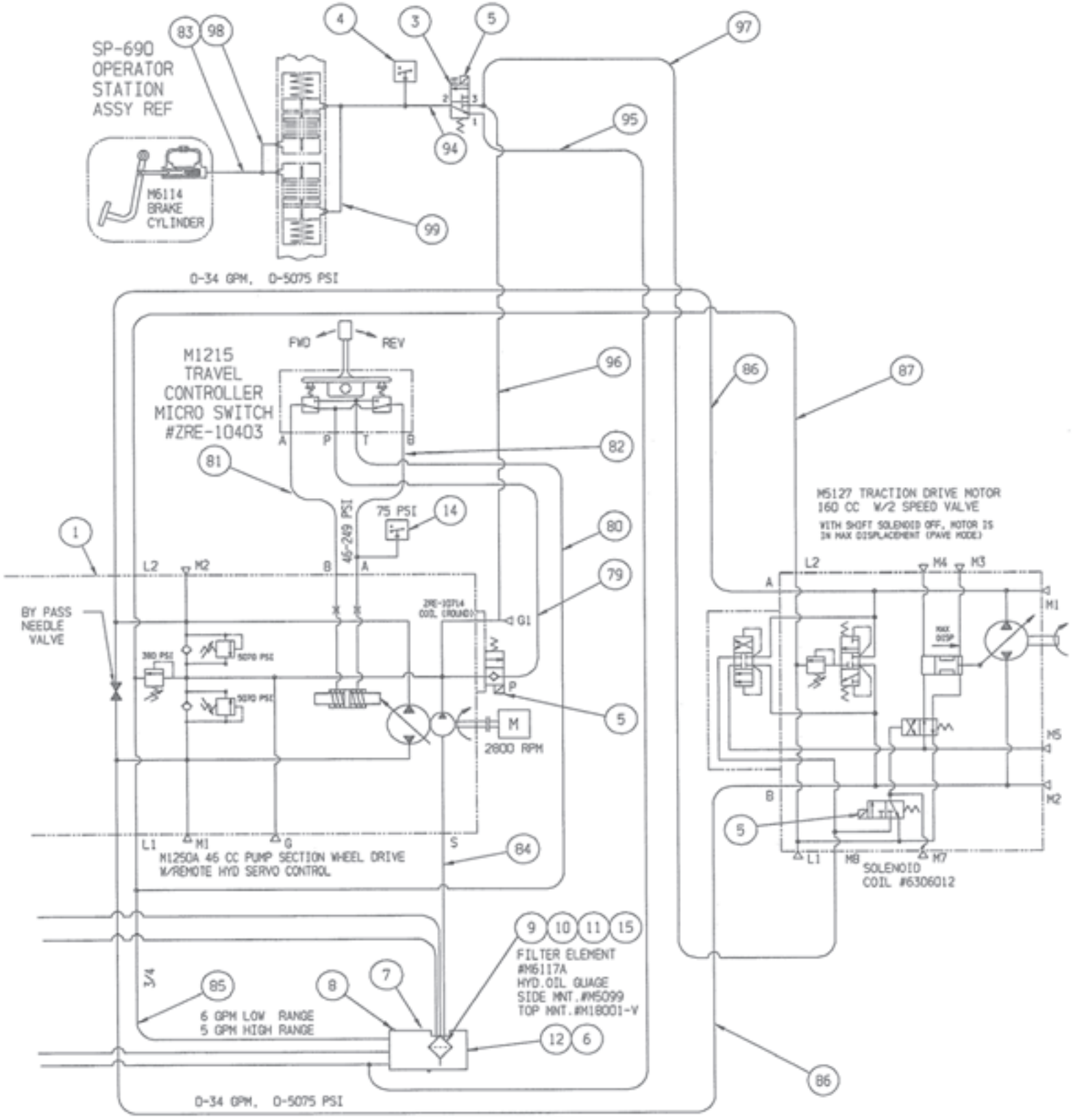
Item No.	Qty.	Item ID.	Item Name
1	1	M1250	PUMP, HYDRAULIC, ASSEMBLY (SP-6)
2	1	M14078	VALVE, COUNTERBALANCE
3	1	M18115	VALVE, DIRECTIONAL CONTROL, W/ BODY
4	1	M18121	PRESSURE SWITCH, SPDT SETS ON 200 PSI FALLING
5	1	M4130	DIN CONNECTOR W/ MOV & LIGHT
6	6	M5099	TEMP/SIGHT GAUGE, HYD TANK (800/NC/SP-6)
7	1	M6053	MAGNETIC PLUG, 1/2 MNPT
8	1	M6103A	FILL NECK 3" HIGH (SP-6 HYDRAULIC)
9	1	M6117	SUCTION FILTER ASSY, TANK TOP MOUNTED
10	1	M6117B	MANOMETER FOR SUCTION FILTER M6117
11	1	M6118	ENDCOVER KIT W/O DRAIN 14" DIA
12	1	M6144	VALVE, SOLENOID, N/O, POPPET TYPE SP-6
13	1	M6154	PRESSURE SWITCH , SPDT 1000 PSI MAX, ADJUSTABLE
14	1	SP-1238	REWORKED FITTING FOR FILTER GAUGE (SP-6)
15	1	SP-700-FK	FITTING KIT, SP-6 HYDRAULIC SYSTEM (SEE NEXT PAGE)
16	1	SP-700-HK	HOSE KIT FOR SP6 HYDRAULIC SYSTEM (SEE NEXT PAGE)
17	1	352	O-RING, BUNA-N SIZE 352 - 3/16 x 4-7/8 ID

HYDRAULIC PUSH ROLLER ASSEMBLY

SP-668

Item No.	Qty.	Item ID.	Item Name
1	4	M11013	HAIRPIN, COTTER, ZINC PLATED
2	1	M14054C	VALVE SPOOL SECTION, 1 SECTION MANUAL, DIRECTIONAL
3	1	SA-349-26	CYLINDER, HYDRAULIC, 2500 PSI, WELDED, 2-1/2" x 12"
4	1	SP-1133	LABEL, PUSH ROLLER
5	1	SP-1243	REWORKED CONTROL HANDLE
-	1	SP-668-FK	FITTING KIT, SP-6 HYDRAULIC PUSH ROLLER ASSY (OPTION)
6	2	2024-8-6S	ADAPTER, 90° ELBOW, 1/2 MNPT x 9/16-18 MJIC
7	2	202702-6-6S	ADAPTER, STRAIGHT, 9/16-18 MORB x 9/16-18 MJIC
8	2	2041-6-6S	ADAPTER, STRAIGHT, BULKHEAD, 9/16-18 MJIC
-	1	SP-668-HK	HOSE KIT FOR SP6 HYDRAULIC PUSH ROLLER ASSY (OPTION)
9	1	SP-668-01	6-100R1AT-6FJS-6FJS90L x 59.0 LG. (PUSH ROLLER-OUT- INSIDE CONSOLE)
10	1	SP-668-02	6-100R1AT-6FJS-6FJS90S x 56.0 LG. (PUSH ROLLER-IN- INSIDE CONSOLE)
11	1	SP-668-03	6-100R1AT-6FJS-6FJS90L x 85.0 LG. (PUSH ROLLER - OUT)
12	1	SP-668-04	6-100R1AT-6FJS-6FJS90S x 98.0 LG. (PUSH ROLLER - IN)


AXLE STEERING CYL.
CARRARO# 137177
M14054A 3 SECTION
MANUAL VALVE
M2081
HOPPER
CYLINDER
M1013
GRADE
CYLINDER
M1019
SLOPE
CYLINDER
M14054B
M14054C
(OPTION) EXTENSION
CYL. SA-349-26
(OPTION) PUSH ROLLER
CYL. SA-349-26
M18042
STEERING
VALVE
1200 PSI
3.6 GPM
BY PASS NEEDLE VALVE
M6144
CONV.
ON/OFF
VALVE
0-24 GPM,
0-3625 PSI
M1250C
GEAR
PUMP
CONV MOTOR
M5061
375 CC
(2) 3PE-10714
COILS (SQUARE)
3620 PSI
360 PSI
M12508 32 CC PUMP SECTION - CONVEYOR
W/ 12VDC SOLENOID ELECT CONTROL
6.7 GPM
M5039
OIL
COOLER
3/4


SP-690 OPERATOR STATION ASSY REF
M6114 BRAKE CYLINDER
0-34 GPM, 0-5075 PSI
M1215 TRAVEL CONTROLLER MICRO SWITCH #ZRE-10403
FWD
REV
75 PSI
46-249 PSI
BY PASS NEEDLE VALVE
380 PSI
5070 PSI
2800 RPM
M1250A 46 CC PUMP SECTION WHEEL DRIVE W/REMOTE HYD SERVO CONTROL
6 GPM LOW RANGE
5 GPM HIGH RANGE
FILTER ELEMENT #M6117A
HYD. OIL GUAGE
SIDE MNT. #M5099
TOP MNT. #M18001-V
M5127 TRACTION DRIVE MOTOR
160 CC W/2 SPEED VALVE
WITH SHIFT SOLENOID OFF, MOTOR IS IN MAX DISPLACEMENT (PAVE MODE)
SOLENOID COIL #6306012

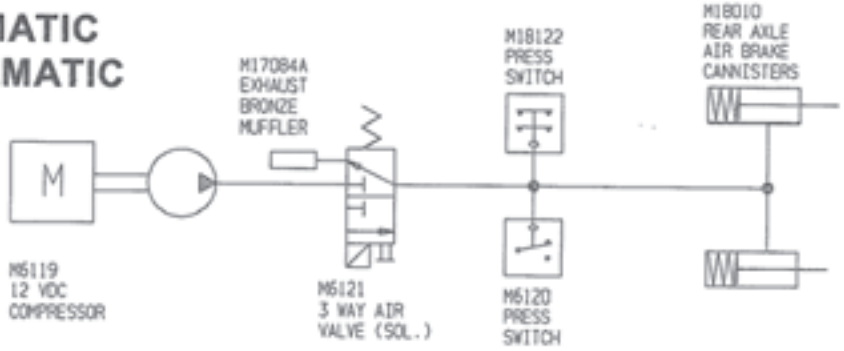
NO.	REQ.	DESCRIPTION	PART NUMBER
50	2	ADAPTER, STRAIGHT, 7/16-20 MORB x 7/16-20 MJIC	202702-4-4S
49	4	ADAPTER, STRAIGHT, 9/16-18 MORB x 7/16-20 MJIC	202702-6-4S
48	9	ADAPTER, STRAIGHT, 9/16-18 MORB x 9/16-18 MJIC	202702-6-6S
47	1	ADAPTER, TEE, 1-1/16-12 MORB x 1-1/16-12 MJIC x 1-1/16-12 MJIC	203005-12-12S
46	1	ADAPTER, TEE, 9/16-18 MORB x 9/16-18 MJIC x 9/16-18 MJIC	203005-6-6S
45	2	ADAPTER, TEE 1-1/16-12 FJIC x 1-1/16-12 MJIC x 1-1/16-12 MJIC	203102-12-12S
44	5	ADAPTER, TEE, 7/16-20 FJIC x 7/16-20 MJIC x 7/16-20 MJIC	203102-4-4S
43	1	ADAPTER, TEE, 9/16-18 FJIC x 9/16-18 MJIC x 9/16-18 MJIC	203102-6-6S
42	1	ADAPTER, TEE, 9/16-18 MJIC x 9/16-18 MJIC x 9/16 -18 MJIC	2033-6-6S
41	4	ADAPTER, STRAIGHT, BULKHEAD, 9/16-18 MJIC	2041-6-6S
40	4	ADAPTER, 90 ELBOW, 1-1/16-12 MORB x 1-1/16-12 MJIC	2062-12-12S
39	1	ADAPTER, 90 ELBOW, 1-1/16-12 MORB x 3/4-16 MJIC	2062-12-8S
38	1	ADAPTER, 90 ELBOW, 1-5/16-12 MORB x 3/4-16 MJIC	2062-16-8S
37	1	ADAPTER, 90 ELBOW, 9/16-18 MORB x 7/16-20 MJIC	2062-6-4S
36	1	ADAPTER, 90 ELBOW, 9/16-18 MORB x 9/16-18 MJIC	2062-6-6S
35	3	ADAPTER, 90 ELBOW, 3/4-16 MORB x 9/16-18 MJIC	2062-8-6S
34	2	ADAPTER, 45 ELBOW, 1-1/16-12 FJIC SWIVEL x 1-1/16-12 MJIC	2070-12-12S
33	1	ADAPTER, PLUG, HEX HEAD 3/8 MNPT	2082-6S
32	2	ADAPTER, CAP NUT, 7/16-20 FJIC	210292-4S
31	2	ADAPTER, STRAIGHT, 7/8-14 FJIC x 9/16-18 MJIC	221501-10-6S
30	1	ADAPTER, STRAIGHT, 1-1/16-12 FJIC x 9/16-18 MJIC	221501-12-6S
29	1	ADAPTER, STRAIGHT, 9/16-18 FJIC x 7/16-20 MJIC	221501-6-4S
28	1	ADAPTER, STRAIGHT, 1/4 FNPT x 7/16-20 FJIC SWIVEL	2242-4-4S
27	1	ADAPTER, STRAIGHT, 1-1/16-12 MORB x 1-1/16-12 FJIC SWIVEL	2266-12-12S
26	1	ADAPTER, STRAIGHT, 7/16-20 FJIC SWIVEL x 7/16-20 FJIC SWIVEL (BRENNAN)	1703952
25	1	ADAPTER, TEE 9/16-18 MJIC x 9/16-18 MJIC x 3/4-16 MORB (BRENNAN)	6803-06-06-08-NWO
24	1	ADAPTER, STRAIGHT, 1/4 FNPT x 9/16-18 FJIC SWIVEL (PARKER)	6G6X
23	1	ADAPTER, 90 ELBOW, 1-3/16-12 MORFS x 1-1/16-12 MORB	FF1868T-1212S
22	1	ADAPTER, 90 ELBOW, LONG, 1-3/16-12 MORFS x 1-1/16-12 MORB	FF2227T-1212S
21	2	SPLIT FLANGE, CODE 62, 1" (2) HALVES, W/ HDWR & O-RING	FF595-16
20	3	ADAPTER, STRAIGHT, 7/16-20 MJIC x G 1/4-19 BSPP MALE	GG106-NP-04-04
19	4	ADAPTER, STRAIGHT, 7/16-20 MJIC x M 10-1.0 METRIC MALE	GG108-NP-04-10
18	1	ADAPTER, 90 ELBOW, 7/16-20 MJIC x G 1/4-19 BSPP MALE	GG306-NP-04-04
17	2	ADAPTER, 90 ELBOW, 7/8-14 MJIC x M 18-1.5 METRIC MALE	GG308-NP-10-18
16	1	ADAPTER, STRAIGHT 3/4-16 MORB x 3/8 MNPT (FAIRVIEW)	S3622-8C
15	1	REWORKED FITTING FOR FILTER GAUGE (SP-6)	SP-1238
14	1	PRESSURE SWITCH , SPDT NOTE 2	M6154
13	1	VALVE, SOLENOID, N/O, POPPET TYPE SP-6	M6144
12	1	ENDCOVER KIT W/O DRAIN 14" DIA	M6118
11	1	GASKET FOR M6117 FILTER(BODY TO TANK)	M6117C
10	1	MANOMETER FOR SUCTION FILTER M6117	M6117B
9	1	SUCTION FILTER ASSY, TANK TOP MOUNTED (SP-6)	M6117
8	1	FILL NECK 3" HIGH	M6103A
7	1	MAGNETIC PLUG, 1/2 MNPT	M6053
6	1	TEMP/SIGHT GAUGE, HYD TANK	M5099
5	6	DIN CONNECTOR W/ MOV & LIGHT	M4130
4	1	PRESSURE SWITCH, SPDT SETS ON 200 PSI FALLING	M1B121
3	1	SOLENOID VALVE, DIR CONTROL-W/ BODY SP-8 & SP-10	M1B115
2	1	VALVE, COUNTERBALANCE	M14078
1	1	PUMP, HYDRAULIC, ASSEMBLY (SP-6) NOTE 1	M1250

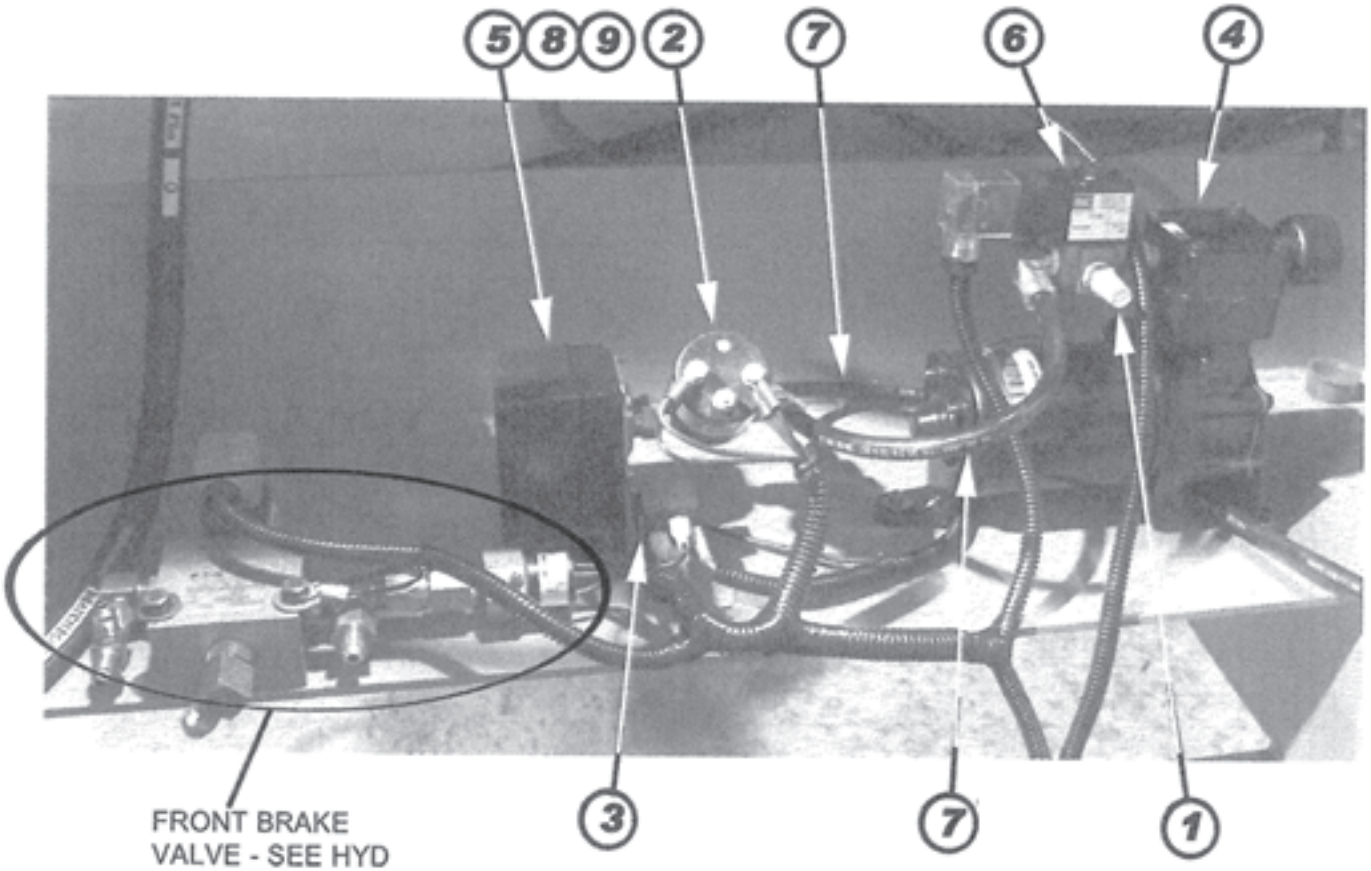
NO.	REQ.	DESCRIPTION	PART NUMBER
101	1	6-10OR1AT-6FJS-6FJS-147.0 (TANK HOSE FROM TEE IN CONSOLE)	SP-700-49
100	1	12-10OR4-12FJS-12FJS90L-21.0 (GEAR PUMP SUCTION)	SP-700-48
99	1	4-10OR1AT-4FJS90S-4FJS90L-27.0 - 0 OFFSET (LOOP HOSE FRT AXLE PARK BRAKE)	SP-700-47
98	1	4-10OR1AT-4FJS90S-4FJS90L-29.0 - 0 OFFSET (LOOP HOSE FRT AXLE SERV BRAKE)	SP-700-46
97	1	4-10OR1AT-4FJS-4FJS-90.0 (FRT BRAKE VLV PORT 3 TO TRACT MOTOR)	SP-700-45
96	1	4-10OR1AT-4FJS-4FJS90S-16.0 (FRT BRAKE VLV PORT 3 TO TRACT PUMP)	SP-700-44
95	1	6-10OR1AT-6FJS-6FJS90S-24.0 (FRT BRAKE VLV PORT 1 TO TANK)	SP-700-43
94	1	4-10OR1AT-4FJS-4FJS-90.0 (FRT BRAKE VLV PORT 2 TO AXLE)	SP-700-42
93	1	12-10OR2AT-12FJS-12FJS90L-188.0 (CONV PUMP TO MOTOR RETURN)	SP-700-41
92	1	12-10OR12-12FJS-12FJS90S-182.0 (CONV PUMP TO MOTOR PRESSURE)	SP-700-40
91	1	12-10OR2AT-12FJS-12FJS90S-27.0 (LOOP HOSE AT VALVE)	SP-700-39
90	1	12-10OR2AT-12FJS-12FJS-74.0 (COOLER TO TANK)	SP-700-38
89	1	12-10OR2AT-12FJS-12FJS-74.0 (CONV PUMP CASE DRAIN TO COOLER)	SP-700-37
88	1	16-10OR4-16FJS-16FJS90S-42.0 (CONV PUMP SUCTION)	SP-700-36
87	1	8-10OR1AT-8FJS-8FJS-85.0 (TRACT MOTOR CASE DRAIN)	SP-700-35
86	2	12-10OR15-12FORS-16-1262SF90-67.0 (6,000 PSI W/P) (FEMALE FORS x CODE 62)	SP-700-34
85	1	12-10OR2AT-12FJS-12FJS-44.0 (TRACT DRIVE PUMP CASE DRAIN)	SP-700-33
84	1	16-10OR4-16FJS-16FJS-55.0 (TRACT DRIVE PUMP SUCTION)	SP-700-32
83	1	4-10OR1AT-4FJS-4FJS90L-128.0 (MASTER CYLINDER)	SP-700-30
82	1	4-10OR1AT-4FJS-4FJS90S-125.0 (TRAVEL CTRL - B PORT TO PUMP A)	SP-700-28
81	1	4-10OR1AT-4FJS-4FJS90S-125.0 (TRAVEL CTRL - A PORT TO PUMP B)	SP-700-26
80	1	6-10OR1AT-6FJS-6FJS-145.0 (TRAVEL CTRL - TANK)	SP-700-25
79	1	4-10OR1AT-4FJS-4FJS90S-132.0 (TRAVEL CTRL - PRESSURE)	SP-700-23
78	1	6-10OR1AT-6FJS90S-4-6FORS-8.5 (STEERING - TANK, TO TEE INSIDE CONSOLE)	SP-700-21
77	1	6-10OR1AT-6FJS90S-4-6FORS-19.0 (STEERING - EXCESS, INSIDE CONSOLE)	SP-700-20
76	1	6-10OR1AT-6FJS-4-6FORS-119.0 (STEERING - PRESSURE)	SP-700-18
75	1	6-10OR1AT-6FJS-6FJS-42.0 (STEERING - RIGHT)	SP-700-17
74	1	6-10OR1AT-6FJS-4-6FORS-63.0 (STEERING - RIGHT - INSIDE CONSOLE)	SP-700-16
73	1	6-10OR1AT-6FJS-6FJS-53.0 (STEERING -LEFT)	SP-700-15
72	1	6-10OR1AT-6FJS-4-6FORS-64.0 (STEERING - LEFT, INSIDE CONSOLE)	SP-700-14
71	1	6-10OR1AT-6FJS-6FJS90L-16.0 (TANK LINE @ VALVE ASSY TO TEE INSIDE CONSOLE)	SP-700-13
70	1	6-10OR1AT-6FJS-6FJS90S-62.0 (GRADE - DOWN)	SP-700-10
69	1	6-10OR1AT-6FJS-6FJS90L-65.0 (GRADE - UP)	SP-700-09
68	1	6-10OR1AT-6FJS-6FJS-33.0 (SLOPE - CYL @ CB VALVE)	SP-700-07
67	1	6-10OR1AT-6FJS-6FJS90S-79.0 (SLOPE - DOWN)	SP-700-06
66	1	6-10OR1AT-6FJS-6FJS90L-114.0 (SLOPE - UP)	SP-700-05
65	1	6-10OR1AT-6FJS-6FJS90L-165.0 (HOPPER - DOWN)	SP-700-04
64	1	6-10OR1AT-6FJS-6FJS90S-151.0 (HOPPER - UP)	SP-700-03
63	1	6-10OR1AT-6FJS-6FJS90S-55.0 (HOPPER - DOWN - INSIDE CONSOLE)	SP-700-02
62	1	6-10OR1AT-6FJS-6FJS90L-57.0 (HOPPER - UP - INSIDE CONSOLE)	SP-700-01
61	2	ADAPTER, STRAIGHT, 3/4 MNPT x 1-1/16-12 MJIC	2021-12-12S
60	2	ADAPTER, STRAIGHT, 3/8 MNPT x 9/16-18 MJIC	2021-6-6S
59	1	ADAPTER, 90 ELBOW, 1/8 MNPT x 7/16-20 MJIC	2024-2-4S
58	2	ADAPTER, 90 ELBOW, 3/8 MNPT x 9/16-18 MJIC	2024-6-6S
57	2	ADAPTER, STRAIGHT, 7/8-14 MORB x 1-1/16-12 MJIC	202702-10-12S
56	1	ADAPTER, STRAIGHT, 7/8-14 MORB x 9/16-18 MJIC	202702-10-6S
55	3	ADAPTER, STRAIGHT, 1-1/16-12 MORB x 1-1/16-12 MJIC	202702-12-12S
54	2	ADAPTER, STRAIGHT, 1-1/16-12 MORB x 1-5/16-12 MJIC	202702-12-16S
53	1	ADAPTER, STRAIGHT, 1-5/16-12 MORB x 1-1/16-12 MJIC	202702-16-12S
52	1	ADAPTER, STRAIGHT, 1-5/16-12 MORB x 1-5/16-12 MJIC	202702-16-16S
51	1	ADAPTER, STRAIGHT, 1-5/8-12 MORB x 1-5/16-12 MJIC	202702-20-16S

SP-645

Item No.	Qty.	Item ID.	Item Name
1	1	M17084A	BRONZE MUFFLER 1/4" MNPT (AIR VALVE EXHAUST)
2	1	M18122	PRESSURE SWITCH, SPDT, 50 PSI RISING
3	1	M4066	RELAY, 40 AMP (VF4)
4	1	M6119	AIR COMPRESSOR (SP-6)
5	1	M6120	SWITCH, AIR COMPRESSOR
6	1	M6121	VALVE, 3 WAY 12 VDC SP-6
7	10 FT.	PFT-6B	TUBING, AIR BRAKE, 3/8 OD (PARKER)
8	1	SP-1134	MOUNTING ANGLE, PRESSURE SWITCH
9	1	T-1232-13	SEAL HOLE HOFFMAN
10	1	SP-645-FK	FITTING KIT, SP-6 PNEUMATIC SYSTEM

PNUMATIC SCHEMATIC





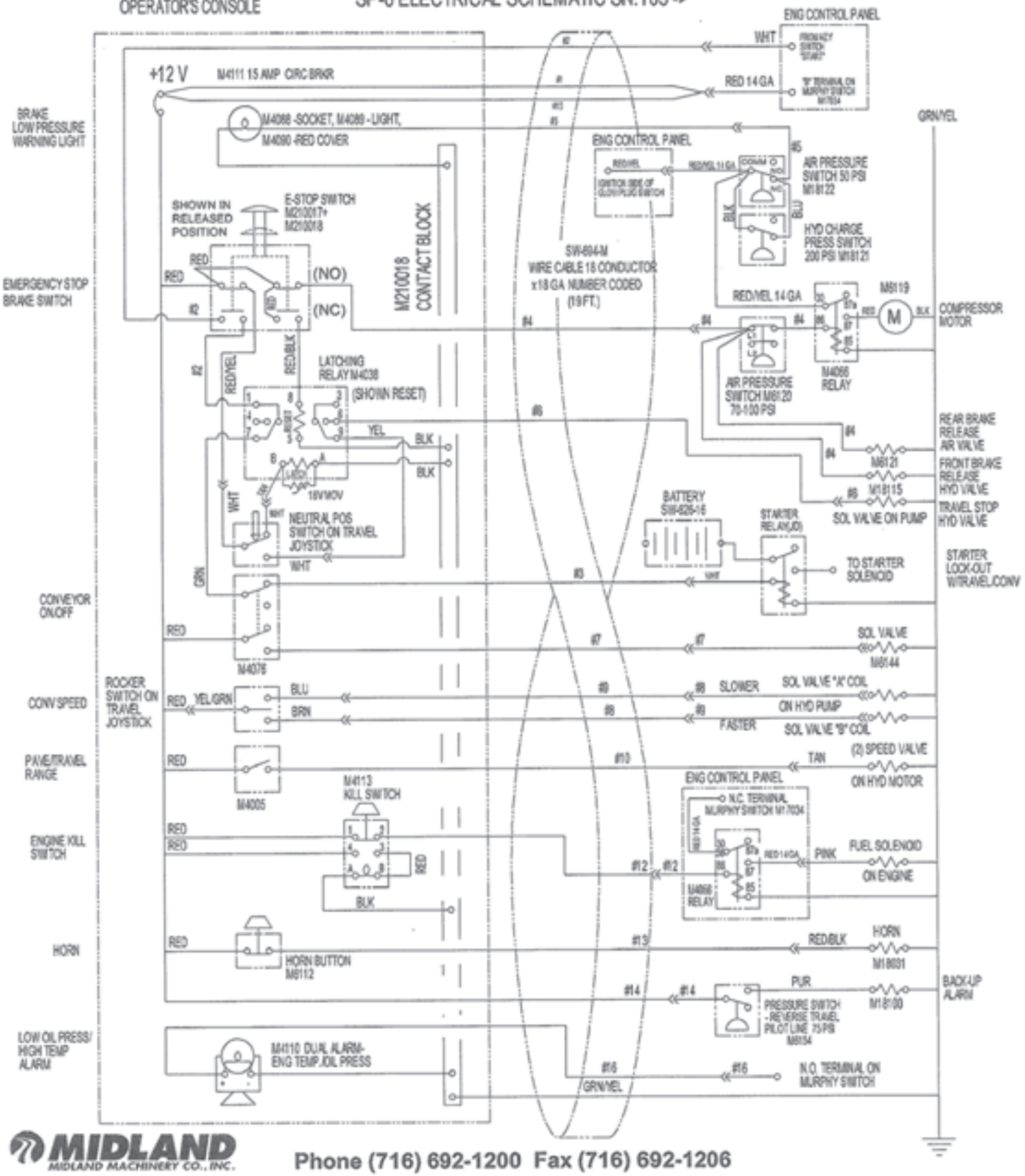
SEE ELECTRICAL SCHEMATIC FOR BRAKE SWITCH WIRING

SP-669

Item No.	Qty.	Item ID.	Item Name
-	1	SP-690	OPERATORS STATION ASSEMBLY (SEE NEXT PAGE)
1	1	M18031	HORN, 12 VDC (20/PK)
2	1	M18100	BACK-UP ALARM

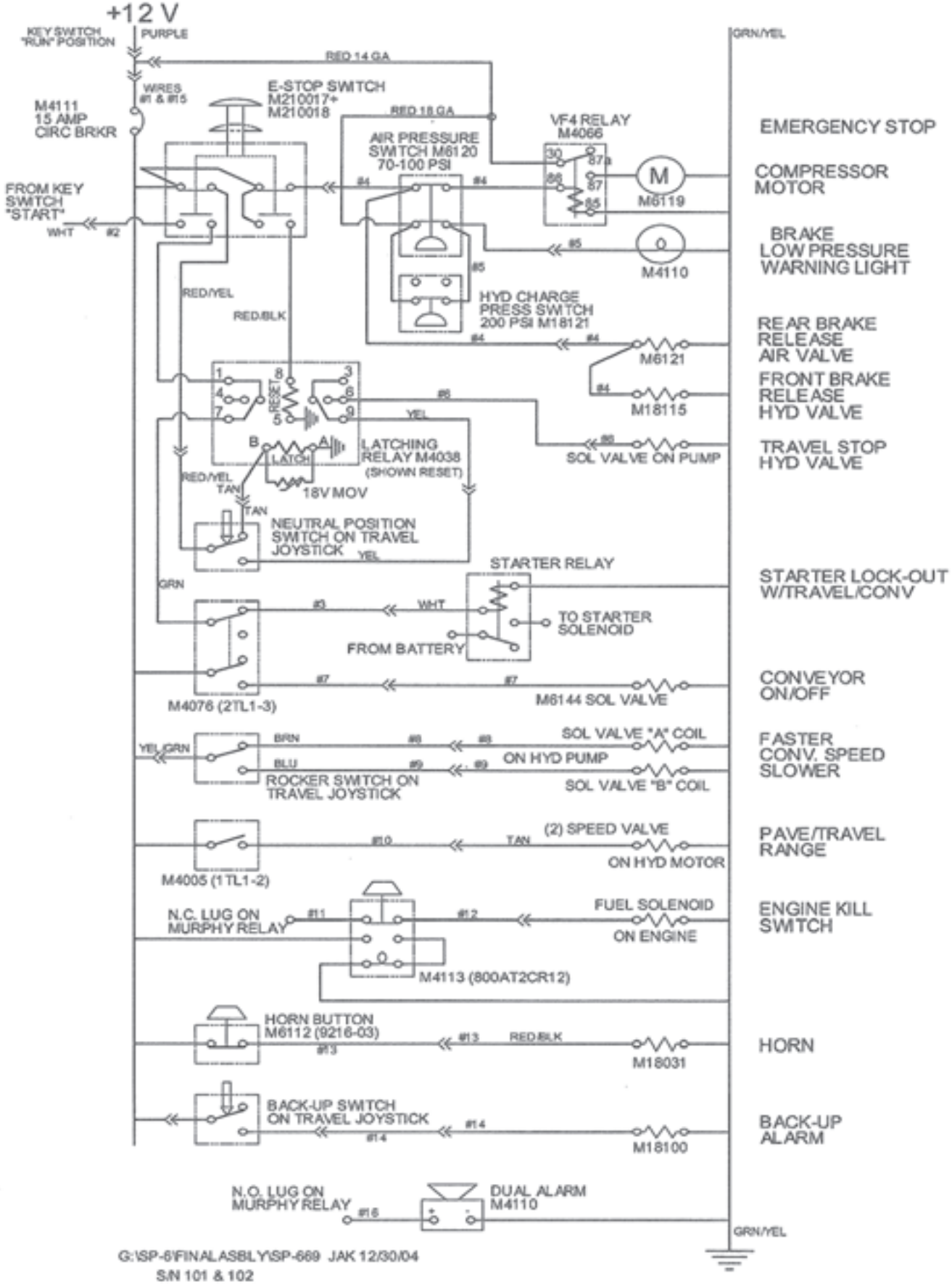
S/N 103 & UP W/PRESSURE SWITCH FOR BACK-UP ALARM (8/15/05), W/ FUEL SOLENOID RELAY (6/5/06)

SP-6 ELECTRICAL SCHEMATIC SN:103 ->



SP-6 SERIAL #101 & 102 ELECTRICAL SCHEMATIC

SP-669

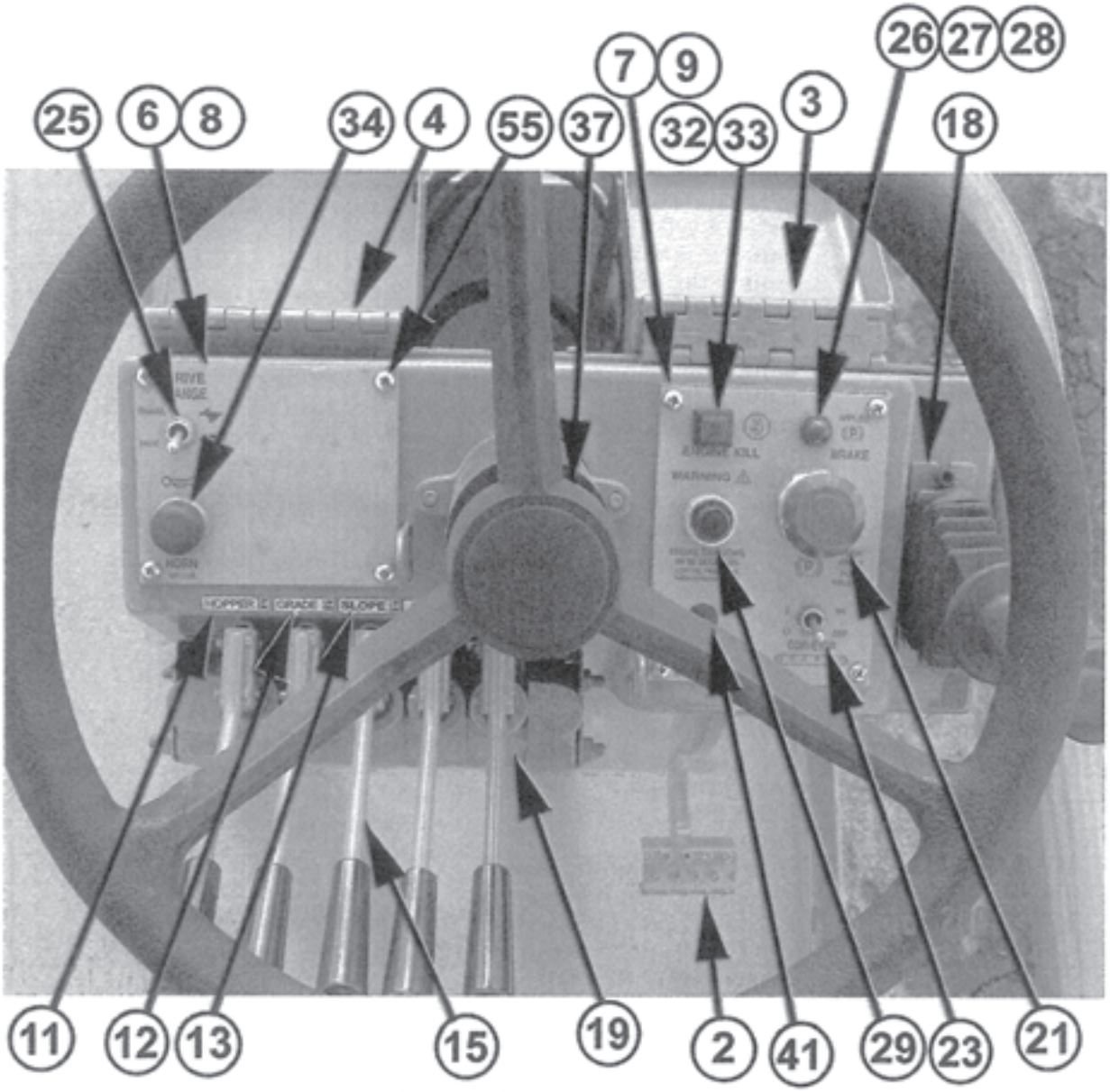


G:\SP-6\FINALASBLY\SP-669 JAK 12/30/04
S/N 101 & 102

SP-690

Item No.	Qty	Item ID	Item Name
1	1	SP-1105	CONSOLE FRONT COVER
2	1	SP-1106	BRAKE PEDAL
3	1	SP-1112	RIGHT COVER WELDMENT
4	1	SP-1113	LEFT COVER WELDMENT
5	1	SP-1115	BRAKE PEDAL CLEVIS
6	1	SP-1116	LEFT SWITCH PLATE (SP-6)
7	1	SP-1117	RIGHT SWITCH PLATE (SP-6)
8	1	SP-1126	LABEL, LEFT SWITCH
9	1	SP-1127	LABEL, RIGHT SWITCH
10	2	SP-1128	MOUNTING FOOT, VALVE
11	1	SP-1129	LABEL, HOPPER
12	1	SP-1130	LABEL, GRADE
13	1	SP-1131	LABEL, SLOPE
14	1	SP-1211	OPERATOR CONSOLE
15	3	SP-1243	REWORKED CONTROL HANDLE
16	1	SP-135 REV-A	OPERATOR SEAT ASSEMBLY
17	19 FT.	SW-694-M	WIRE CABLE 18 CONDUCTOR x 18 GA NUMBER CODED (PER FT.)
18	1	M1251	JOYSTICK CONTROLLER (SP-6)
19	1	M14054A	VALVE ASSEMBLY, 3 SECTION MANUAL, DIRECTIONAL
20	1	M18042	STEERING UNIT (COLUMN & VALVE) (SP-6)
21	1	M210017	SWITCH, 2 POS. PUSH/PULL BUTTON (SP-6)
22	1	M210018	CONTACT BLOCK (SP-6)
23	1	M4005	SWITCH, TOGGLE (1TL1-2)
24	1	M4038	LATCHING RELAY
25	1	M4076	SWITCH, TOGGLE (2TL1-3)
26	1	M4088	SOCKET, LAMP BASE
27	1	M4089	LAMP, CONTROL, 12VDC
28	1	M4090	COVER (RED), LAMP
29	1	M4110	DUAL ALARM
30	1	M4111	CIRCUIT BREAKER, 15 AMP
31	1	M4112	TERMINAL STRIP (8 POS.)
32	1	M4113	KILL SWITCH - SP (PUSH BUTTON, MAINTAINED CONTACT)
33	1	M4114	LEGEND INSERT, PUSH BUTTON
34	1	M6112	HORN BUTTON (SP-6)
35	1	M6114	MASTER CYLINDER (BRAKES) (SP-6)
36	1	M6114B	FILLER PLUG FOR MASTER CYLINDER M6114
37	1	M6122	STEERING WHEEL (40T SPLINED MOUNT) (SP-6)
38	1	M6149	CLEVIS PIN 5/8" DIA x 1-1/4" LG 10/PK
39	2	20C314	HOLD DOWN CLIP
40	1	701-1074-05	SOCKET, SCREW TERMINAL
41	1	9M0059	HOLE COVER, 1/2" BLACK PLASTIC
42	9	FLW-#10	FLAT WASHER, #10
43	6	FLW-1/4	FLAT WASHER, 1/4
44	6	FLW-3/8	FLAT WASHER, 3/8
45	6	HCS-1/4-20-0.50	HEX HD CAP SCREW 1/4-20 UNC x 1/2
46	15	HCS-3/8-16-1.25	HEX HD CAP SCREW 3/8-16 UNC x 1-1/4
47	4	HCS-M-8-1.25-16	HEX HD CAP SCREW (METRIC) 8 x 1.25 x 16
48	1	HXN-#8-32	HEX NUT, #8-32 UNC
49	15	HXN-3/8-16	HEX NUT, 3/8-16 UNC
50	2	KCS-1/4-20-0.75	SOCKET HD CAP SCREW 1/4-20 UNC x 3/4
51	1	LKW-#8	LOCK WASHER, #8
52	2	LKW-1/4	LOCK WASHER, 1/4
53	15	LKW-3/8	LOCK WASHER, 3/8
54	4	LKW-M-8	LOCK WASHER (METRIC) 8
55	17	PMS-#10-24-0.50	PAN HD MACHINE SCREW #10-24 UNC x 1/2
56	1	PMS-#8-32-1.00	PAN HD MACHINE SCREW #8-32 UNC x 1
57	2	RMS-#6-32-0.50	ROUND HD MACHINE SCREW #6-32 UNC x 1/2

SP-690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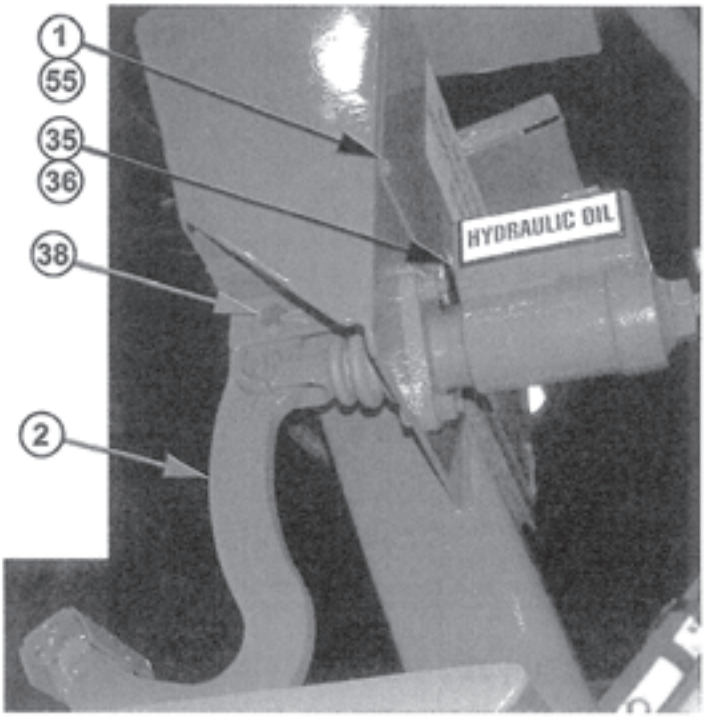
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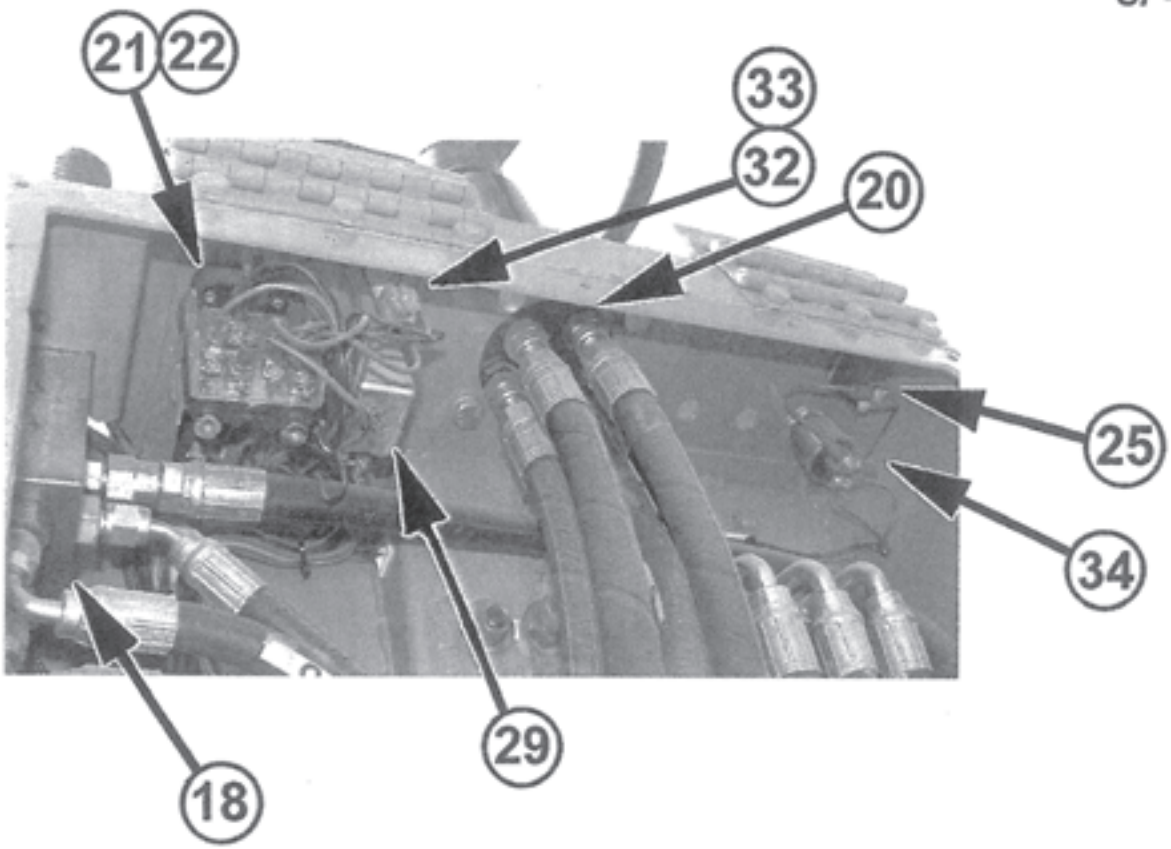
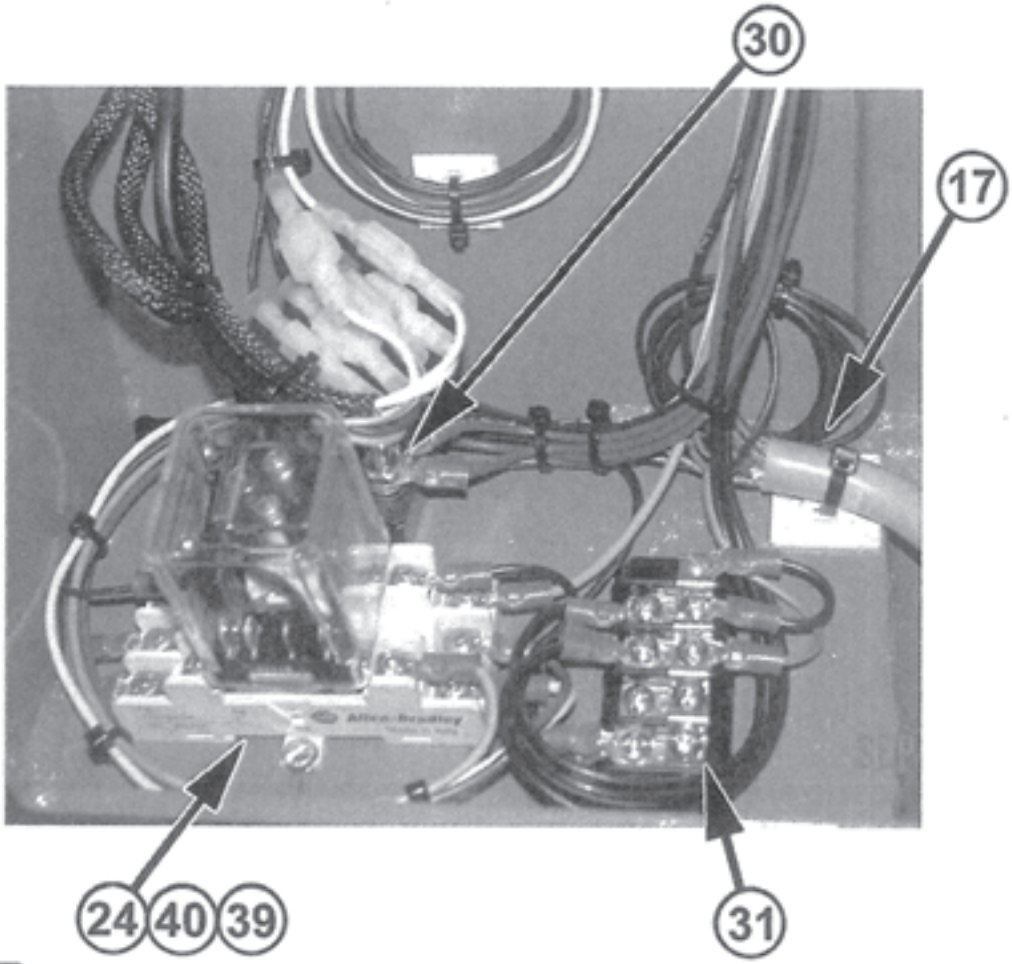
HYDRAULIC OIL

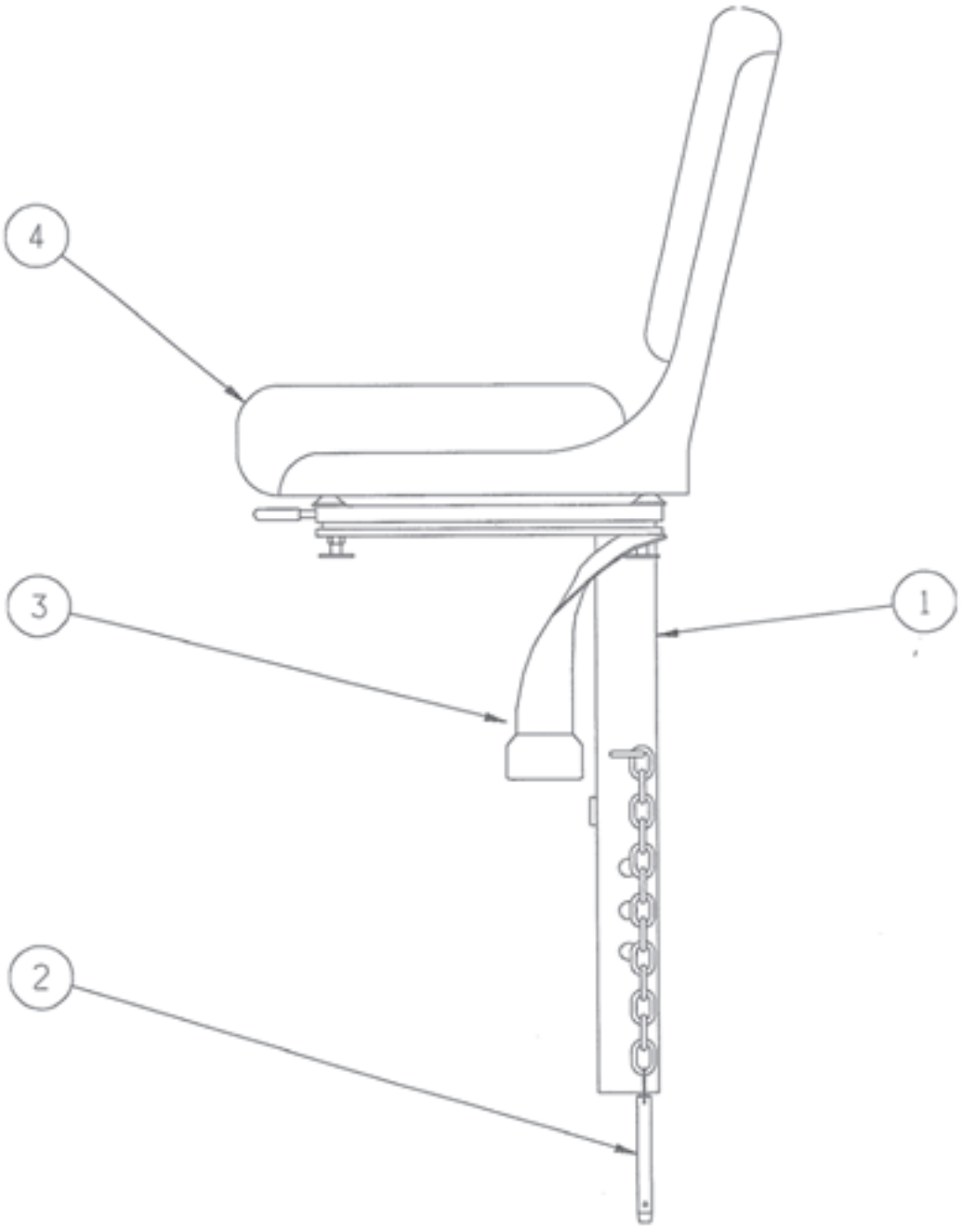
SP-690





SP-135 Rev. A

Item No.	Qty.	Item ID.	Item Name
1	1	SP-136	OPERATOR SEAT WELDMENT
2	1	M18070	PIN, QUICK RELEASE, 1/2 DIA X 3 1/2 GRIP (SP SEAT PIN)
3	1	M18007B	SEAT BELT, LAP TYPE, FOR SEAT # M18007
4	1	M18007	SEAT, W/ POSITION ADJUSTMENT

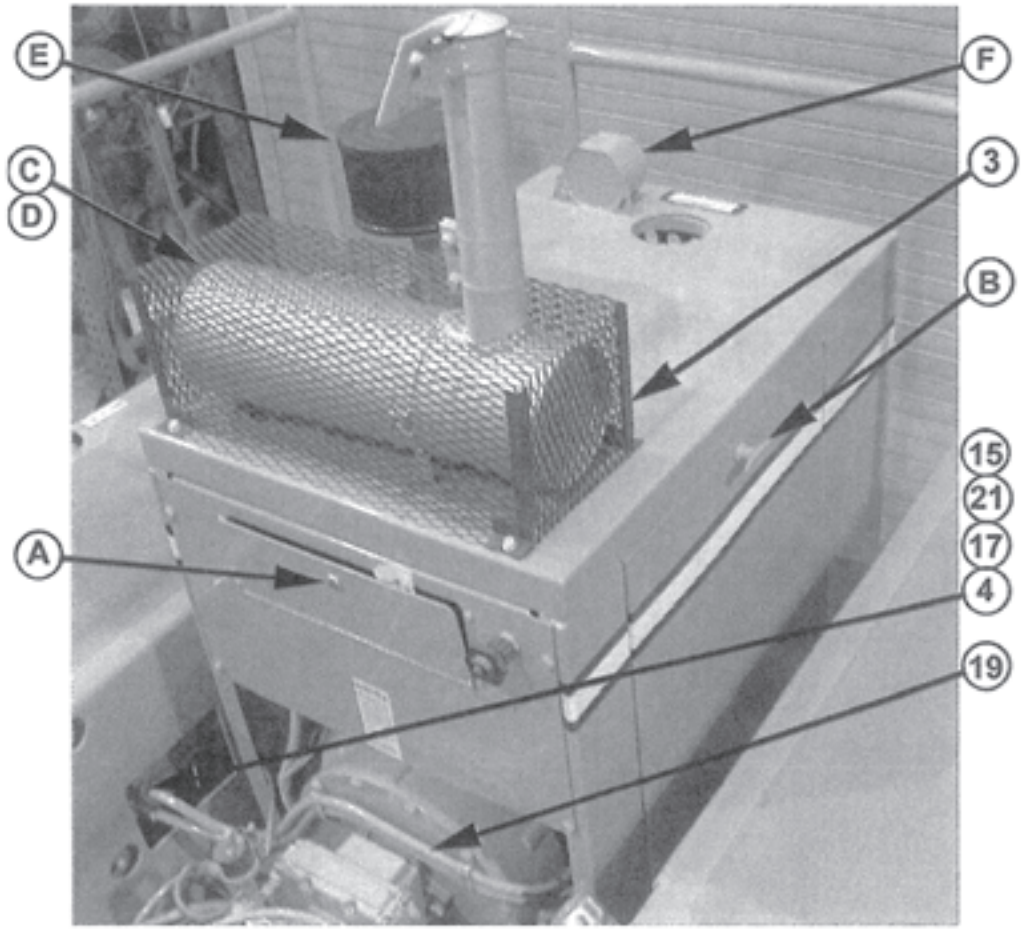


SP-682

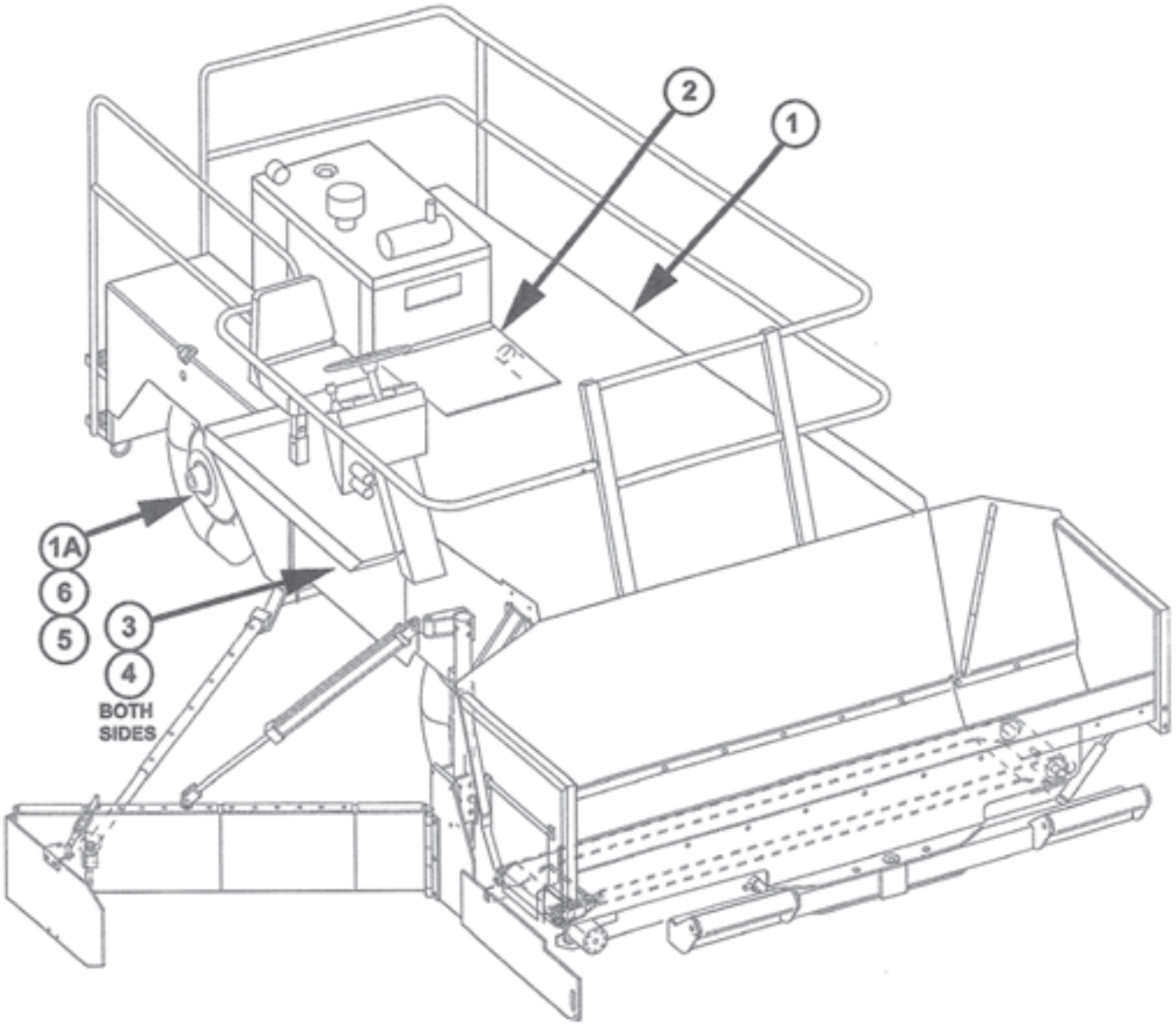
Item No.	Qty.	Item ID.	Item Name
1	1	M5083	SP-6 ENGINE JD 4024-T49 TIER II
2	1	SW-626-16	BATTERY 12V
3	1	SP-1239	MUFFLER GUARD WELDMENT
4	1	SP-1231	FUEL DIP TUBE W/ ELBOW
5	1	SP-1168	GROUND CABLE, ENGINE TO CHASSIS (SP-6)
6	1	SP-1167	BATTERY CABLE, NEGATIVE (SP-6)
7	1	SP-1166	BATTERY CABLE, POSITIVE (SP-6)
8	1	PCL-2	COUPLER, PIPE, BLACK 2 FNPT
9	1	NPL-2	NIPPLE, PIPE, 2 x CLOSE
10	1	M6123	BATTERY HOLD DOWN, ADJ,
11	1	M5055	BATTERY BOLTS (2) 10" J-HOOKS W/ HARDWARE
12	4	M5030	ENGINE MOUNT
13	4	M5006A	ENGINE MOUNT WASHER
14	4	M5006	ENGINE MOUNT WASHER
15	1	M18001	FUEL TANK, 50 GAL
16	1	M18001-V	VISUAL GAUGE (TOP MOUNTED) FOR FUEL TANK M18001
17	4	HS-06	HOSE CLAMP SAE NO. 06 SIZE RANGE 7/16 - 25/32
18	8	FLW-1-1/4	FLAT WASHER, 1-1/4
19	144 IN.	FC-234-05	FUEL LINE, 1/4 ID
20	2	30682-4-4	HOSE END, 7/16-20 FJIC SWIVEL x 1/4 HOSE, PUSH-LOK
21	1	2024-4-4S	ADAPTER, 90° ELBOW, 1/4 MNPT x 7/16-20 MJIC

ENGINE ENCLOSURE COMPONENTS

A. (1) ZRE-SD910 CONTROL PANEL LOCK
B. (2) Z-M150030 T-HANDLE (NO LOCK) SP ENG. ENCLOSURE
- ZRE-31125 LATCH, T-HANDLE, LOCKING FOR SP-6 *OPTION
C. (1) ZRE-10330 MUFFLER
D. (1) ZRE-P20-6405 MUFFLER CLAMP(FROM ENG)
E. (1) Z-C085005 AIR FILTER FOR SP-6 ENGINE (DURA-LIFE)



Item No.	Qty.	Item ID.	Item Name
1	1	SP-665	CHASSIS BODY & FRAME ASSEMBLY (SP-6)
1A	1	T-501-3	AXLE #D22-FC167W-B10A-71.50"
2	1	SP-1194	PUMP ACCESS HATCH
3	2	SP-1040	CENTER DOOR WELDMENT
4	2	M6111	LATCH, PAWL / CAM ACTION T-HANDLE, W/ KEYLOCK
5	2	M6109	TIRE, RADIAL, ALL POSITION 255/70R22.5
6	2	M6108	WHEEL, STEEL, TUBELESS 22.5 X 7.50 10 HOLE



SP-684

Item No.	Qty.	Item ID.	Item Name
1	1	CA640710	AXLE, FRONT DRIVE, STEERING (SP-6) (See Manufacturers Info. sect)
18	1	SP-1070	GEARBOX MOUNT, L/S
17	1	SP-1069	GEARBOX MOUNT, R/S
16	2	SP-1031	BOTTOM PLATE, AXLE MOUNT
15	2	M6110	WHEEL, STEEL TUBELESS 22.5 X 7.50, 8 HOLE - 221mm BORE
14	2	M6109	TIRE, RADIAL, ALL POSITION 255/70R22.5
13	1	M5127	MOTOR, HYDRAULIC, VARIABLE, 160 CC
13a	1	ZRE-10702	BUNA-N O-RING FOR M5127 MOTOR
12	4	LKW-M-16	LOCK WASHER (METRIC) 16
11	8	LKW-7/8	LOCK WASHER, 7/8
10	4	LKW-1/2	LOCK WASHER, 1/2
9	4	KCS-M-16-2.0-40	SOCKET HD CAP SCREW (METRIC) 16 x 2.0 x 40
8	4	HXN-1/2-13	HEX NUT, 1/2-13 UNC
7	8	HIN-7/8-14	HIGH HEX NUT, 7/8-14 UNF (GRADE 8)
6	8	HCS-7/8-14-11.00	HEX HD CAP SCREW 7/8-14 UNF x 11.0 (GRADE 8)
5	4	HCS-1/2-13-4.00	HEX HD CAP SCREW 1/2-13 UNC x 4
4	16	FLW-MP-18	FLAT WASHER - METRIC, ZINC PLATED 18
3	4	FLW-M-16	FLAT WASHER (METRIC) 16

COMPONENTS

CARRARO

Catalogo Parti Di Ricambio

Spare Parts List

ASSALE 26.20M+TB172

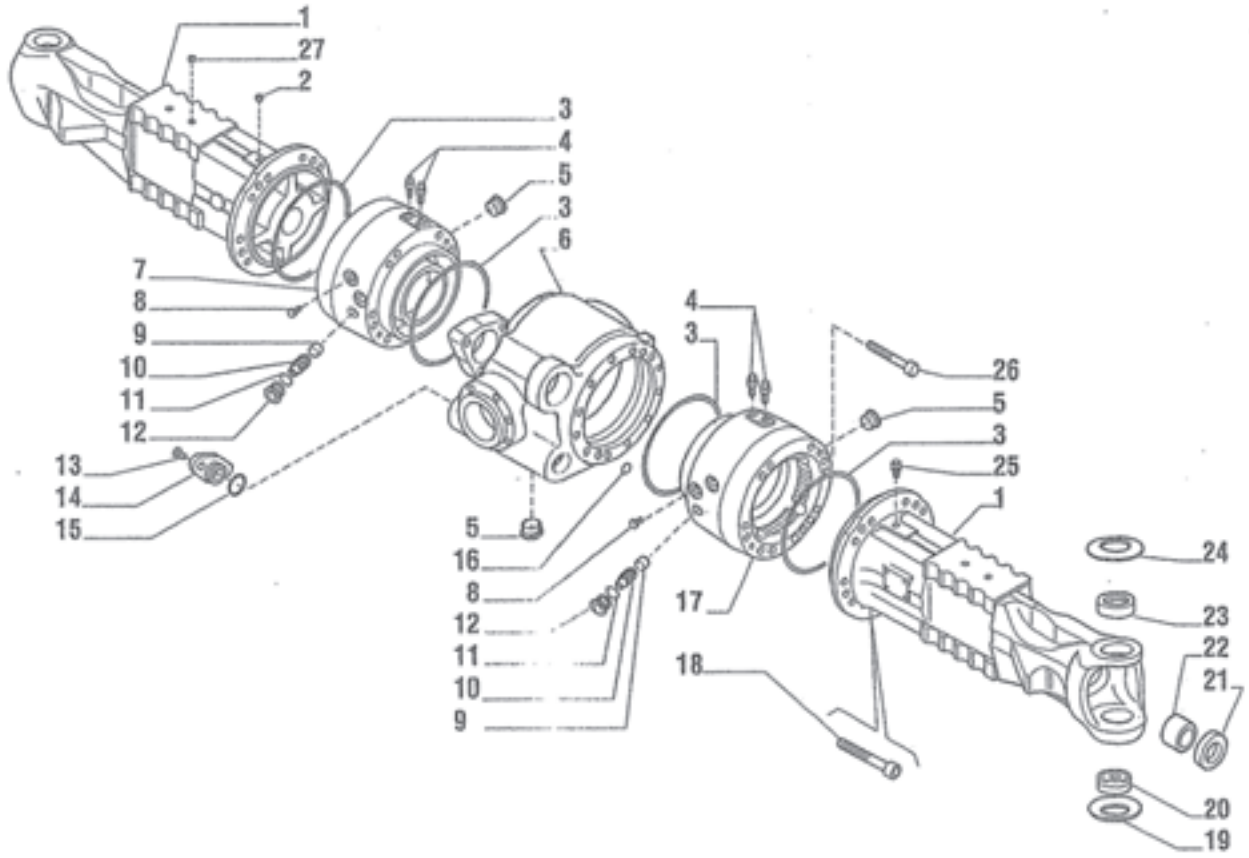
26.20M+TB172 AXLE

REF. 641551

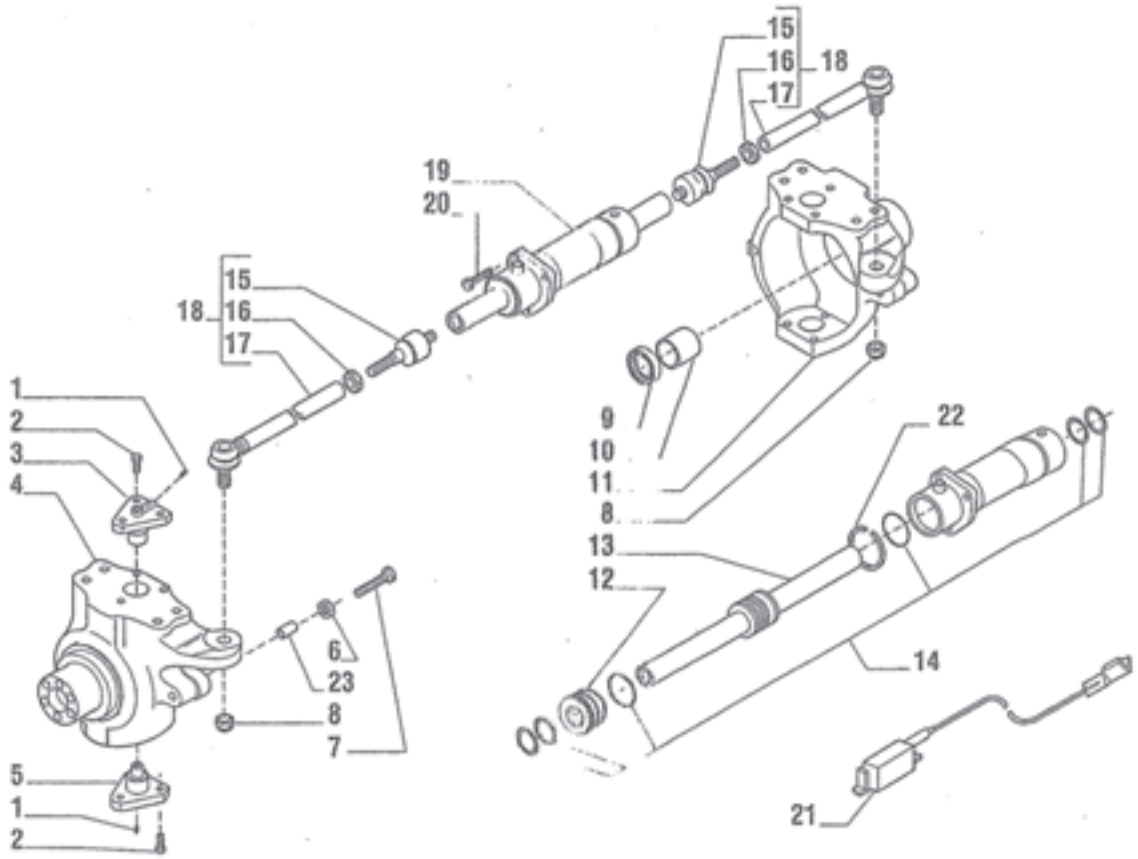
1° EDITION - April/05 - CM 9695

REVISION DATE 00/00

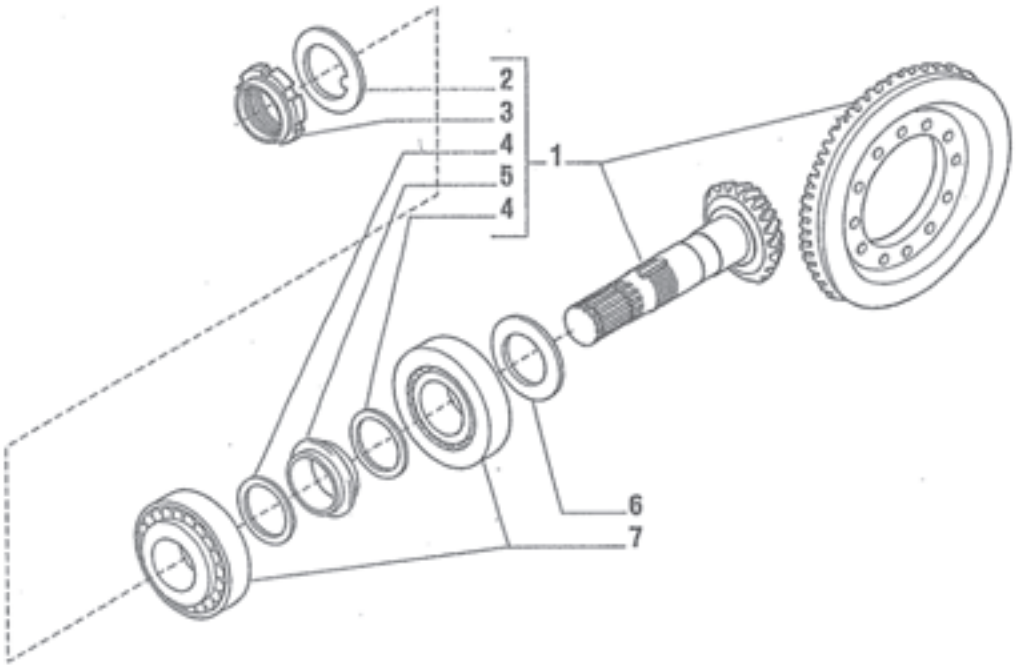
P/N: CA355918



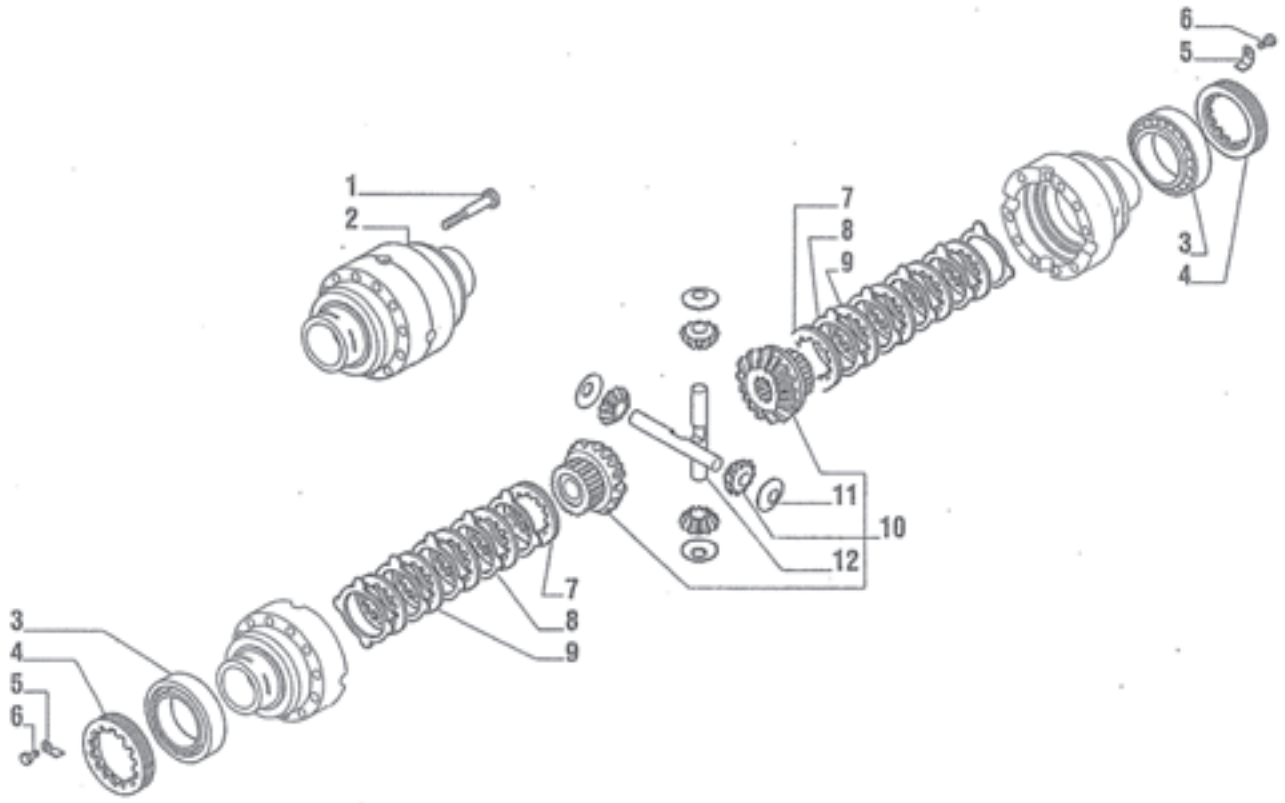
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	145312	2	Tromba	Trumpet		
2	021558	1	Tappo M10x1	Plug M10x1		
3	028562	4	Anello OR	ORing		
4	116792	4	Sfiato M10x1	Breather M10x1		
5	125280	3	Tappo M30x2	Plug M30x2		
6	140520	1	Corpo centrale	Centra bodyl		
7	139819	1	Flangia SX	LH Brake cylinder		
8	030740	4	Tappo	Plug		
9	139955	6	Spina	Pin		
10	136152	6	Vite M16x1.5	Screw M16x1.5		
11	028534	6	Anello OR	O ring		
12	139922	6	Vite speciale	Screw		
13	020781	2	Vite M8x25	Screw M8x25		
14	130033	1	Coperchio	Cover		
15	028557	1	Anello OR	O ring		
16	028111	2	Anello OR	O ring		
17	139815	1	Flangia DX	RH Brake cylinder		
18	021364	24	Vite M16x150	Screw M16x150		
19	128630	2	Molla tazza	Belleville washer		
20	123726	2	Rotula sferica	Spherical joint		
21	139101	2	Anello di tenuta	Seal		
22	118547	2	Bronzina	Bushing		
23	143563	2	Bocola	Bushing		
24	128633	2	Molla tazza	Belleville washer		
25	104988	1	Sfiato M10x1	Breather M10x1		
26	021334	2	Vite M12x110	Screw M12x110		
27	021494	4	Grano M10x10	Grub M10x10		



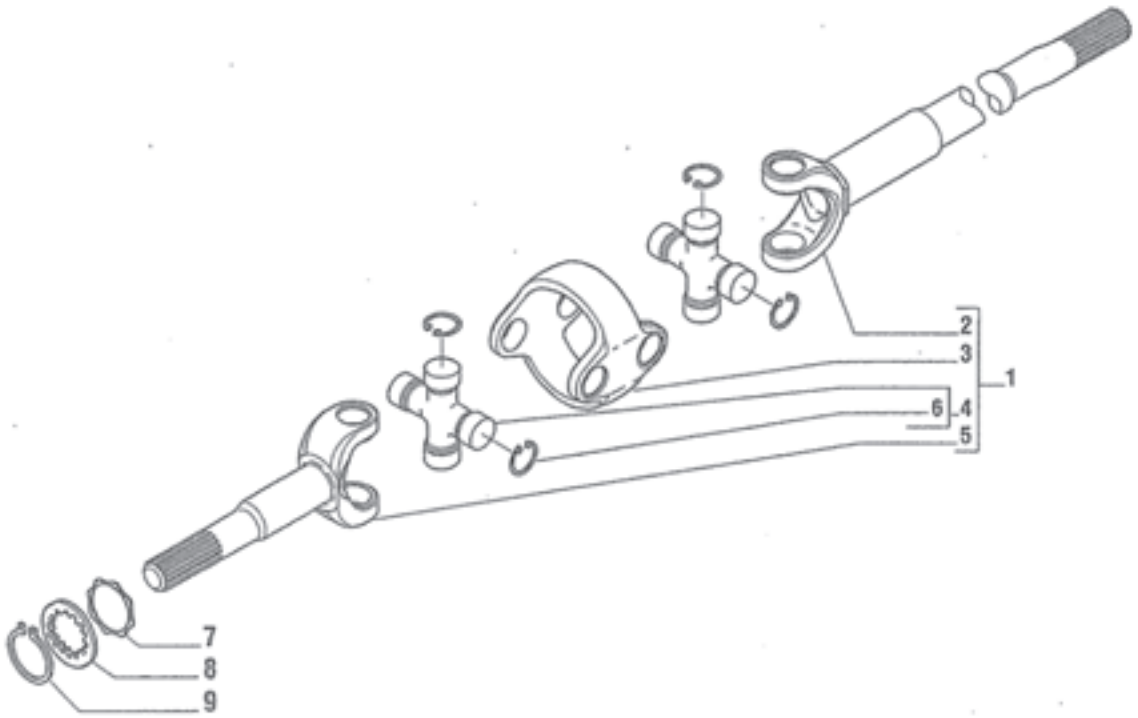
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	024210	4	Ingrassatore M6x1	Greaser		
2	126922	12	Vite M14x35 (Atbl)	Screw		
3	128880	2	Perno snodo	King pin		
4	145034	1	Calotta SX	LH Swivel housing		
5	128881	2	Perno snodo	King pin		
6	022129	4	Dado M16	Nut		
7	138855	4	Vite M16x130	Screw		
8	022431	2	Dado M20x1.5	Nut		
9	144485	1	Anello tenuta	Seal		
10	125390	2	Bronzina	Bushing		
11	145033	1	Calotta DX	RH Swivel housing		
12	049138	1	Testata martinetto	Cylinder head	137177	
13	049074	1	Stelo	Rod	137177	
14	049226	1	Kit guarnizioni	Seal kit	137177	
15	049013	2	Snodo sferico	Ball joint	135578	
16	070787	2	Dado M24x1.5	Nut	135578	
17	049029	2	Tirante snodo	Tie rod	135578	
18	135578	2	Asta di guida	Steering arm		
19	137177	1	Martinetto	Steering cylinder		
20	128534	3	Vite M12x45	Screw		
21	137179	1	Sensore	Sensor		
22	049314	1	Banda magnetica	Magnetic ring		
23	143038	4	Bussola	Bushing		



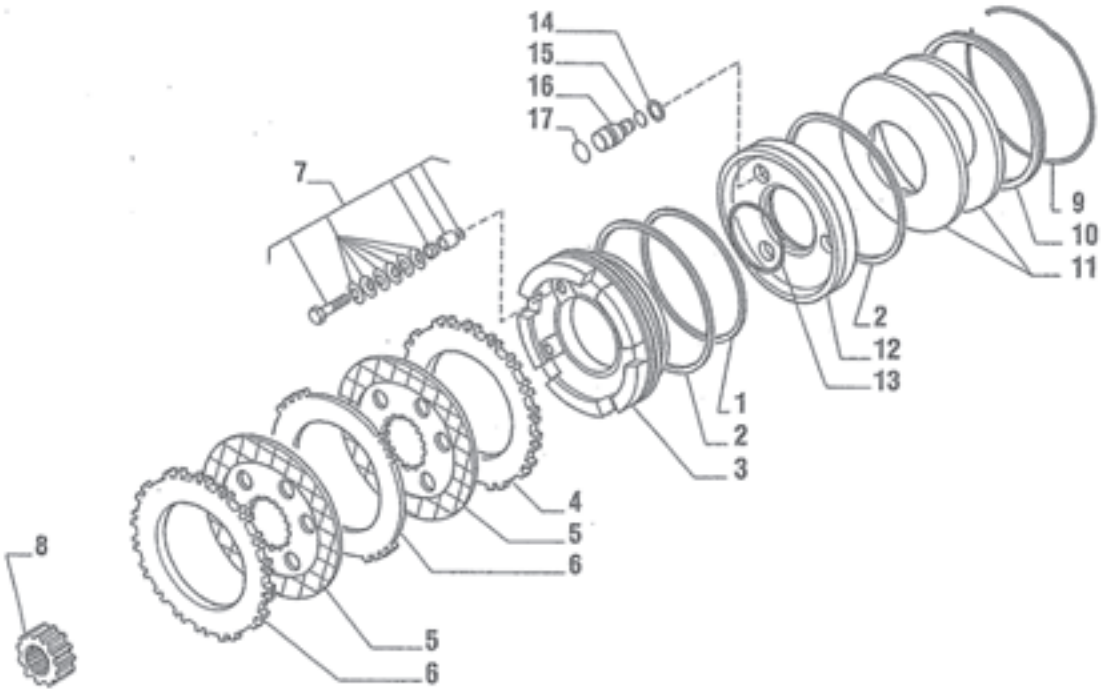
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	066090	1	Coppia conica Z=13/31	Bevel gear set 13/31		
2	113717	1	Rondella fermo ghiera	Washer	066090	
3	115054	1	Ghiera serraggio M40x1.5	Ring nut	066090	
4	125829	2	Rondella 51x35x3	Washer	066090	
5	125806	1	Distanziale elastico	Spacer	066090	
6	132265	-	Spessore 2.50mm	Shim 2.50mm		
6	132266	-	Spessore 2.60mm	Shim 2.60mm		
6	132267	-	Spessore 2.70mm	Shim 2.70mm		
6	132268	-	Spessore 2.80mm	Shim 2.80mm		
6	132269	-	Spessore 2.90mm	Shim 2.90mm		
6	132270	-	Spessore 3.00mm	Shim 3.00mm		
6	132271	-	Spessore 3.10mm	Shim 3.10mm		
6	132272	-	Spessore 3.20mm	Shim 3.20mm		
6	132273	-	Spessore 3.30mm	Shim 3.30mm		
6	132274	-	Spessore 3.40mm	Shim 3.40mm		
7	027350	2	Cuscinetto	Bearing		



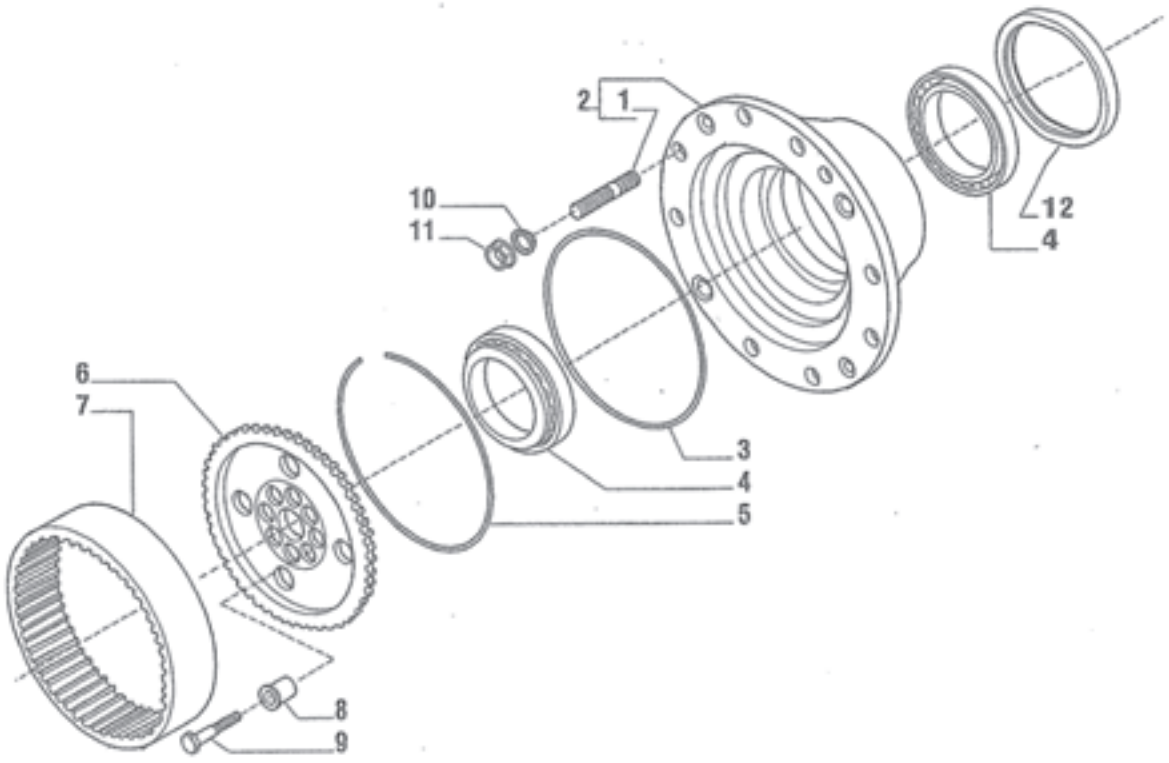
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	125552	12	Vite M10x75	Screw		
2	137972	1	Scatola differenziale	Differential housing		
3	027309	2	Cuscinetto	Bearing		
4	107400	2	Ghiera	Ring nut		
5	136156	2	Fermo ghiera	Lock nut		
6	128440	2	Vite M6x10	Screw		
7	110642	2	Disco bloc. Diff.	Differential lock disc		
8	110643	10	Controdisco bloc. Diff.	Differential lock plate		
9	110644	8	Disco bloc. Diff.	Differential lock disc		
10	066759	1	Kit ingr. Differenziale	Differential gears kit		
11	115730	4	Ralla rasamento	Thrust washer	066759	
12	116369	2	Perno	Shaft	066759	



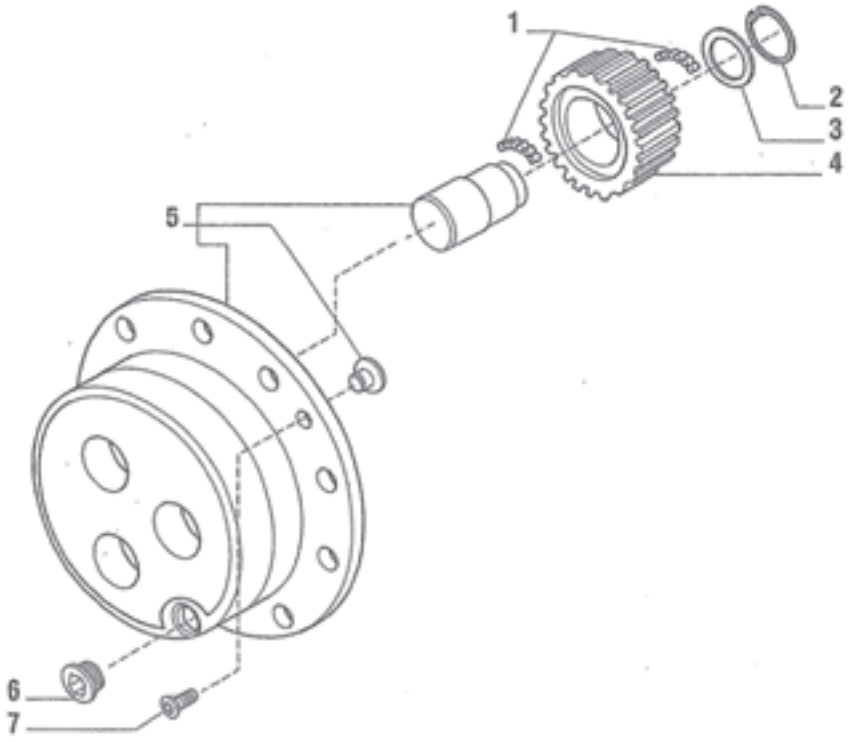
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	144607	2	Doppio giunto	Double joint		
2	046218	2	Forcella (lato diff.)	Fork (diff. Side)	144607	
3	046217	4	Crociera	Spider	144607	
4	046215	2	Corpo centrale	Central body	144607	
5	046175	2	Forcella (lato ruota)	Fork (wheel side)	144607	
6	046216	16	Anello d'arresto	Snap ring	144607	
7	141366	2	Rondella	Washer		
8	132165	2	Rondella	Washer		
9	141368	2	Anello	Snap ring		



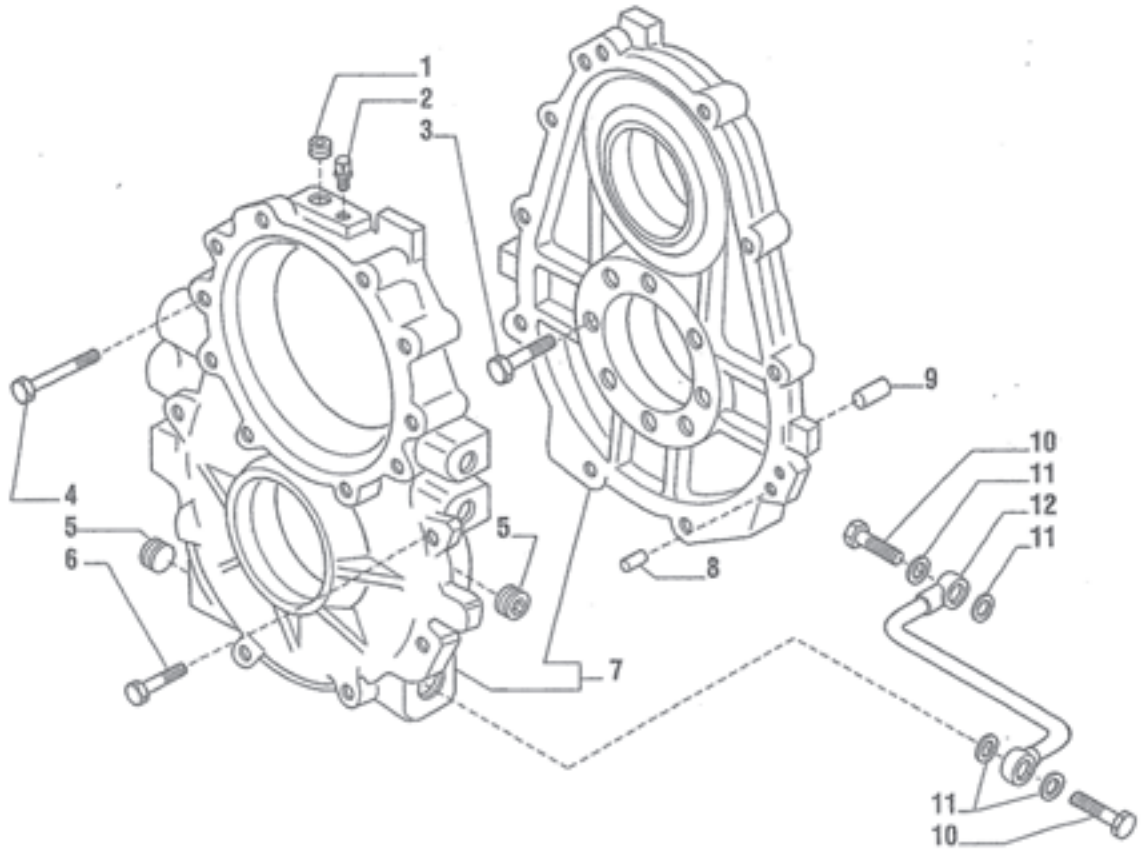
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	141939	2	Anello "Quadring"	Quadring		
2	141937	4	Anello "Quadring"	Quadring		
3	135966	2	Pistone freno pos.	Piston		
4	136644	2	Controdisco freno	Counter plate		
5	136112	4	Disco freno	Brake disc		
6	136155	4	Controdisco freno	Counter plate		
7	068573	2	Kit self-adjust	Self-adjust kit		
8	136648	2	Manicotto traino	Sleeve		
9	135572	2	Anello	Ring		
10	135998	2	Manicotto	Sleeve		
11	135964	4	Molla tazza	Belleville washer		
12	135965	2	Pistone freno neg.	Piston		
13	141938	2	Anello "Quadring"	Quadring		
14	024782	6	Rondella	Washer		
15	141936	6	Anello OR	O ring		
16	145815	6	Perno di spinta	Pin		
17	141935	6	Anello OR	O ring		



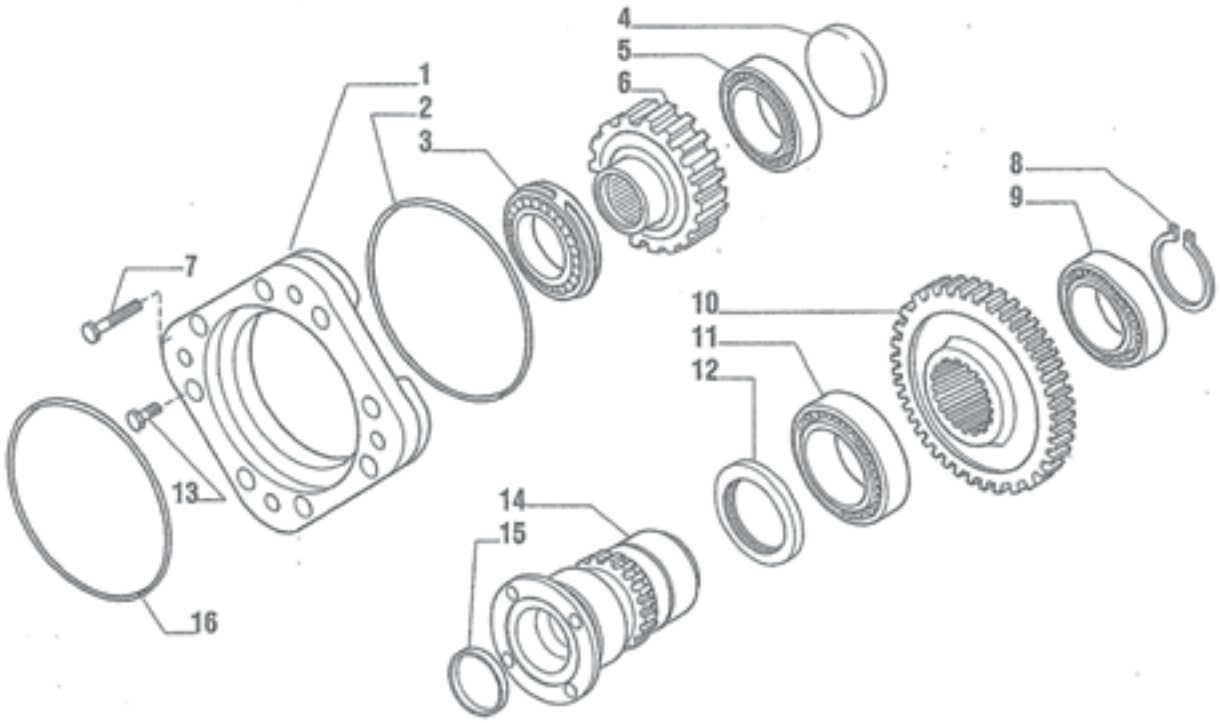
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	130679	16	Prigioniero	Stud	068313	
2	068313	2	Kit mozzo ruota	Wheel hub kit		
3	028683	2	Anello OR	ORing		
4	118370	4	Cuscinetto	Bearing		
5	125344	2	Anello	Ring		
6	134298	2	Mozzo fermo corona	Wheel carrier		
7	134299	2	Corona epicicloidale	Crown gear		
8	141196	16	Bussola centraggio	Bushing		
9	140259	16	Vite M12x45	Screw M12x45		
10	119505	16	Rondella	Washer		
11	115812	16	Dado M22x1.5	Nut M22x1.5		
12	047702	2	Tenuta a cassetto	Cassette seal		



Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	028370	33.6	Rullini 5x10 (a decine)	Roller bearing (by tens)		
2	024793	6	Anello seeger	Lock ring		
3	135366	6	Ralla	Washer		
4	135947	6	Ingranaggio Z=23	Gear Z=23		
5	066285	2	Kit treno portasatelliti	Planetary carrier assy		
6	125280	2	Tappo M30x2	Plug M30x2		
7	020490	4	Vite M8x20	Screw M8x20		



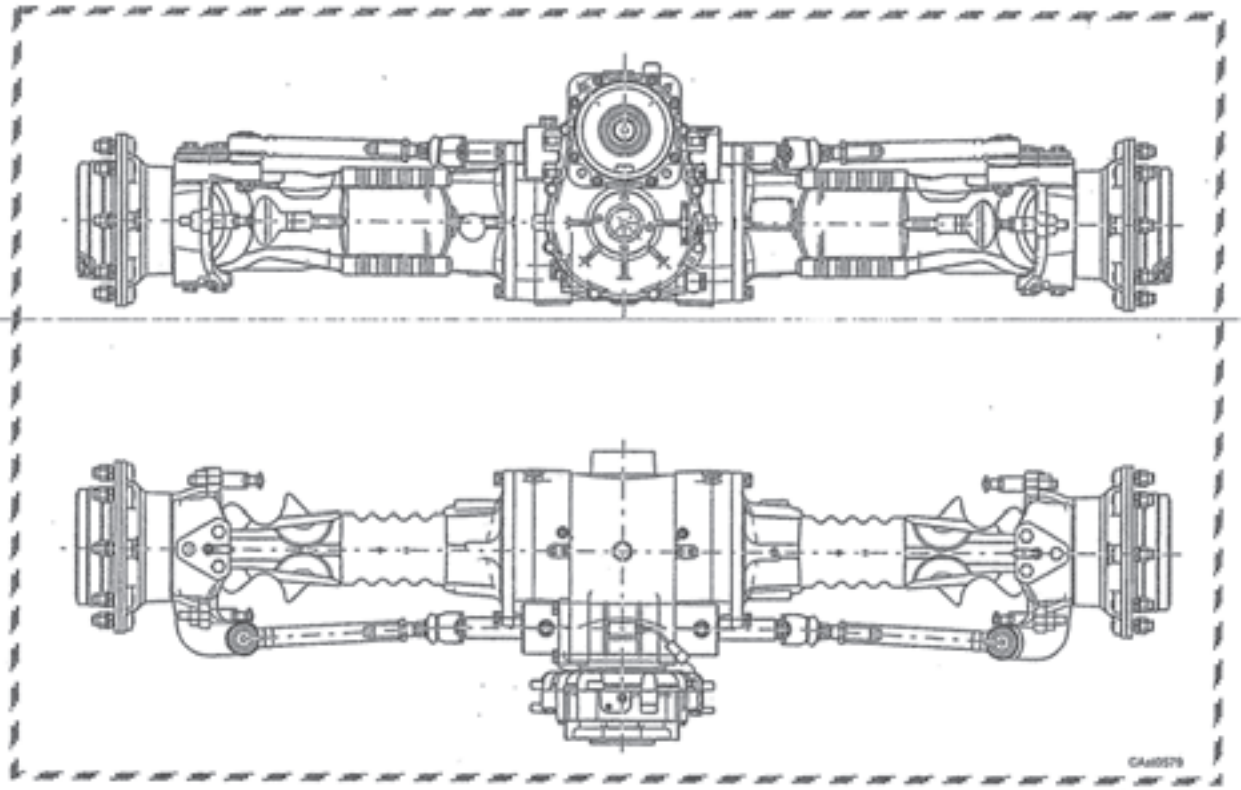
Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	021567	1	Tappo M16x1.5	Plug M16x1.5		
2	104988	1	Sfiato M10x1	Breather M10x1		
3	021097	8	Vite M12x55	Screw M12x55		
4	020868	2	Vite M10x75	Screw M10x75		
5	128059	2	Tappo M24x1.5	Plug M24x1.5		
6	020864	6	Vite M10x55	Plug M10x55		
7	128571	1	Scatola trasmissione	Transmission housing		
8	072259	4	Spina D10x25	Pin D10x25		
9	121710	1	Spina D12x25	Pin D12x25		
10	128785	2	Vite M24x1.5	Screw M24x1.5		
11	023271	4	Rondella	Washer		
12	134134	1	Tubo ricircolo olio	Oil pipe		



Pos.	Ref.	Q.ty	Descrizione	Description	Kit	Note
1	136878	1	Flangia	Flange		
2	028611	2	Anello OR	O ring		
3	025820	1	Cuscinetto	Bearing		
4	109747	1	Tappo D80x12	Plug		
5	025741	1	Cuscinetto	Bearing		
6	148766	1	Ingranaggio Z=46	Gear Z 46		
7	021434	2	Vite M10x90	Screw		
8	024816	1	Anello seeger D.65	Snap ring D 65		
9	025742	1	Cuscinetto	Bearing		
10	148767	1	Ingranaggio Z=90	Gear Z 90		
11	025743	1	Cuscinetto	Bearing		
12	025296	1	Anello di tenuta	Seal		
13	021412	6	Vite M10x35	Screw M10x35		
14	131757	1	Albero inferiore	Lower shaft		
15	130667	1	Tappo D42x12	Plug		

Kit	Ref.	Descrizione	Description	Q.ty	Note
135578	-	Asta guida	Steering arm	-	
	049029	Tirante	Tie rod	1	
	070787	Dado	Nut	1	
	049013	Snodo sferico	Ball joint	1	
137177	-	Martinetto	Steering cylinder	-	
	049138	Testata	Head	1	
	049074	Stelo	Rod	1	
	049314	Banda magnetica	Magnetic ring	1	
	049226	Kit guarnizioni	Seal kit	1	
066090	-	Kit coppia conica	Bevel gear set	-	
-	-	Coppia conica Z=13/31	Bevel gear Z=13/31	1	
-	125829	Rondella 50x40.5x2	Washer 50x40.5x2	2	
-	125806	Distanziale elastico	Spacer	1	
-	115054	Ghiera serraggio M40x1.5	Ring nut M40x1.5	1	
-	113717	Rondella fermo ghiera	Washer	1	
068759	-	Kit ingranag. differenziale	Differential gear kit	-	
-	115730	Rondella spallamento	Washer	4	
-	116369	Perno	Pin	2	
-	-	Ingranaggio Z=12	Gear Z=12	4	
-	-	Ingranaggio Z=18	IGear Z=18	2	
068313	-	Kit mozzo ruota	Wheel hub kit	-	
-	130679	Prigioniero	Stud	8	
-	-	Mozzo ruota	Wheel hub	1	
066285	-	Kit treno portasatelliti	Planetary carrier assy	-	
-	-	Pattino d'arresto	Pad	1	
-	-	Treno portasatelliti	Planetary carrier	1	
-	-	Perno	Shaft	3	
066573	-	Kit self-adjust	Self-adjust kit	-	
-	-	Vite	Screw	3	
-	-	Boccola	Washer	3	
-	-	Spina	Pin	3	
-	-	Molla tazza	Belleville washer	18	
-	-	Molla tazza	Belleville washer	3	

CARRARO



MANUALE DI RIPARAZIONE

REPAIR MANUAL

ASSALE - *AXLE*

Mod. 26.20M+TB172

Rif. CA139970

1ST Edition date: 05/2001

Revision date: 00/00

P/N: CA357141

al14501

Indice

Index

A INFORMAZIONI GENERALI

A *GENERAL INFORMATION*

A.1 Utilizzo del manuale

Destinatari

- Installatore.
- Utilizzatore.
- Manutentore.

Manutenzione

Il buon funzionamento ed il rendimento degli organi meccanici dipendono principalmente da una costante e corretta manutenzione.
PRENDERE VISIONE DI TUTTO IL MANUALE consente di svolgere correttamente le operazioni di manutenzione ordinaria e straordinaria. L'omissione delle operazioni raccomandate può pregiudicare la durata e l'integrità dell'assale e comportare danni o infortuni all'operatore.
Nell'eventualità di guasti o anomalie il tempestivo intervento da parte di personale specializzato garantisce una durata più lunga del gruppo, evitando danni maggiori nel tempo.

Riparazione

Le procedure per lo smontaggio/montaggio dell'assale consentono di eseguire la revisione totale del gruppo e sono descritte in sequenza con l'ausilio di illustrazioni, per una guida completa e sicura all'esecuzione di ogni operazione.
Nella descrizione delle operazioni si presuppone che l'assale sia stato rimosso dal veicolo. Per la rimozione dell'assale dal veicolo si dovrà consultare il manuale fornito a tale proposito dal costruttore del veicolo stesso.
La conoscenza approfondita del gruppo consente la corretta valutazione del tipo di intervento da eseguire, che può richiedere solamente lo smontaggio di alcuni componenti operando solo parzialmente nel gruppo.

Proprietà delle informazioni

Questo manuale contiene informazioni di proprietà riservata. Tutti i diritti sono riservati.

Questo manuale non può essere riprodotto o fotocopiato, tutto o in parte, senza il preventivo consenso scritto di CARRARO S.p.A. L'uso di questo materiale documentale è consentito solo al cliente a cui il manuale è stato fornito come corredo dell'assale, e solo per scopi di uso, manutenzione e riparazione.

A.1 Manual use

End users

- *Installer*
- *User*
- *Maintenance operator*

Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine and extraordinary maintenance which could promote the integrity and duration of the axle and avoid damages or any harm to the operator.
In case of any damages or anomalies, quick intervention of specialized personnel can avoid future impairment and lengthen the working life.

Repair

The disassembly/assembly procedures have been outlined for a total group overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.
Operation description presumes that the axle has already been removed from the vehicle. The manual supplied by the vehicle manufacturer should be consulted in case of a overhauling or maintenance intervention requiring the removal of the axle.
Moreover, the attentive group inspection leads to a correct repair work estimation that could merely require dismounting only few components, and thus operating partially on the group.

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No part of this manual may be reproduced, in any form or by any means, without prior written permission of CARRARO S.p.A. Only the customer, whom the manual, together with the axle, has been issued to, is allowed to use this document, and only in order to use, maintain and repair the axle.

CARRARO S.p.A. dichiara che le informazioni contenute in questo manuale sono congruenti con le specifiche tecniche e di sicurezza dell'assale a cui il manuale si riferisce. Il fabbricante non si assume alcuna responsabilità per danni diretti o indiretti a persone, cose o animali, conseguenti all'uso di questo materiale documentale o dell'assale in condizioni diverse da quelle previste.

CARRARO S.p.A. declares that the subject of this manual consists with the technical and safety specifications of the axle that the manual is referred to. The manufacturer shall not be held liable for direct or indirect damages to persons, things or animals due to an improper use of this document or of the axle or to a different use of them, which does not comply with what is provided for in this manual.

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A.2 Convenzioni e definizioni

Convenzioni

Le illustrazioni nel manuale NON sono in scala quindi NON sono attendibili valutazioni delle dimensioni dei componenti basate sulle stesse.
Le illustrazioni hanno il compito di evidenziare le sequenze e le fasi di manipolazione dell'assale e dei suoi componenti, per questo potrebbero non rappresentare esattamente gli elementi di questo assale ma quelli di assali simili.

Definizioni

Lato sinistro: parte sinistra dell'assale vista nel senso di marcia del veicolo.
Lato destro: parte destra dell'assale vista nel senso di marcia del veicolo.

Convenzioni tipografiche

Nota: Informazioni importanti, evidenziate al di fuori del testo a cui si riferiscono.
Attenzione: procedure la cui totale o parziale inosservanza può produrre danni alla macchina o alle apparecchiature ad essa collegate.
Pericolo: procedure la cui totale o parziale inosservanza può produrre lesioni o danni alla salute dell'operatore.

Unità di misura

Nel manuale si utilizzano le unità di misura del sistema internazionale (SI). Per la conversione al sistema anglosassone riferirsi alla seguente tabella.

A.2 Agreements and definitions

Agreements

Illustrations like pictures, drawings and components of this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.
Illustrations are supposed to point out the various handling sequences and phases of the axle and its components, therefore they could not display exactly the same group elements.

Definitions

***Left side:** it is the left side of the axle considering the vehicle running conditions.*
***Right side:** it is the right side of the axle considering the vehicle running conditions.*

Typographic agreements

***Note:** The notes, pointed out externally to the text they refer, include important information.*
***Warning:** Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.*
***Danger:** Danger indications point out the procedures, whose partial or complete non-observance can injury the operator.*

Measurements

This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

Tabella di conversione / *Conversion table*

S.I.		*ENGLISH AND USA SYSTEM*	
1	(mm)	0.03937	(in)
10	(mm)	0.3937	(in)
25.4	(mm)	1	(in)
6.4516	(cm^2)	1	(sq. in)
1	(m^2)	1550	(sq. in)
16.378	(cm^3)	1	(cu. in)
0.473	(dm^3)	1	(U.S. pint)
1	(l)	61.02	(cu. in)
1	(l)	0.2642	(U.S. gal)
1.772	(g)	1	(oz)
0.4536	(kg)	1	(lb)
0.00070308	(kg/mm^2)	1	(lb/sq. in)
1	(bar)	14.51	(psi)
1	(kg.m)	7.246	(lb.ft)
1(daN) = 10 (N) = 1.02 (kg.f)		2.24	(lb.f)

Simbologia

Symbology

DESCRIZIONE	*SIMBOLI / SYMBOLS*	*DESCRIPTION*
ATTENZIONE avvertenze generali		*WARNING* *general warning*
REGOLAZIONI coppie di serraggio / misurazioni		*ADJUSTMENTS* *tightening torques / measurements*
ATTREZZATURE SPECIALI		*SPECIAL TOOLS*
CONTROLLI E SOSTITUZIONI anelli / guarnizioni		*CHECK AND REPLACE* *seals / gaskets*
SIGILLANTI COLLANTI		*SEALING OR* *LOCKING FLUIDS*
MARCHIARE O SEGNARE		*MARK OR INDICATE*
RIEMPIMENTO - RABBOCCO OLIO		*OIL FILLING OR OIL LEVEL*
SCARICO OLIO		*OIL DRAIN*

A.3 Indicazioni generali

L'assale deve essere controllato e/o riparato solo da personale tecnico specializzato che sia a conoscenza delle sue particolari caratteristiche e delle relative norme di sicurezza (prevenzione infortuni).

Prima di svolgere qualsiasi operazione, pulire accuratamente l'assale rimuovendo eventuali incrostazioni ed accumuli di terriccio e/o grasso.

Tutti gli organi meccanici smontati devono essere accuratamente puliti con prodotti adeguati, per evitare possibili danni. Verificarne l'integrità, sostituendoli in caso di danni, usura, incrinature, grippaggi o difetti che potrebbero compromettere il buon funzionamento dell'assale.
In particolar modo si deve verificare l'integrità delle parti in movimento (cuscinetti, ingranaggi, alberi) e delle parti di tenuta (anelli OR, anelli di tenuta), soggette a maggiori sollecitazioni, usura, invecchiamento. Si consiglia di sostituire ad ogni revisione o riparazione gli organi di tenuta.
Si ricordi che la sostituzione di un componente della coppia conica comporta la sostituzione anche dell'altro.

Utilizzare solo le parti di ricambio e la viteria indicate, inoltre usare utensili metrici per la viteria metrica e inglesi per la viteria inglese.

Come indicato nelle istruzioni di disassemblaggio, alcune operazioni sono distruttive per alcuni componenti dell'assale. Leggere attentamente le descrizioni delle varie fasi dell'intervento ed operare con attenzione per non compromettere la funzionalità di altri elementi.

A.3 General description

The axle should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out axle cleaning accurately by removing oil/ grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized, etc. as they could affect proper functioning of the axle.
Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-Rings, seals ring) should be examined carefully, as they are subject to major stress, wearing and ageing.
We highly advice to replace tightening parts during every teardown or repair.
Replacing one part of the bevel gear set requires the replacement of the other part too.

Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and imperial tools for the others.

Please read the disassembly instructions very carefully because some operations are destructive for some axle components and in order to avoid the elements damage operate advertently.

A.4 Raccomandazioni generali per le operazioni di smontaggio e montaggio

Prima di iniziare le operazioni di smontaggio e montaggio leggere attentamente le seguenti avvertenze.

Anelli di tenuta per alberi

Per il montaggio degli anelli di tenuta attenersi alle seguenti raccomandazioni:

- Pulire accuratamente l'albero ed assicurarsi che non sia danneggiato, rigato od ovalizzato nelle zone di contatto con gli anelli.
- Montare gli anelli in modo che il labbro sia rivolto verso il lato olio.
- Lubrificare il labbro degli anelli (usare preferibilmente olio) e riempire per 3/4 di grasso la camera degli anelli stessi.
- Montare gli anelli usando un appropriato calettatore. Non usare il martello direttamente sugli anelli.
- Non danneggiare gli anelli durante il montaggio dell'albero.

Anelli OR

Lubrificarli adeguatamente prima di inserirli nella propria sede evitando "arrotolamenti" durante il montaggio dell'albero.

Spessori di registro

Per le registrazioni utilizzare gli appropriati spessori di registro, misurandoli singolarmente. La misurazione del pacco completo o la stampigliatura riportata sugli spessori stessi può risultare non sempre affidabile: verificare.

Cuscinetti

Per un corretto montaggio è consigliabile riscaldarli in forno ad una temperatura di 80°C - 90°C prima di montarli sui rispettivi alberi o raffreddarli prima di inserirli nelle relative sedi con piantaggio esterno. Usare sempre gli estrattori idonei per rimuovere i cuscinetti. Prima di rimontarli, pulirli, ispezionarli e lubrificarli.

Spine elastiche

Al montaggio delle spine elastiche ad intaglio assicurarsi che l'intaglio delle stesse sia orientato nel senso dello sforzo sollecitante la spina.
Le spine elastiche a spirale invece non necessitano di alcun orientamento di montaggio.

Sigillante

Usare sigillanti secondo le specifiche. Assicurarsi che le parti da sigillare siano pulite, asciutte e completamente prive di grasso.

A.4 General recommendations for disassembly and assembly operations

Before starting any disassembly and assembly operations, read carefully the following recommendations.

Shafts seals

Respect the following recommendations during shaft seal assembly:

- *Clean shaft very carefully and ensure that the part in contact with the shaft seal is not damaged, cut or out of roundness.*
- *Assemble the seals so that the lip is fitted towards the oil side.*
- *Lubricate seal lips (use oil) and fill 3/4 of seal cavity with grease.*
- *Use appropriate drivers. Do not use a hammer directly on the seals.*
- *Do not damage the seals while assembling the shaft.*

O-rings

Lubricate adequately before inserting them at the right place and avoid rolling while inserting the shaft.

Adjusting shims

Use appropriate adjusting shims and measure each one separately.
Complete group measurement or stampings on the shims are not always reliable: check

Bearings

Its advisable to heat up bearings to 80°C - 90°C before assembling them onto their respective shafts or to cool them (dry ice) before inserting them into corresponding bore. Always use suitable extractors to remove the bearings. Before reassembling the bearings, clean, check and lubricate them.

Split pins

Before assembling elastic pins, make sure that the notch is oriented towards the stressing force.
Spiral elastic pins do not need orientation.

Sealing

Use sealing as advised by specifications. Ensure that parts to be sealed are clean, dry and completely grease free.

Scarico dell'olio

Prima di intervenire sul prodotto è necessario scaricare l'olio dal gruppo.

ATTENZIONE

Smaltire gli oli esausti nel rispetto delle vigenti norme.

Pulizia

Lavare accuratamente tutte le parti in movimento relativo (ingranaggi, cuscinetti, ecc.) utilizzando gasolio o cherosene.
E' da evitare l'uso di benzina e soluzioni acquose alcaline. Evitare lavaggi con vapore o acqua calda perché sarebbe difficile eliminare completamente l'umidità superficiale.
Asciugare accuratamente tutti i particolari mediante un getto d'aria o stracci per evitare di rigare le superfici con residui abrasivi.
Tutte le superfici devono essere ricoperte da un leggero strato di lubrificante per proteggerle da eventuali ossidazioni.

Oil drain

Before disassembly, oil should be drained out.

WARNING

Disposal of used oil must be done according to laws

Cleaning

Wash all moving parts (gears, bearings, etc.) accurately with diesel fuel or kerosene.
Avoid gasoline and watery alkaline solutions. Do not wash with steam or hot water, as it will be very difficult to eliminate surface humidity.
Dry all parts with a rag or air jet to avoid scratching from abrasive residuals.
All surfaces should be covered with lubricant so as to protect it from future oxidation.

Controlli

Verificare accuratamente tutti i cuscinetti, gli anelli esterni eventualmente ancora piantati nelle proprie sedi e i perni su cui rotolano i rullini. Sostituire quei particolari che presentano tracce di usura o di danneggiamento.
Controllare che tutti gli ingranaggi non presentino avarie od usure eccessive delle dentature: gli smussi dei denti non devono essere deteriorati.
Controllare che tutti i tratti scanalati siano privi di usure eccessive o di altri danneggiamenti.
Sostituire i particolari avariati con ricambi originali.
Dopo ogni smontaggio è buona norma sostituire le guarnizioni di tenuta sugli alberi rotanti.

Checks

Examine accurately all bearings, external rings which may be still stuck in their position and pivot pins on which rolls rotate. Replace those which are worn out or damaged.
Gears should not be spoiled and teething should not be excessively worn out. Teeth smoothing should not be deteriorated.
Check all grooves: assure that they are not worn out or damaged.
Replace spoiled parts with original spare parts.
Replace seals on rotating shafts, before reassembly.

Estremità di flange ed attrezzi

Prestare la massima attenzione quando si martellano le estremità di attrezzi o di flange per evitare di compromettere la funzionalità e l'integrità sia degli attrezzi che dei componenti su cui si opera.

Ends of flanges and tools

Be careful when hammering tool or flange ends, in order to avoid jeopardizing functionality and integrity of either the tools or the components on which you are operating.

Metodi di riassemblaggio

Per riassemblare il gruppo si deve impiegare un'adeguata attrezzatura di sostegno.

Per posizionare il gruppo, per smontare e rimontare la corona dentata e per sostenere la scatola ingranaggi è necessario un sistema di sollevamento.

Per facilitare le operazioni di smontaggio e montaggio utilizzare un disegno di assieme del gruppo.

Reassembly ways

In order to reassemble the group, an appropriate fixture must be used.

In order to position the group, to disassemble and reassemble the ring gear and to support the gear housing, a lifting system is needed.

To make disassembling and assembling operations easier, use a group assembly drawing.

Impiego di lubrificante

Per ottenere una corretta lubrificazione ed una esatta temperatura di funzionamento negli assali CARRARO, è importante usare i lubrificanti raccomandati (Sez.C.7), mantenendone il livello costante secondo quanto indicato nel presente manuale.

Lubricant use

In order to lubricate the CARRARO axles correctly and to reach the exact operation temperature, it is important to use the recommended lubricants (Section C.7), keeping their level constant as indicated in this manual.

B INFORMAZIONI SULLA SICUREZZA

B *SAFETY INSTRUCTIONS*

B.1 Raccomandazioni generali per la sicurezza

IMPORTANTE:
Prima di iniziare qualsiasi tipo di operazione leggere attentamente questo capitolo.

Precauzioni per la sicurezza:

Il corretto uso e la corretta riparazione degli assali e dei loro componenti sono molto importanti per la sicurezza e l'affidabilità.
Le procedure raccomandate e descritte in questo manuale sono testate, quindi sono effettivi metodi operativi. Seguire strettamente ogni procedura facendo uso sia del testo che delle illustrazioni.
Alcune di queste procedure mostrano l'uso di appositi strumenti progettati perché le operazioni vengano condotte in modo chiaro e corretto.
Alcuni strumenti specifici devono essere usati dove necessario per eseguire determinate operazioni.
E' impossibile trattare ogni metodo di lavoro o tutte le possibili metodologie per svolgerlo e le rischiose conseguenze di ognuna, perciò chi usa procedure o strumenti non consigliati deve sapere che la sicurezza dell'operatore e del veicolo saranno messi a repentaglio.

Pericolo
Gli occhiali di sicurezza devono essere indossati sempre durante l'esecuzione di tutte le operazioni di montaggio o smontaggio.

B.1 General safety recommendations

IMPORTANT:
Before proceeding with any operations please read this chapter very carefully.

Safety precautions:

Correct use and repair of axles and of their components is very important for safety and reliability.
Recommendations and all described procedures given in this manual have been experimented and hence are effective operational methods. Please follow every procedure. Use the text as well as the illustrations.
Certain procedures show use of special tools, designed so that the operations can be carried out in a clear and correct manner.
Special tools must be used when a particular operation is being carried out.
It is impossible to advice every working method or know all possible methodologies for carrying it out or to predict risky consequences of each operation. Hence, performing procedures or using instruments which have not been advised could be dangerous for the operator/ mechanic as well as the vehicle.

Danger
Safety goggles must be worn while carrying out every assembling or disassembling operations.

B.2 Simboli di sicurezza

Identificazione delle informazioni sulla sicurezza

Questo è il simbolo di allarme per la sicurezza; quando lo trovate sulla macchina o sul manuale, siete avvisati del pericolo potenziale di incidenti o danni alla persona. Seguite i suggerimenti e le raccomandazioni per operare in sicurezza.

Significato delle scritte di avvertimento

PERICOLO

AVVISO

ATTENZIONE

Una scritta di avvertimento (PERICOLO, AVVISO o ATTENZIONE), viene usata insieme al simbolo di allarme per la sicurezza.
I segnali PERICOLO o AVVISO sono utilizzati vicino ad aree pericolose. PERICOLO identifica la situazione più pericolosa.
Precauzioni generali sono invece segnalate da ATTENZIONE.

Seguire le istruzioni di sicurezza !

Leggere con cura tutti i messaggi sulla sicurezza di questo manuale.

Modifiche non autorizzate possono compromettere il funzionamento, la sicurezza d'impiego e la durata.
Se non comprendete le istruzioni del manuale, contattate il rappresentante a voi più vicino.

B.2 Safety symbols

Recognize safety information

This is the safety alarm symbol; whenever you find it in the manual or see it on the machine, you are being warned about potential danger of accidents or harm to personnel. Follow the do's and don't's to operate in total safety.

Understanding written warnings

DANGER

WARNING

CAUTION

Written warning (DANGER, WARNING or CAUTION) is used along with an alarm symbol.
DANGER or WARNING signs are used near danger zones, while CAUTION sign indicates general precaution.

Follow safety instructions !

Read all suggestions given in this instruction manual very carefully.

Unauthorized changes could endanger the functioning, work safety and work span.
If you do not understand this instruction manual, contact the nearest sales representative.

B.3 Precauzioni generali

In ogni movimento dovranno essere osservate le norme sulla prevenzione infortuni, tutte le regole generali di sicurezza e di medicina del lavoro.
Prima di procedere nelle operazioni di manutenzione o sistemazione di eventuali problemi, assicurarsi del buon stato e del buon funzionamento delle attrezzature quali banchi di sostegno, cavalletti, martelli, leve, estrattori e chiavi apposite facilitando le operazioni da svolgere in modo ottimale riducendo i rischi sia per gli organi ed i componenti del prodotto che della incolumità dell'operatore.
Tutte le modifiche arbitrarie apportate al prodotto sollevano la CARRARO SpA da ogni responsabilità per qualsiasi danno o incidente.
Il prodotto, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto a "uso non previsto". CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.

B.3 General precautions

Observe safety instructions, accident prevention rules and all general safety regulations in each and every step at work.
Before going ahead with maintenance or repair work ensure that all the tools, the supporting bench, stands, levers, extractors and spanners are in good condition so that the work can be carried out easily.
Risks to various parts and components will also be reduced in this way and working condition for the operator will also be safer.
CARRARO SpA declines any responsibility in case of an accident or damage resulting due to changes made arbitrarily on product.
The product is used for any other purpose different from the one foreseen, than CARRARO SpA declines any responsibility.
In this case all consequences will be at the customer's expense.

Norme per la manutenzione in sicurezza

1 Operare in ambiente pulito e asciutto.
2 Non lubrificare, manipolare o registrare il gruppo in moto.
3 Tenere lontani mani, piedi, indumenti da parti in movimento.
4 Essere sempre pronti per i principi di incendio.
Tenere a portata di mano estintore e cassetta di pronto soccorso.
5 Tenere in evidenza il n° di telefono di un medico, ambulanza, ospedale e vigili del fuoco presso il proprio telefono.

Safety maintenance rules

1 Operate in a clean and dry environment.
2 Do not lubricate, handle or adjust the group underway.
3 Keep off your hands, feet and clothing from moving parts.
4 Be always prepared for fires.
Keep the extinguisher and the first aid kit within reach.
5 Keep the phone numbers of a doctor, of an ambulance, of a hospital and of the fire department within reach near the telephone set.

6 Usare indumenti e protezioni adatte allo scopo come: tuta, guanti protettivi e cuffie.
7 Usare protezioni auricolari appropriate a salvaguardare l'udito, come tappi o cuffie per le orecchie contro rumori molesti o fastidiosi.

6 Wear suitable clothing and protections as overalls, safety gloves and ear safety devices.
7 Use suitable ear protections, like ear plugs, to keep out noise and prevent injury to the ears.

Una prolungata esposizione al rumore può danneggiare l'udito.

8 Le attrezzature richiedono la piena attenzione dell'operatore. Non usare cuffie per ascoltare musica mentre si interviene sul prodotto o gruppo.

Eliminazione dei rischi residui

- Rischio di schiacciamento e cesoiamento dovuto alla presenza di elementi in movimento.
  Attenzione
  Eseguire tutte le operazioni di manutenzione a macchina ferma.
- Rischio dovuto all'inalazione di gas nocivi che si possono sviluppare scaldando le vernici durante eventuali saldature.
  Attenzione
  Utilizzare postazioni di lavoro dotate di sistemi di evacuazione di polveri e fumi.
  Lasciate disperdere i fumi per almeno 15 minuti prima di saldare o riscaldare, o riprendere a lavorare sul gruppo.
- Rischio di incendio dovuto ai solventi utilizzati e all'olio presente nell'assale.
  Attenzione
  Tenere lontano dalla zona di lavoro ogni fonte di calore.
  Quando si usano solventi o svernicianti, rimuoverli con acqua e sapone prima di saldare.
  Rimuovere i contenitori di solvente, sverniciante o altri prodotti infiammabili dall'area di lavoro.
- Rischio dovuto alla caduta, allo sganciamento o alla violenta espulsione di oggetti o olio dall'assale.
  Attenzione
  Questi rischi residui e le procedure per eliminarli completamente, sono evidenziati dettagliatamente nelle procedure di montaggio e smontaggio. Seguire attentamente, durante la manutenzione, tutte le procedure di sicurezza indicate nel manuale.

A prolonged exposure to noise can damage your hearing.

8 The operator must be very careful with the equipment. Do not use headphones to listen music while you are working on the product or on the group.

Residual risk elimination

- *Risk of squashing and shearing due to the presence of moving parts.*
  Warning
  Carry out all maintenance operations when the machine is stationary.
- *Risk due to inhalation of poison gases that can be produced by heating the varnishes during any welding.*
  Warning
  Use work stations equipped with dust and fume discharging systems.
  Let the fumes disperse for at least 15 minutes, before welding or reheating, or working on the group again.
- *Risk of fire due to the solvents used and to the oil in the axle.*
  Warning
  Keep off any heat sources from the working area.
  When solvents or paint removers are used, they should be removed with soap and water, before welding.
  Remove any containers of solvent, paint remover or any other inflammable products from the working area.
- *Risk due to fall, drop or violent ejection of objects or oil from the axle.*
  Warning
  These residual risks and the suitable relative procedures to eliminate them completely are pointed out, in detail, in the assembly and disassembly procedures. During maintenance, follow carefully all the safety procedures indicated in the manual.

CARATTERISTICHE GENERALI

GENERAL SPECIFICATIONS

C.1 Usi previsti

Questo assale è stato progettato e costruito per essere installato in macchine di tipo industriale. L'assale è un componente che ha la funzione di trasmettere la potenza dal motore alle ruote.
L'assale in oggetto, costruito secondo specifiche fornite dal cliente, permette:

- l'aumento della forza di trazione riducendo il numero di giri;
- la compensazione della velocità delle ruote interne con quelle esterne durante la sterzata.

Non installare mai questo assale su macchine diverse da quelle per cui e stato progettato e costruito.

L'assale, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto ad "uso non previsto".
CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.
Costituisce inoltre un elemento essenziale, nell'ambito dell'uso previsto, l'osservanza scrupolosa delle modalità di funzionamento e delle regolari manutenzioni e riparazioni specificate da CARRARO SpA.

C.1 Foreseen uses

This axle has been designed and manufactured to be mounted on industrial machines.
The axle is a component that transmits the power from the engine to the wheels.
The axle, manufactured according to the customer's technical specifications, allows:

- *increasing of tractive force, reducing the number of revolutions*
- *adjusting of inner wheels' speed with outer wheels' speed during steering.*

Never mount this axle on machines different from the ones for which it has been designed and manufactured

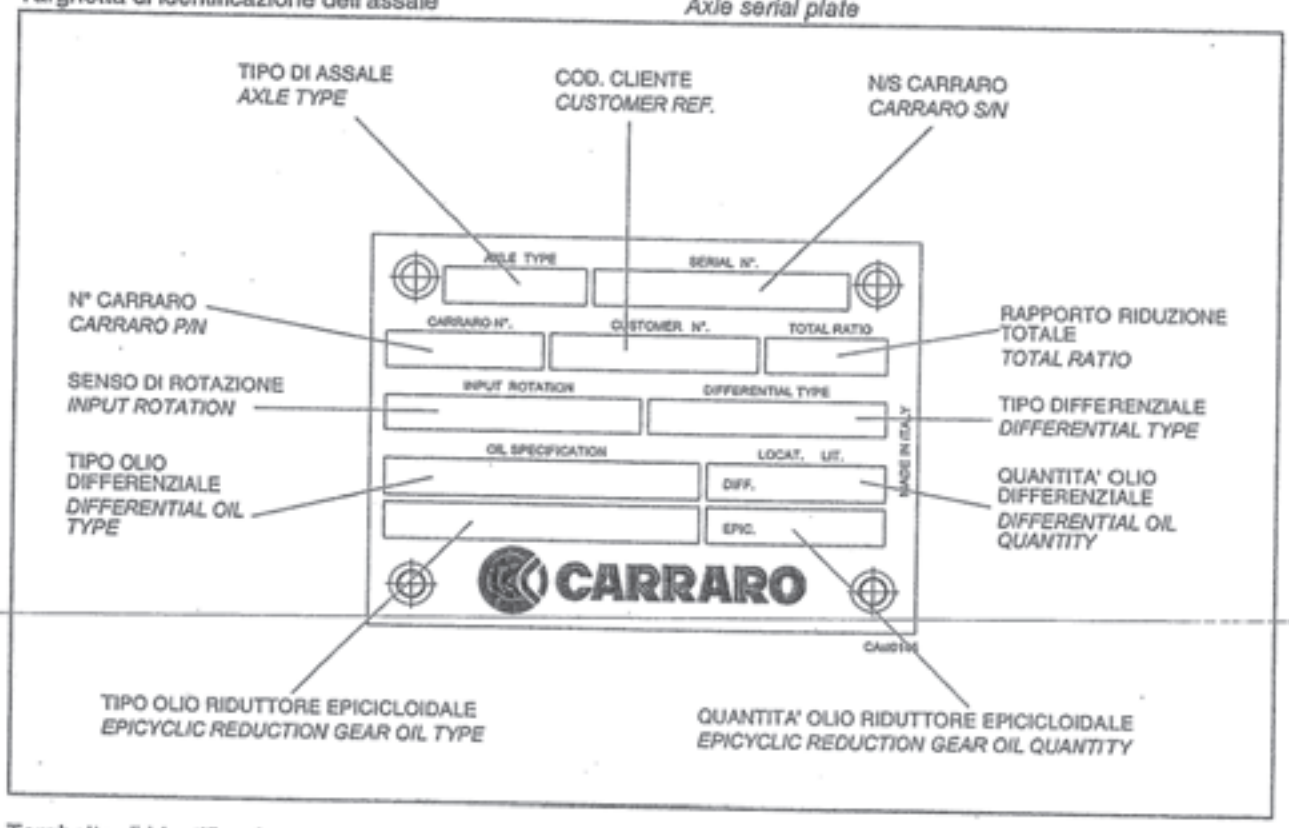
If the axle is used for any other purpose than the one foreseen, CARRARO SpA declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the client.
However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by CARRARO SpA are to be observed strictly.

C.2 Identificazione del prodotto

C.2 Product identification

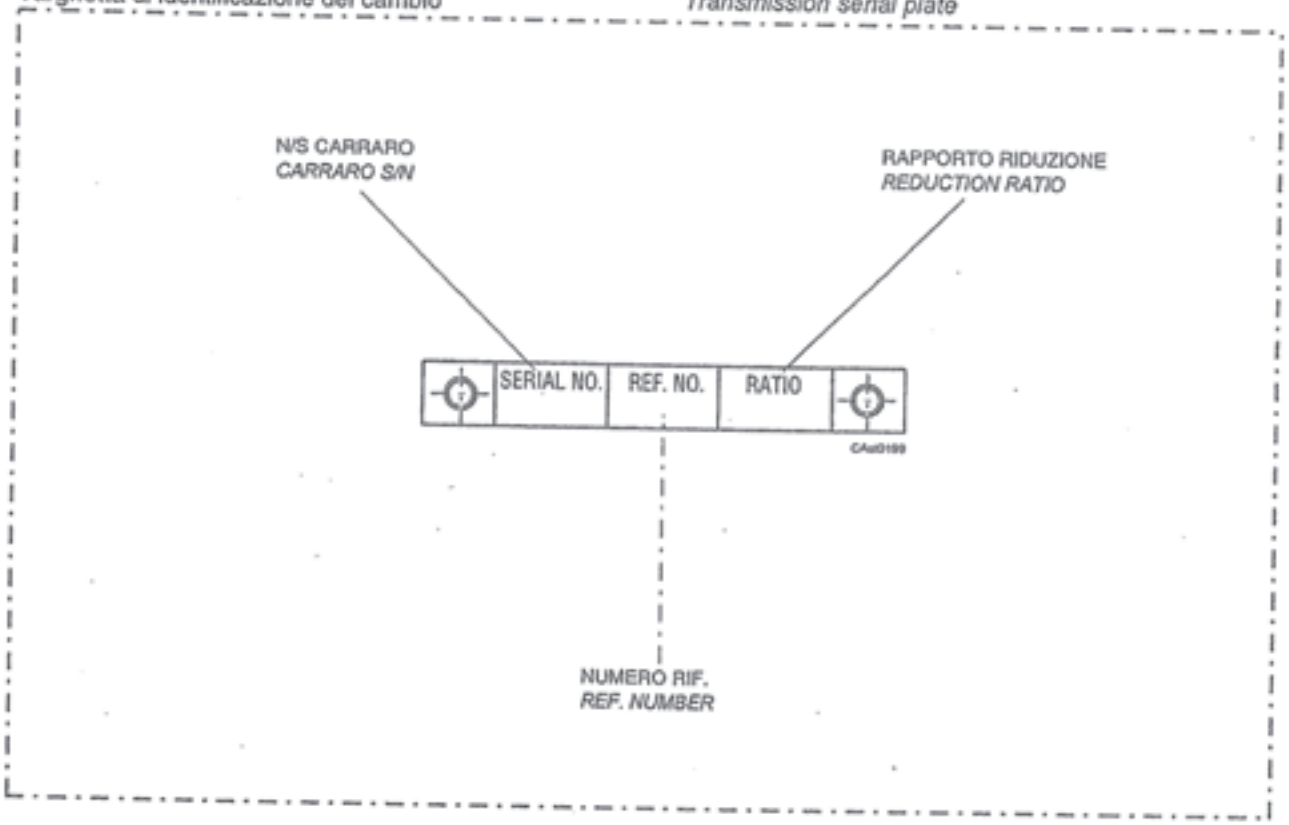
Targhetta di identificazione dell'assale

Axle serial plate



Targhetta di identificazione del cambio

Transmission serial plate

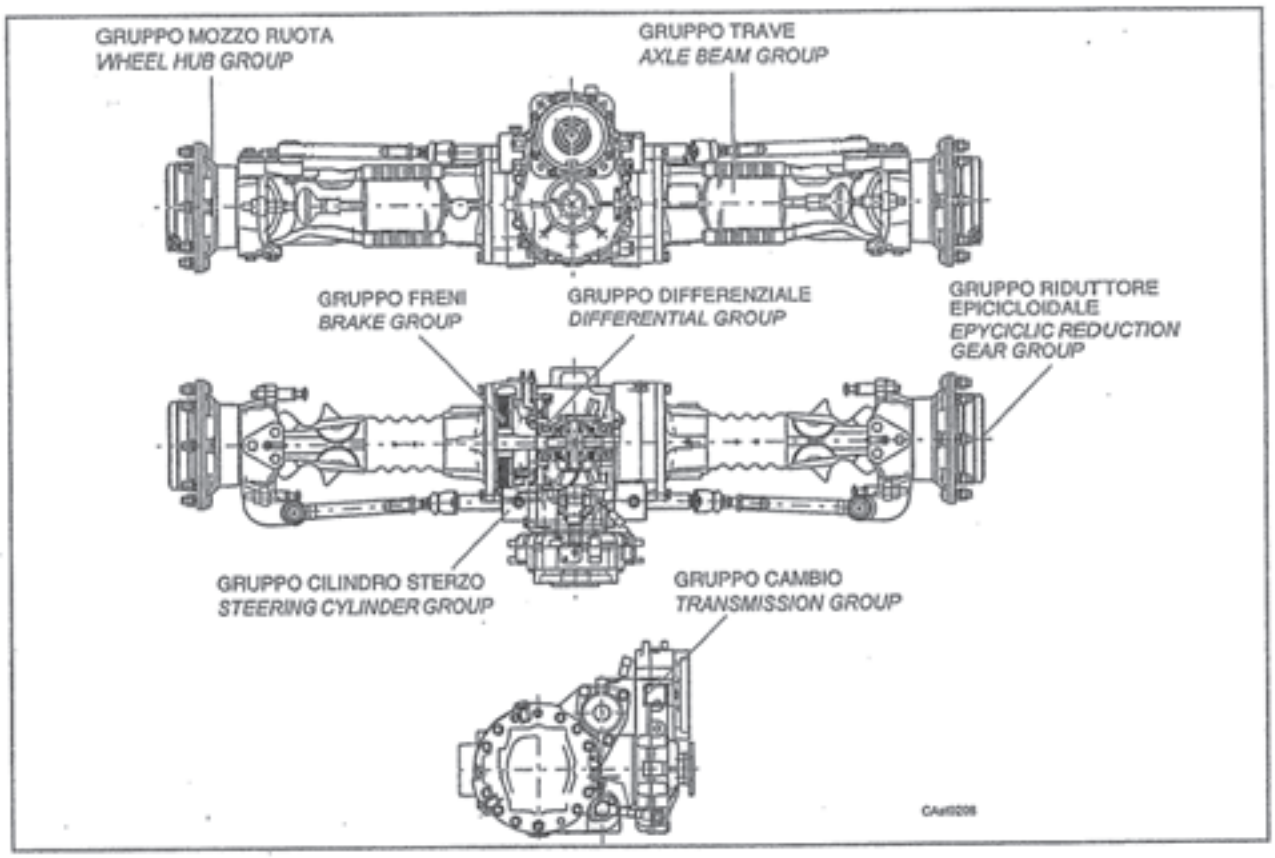


C.3 Descrizione generale

L'assale in oggetto, progettato e costruito secondo le richieste del cliente, è costituito da un corpo trave contenente il gruppo differenziale nella parte centrale e dai gruppi mozzo ruota alle estremità.
Il gruppo differenziale, autobloccante di tipo "limited slip", è supportato da due cuscinetti montati in un'apposita struttura ove è possibile effettuare le operazioni di registrazione della coppia conica.
La posizione della corona conica si registra agendo su due ghiere contrapposte, mentre quella del pignone conico, supportato da due cuscinetti, si effettua mediante interposizione di spessori di registro.
I mozzi ruota contenenti i riduttori epicicloidali, sono supportati da due cuscinetti a rulli conici e vengono comandati da un gruppo sterzante ad azionamento idraulico.
L'assale dispone inoltre di un proprio sistema frenante, dotato di comando meccanico per la frenata di servizio.
La struttura viene completata da una scatola di trasmissione/riduzione, che permette il pieno controllo dei parametri del moto all'ingresso della coppia conica.

C.3 General description

The axle described in this manual, designed and manufactured following the customer's requests, consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end.
The differential, type "limited slip", is supported by two bearings mounted on a suitable structure allowing the bevel gear set to be adjusted.
The ring bevel gear is adjusted by means of two ring nuts located opposite each other.
The position of the bevel pinion, supported by two bearings, is adjusted by inserting adjusting shims.
The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings.
Additionally, the axle has its own internal braking system.
The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings and are powered by a hydraulically-operated steering unit.
Furthermore the axle has a braking system, fitted with a mechanical drive for service braking.
The frame is completed with a transmission/reduction box, which allows to control fully the motion parameters at the bevel gear entry.



C.4 Caratteristiche Tecniche — C.4 Technical Features

CODICE ASSALE	CA139970	AXLE CODE
MODELLO ASSALE	26.20M+TB172	AXLE MODEL

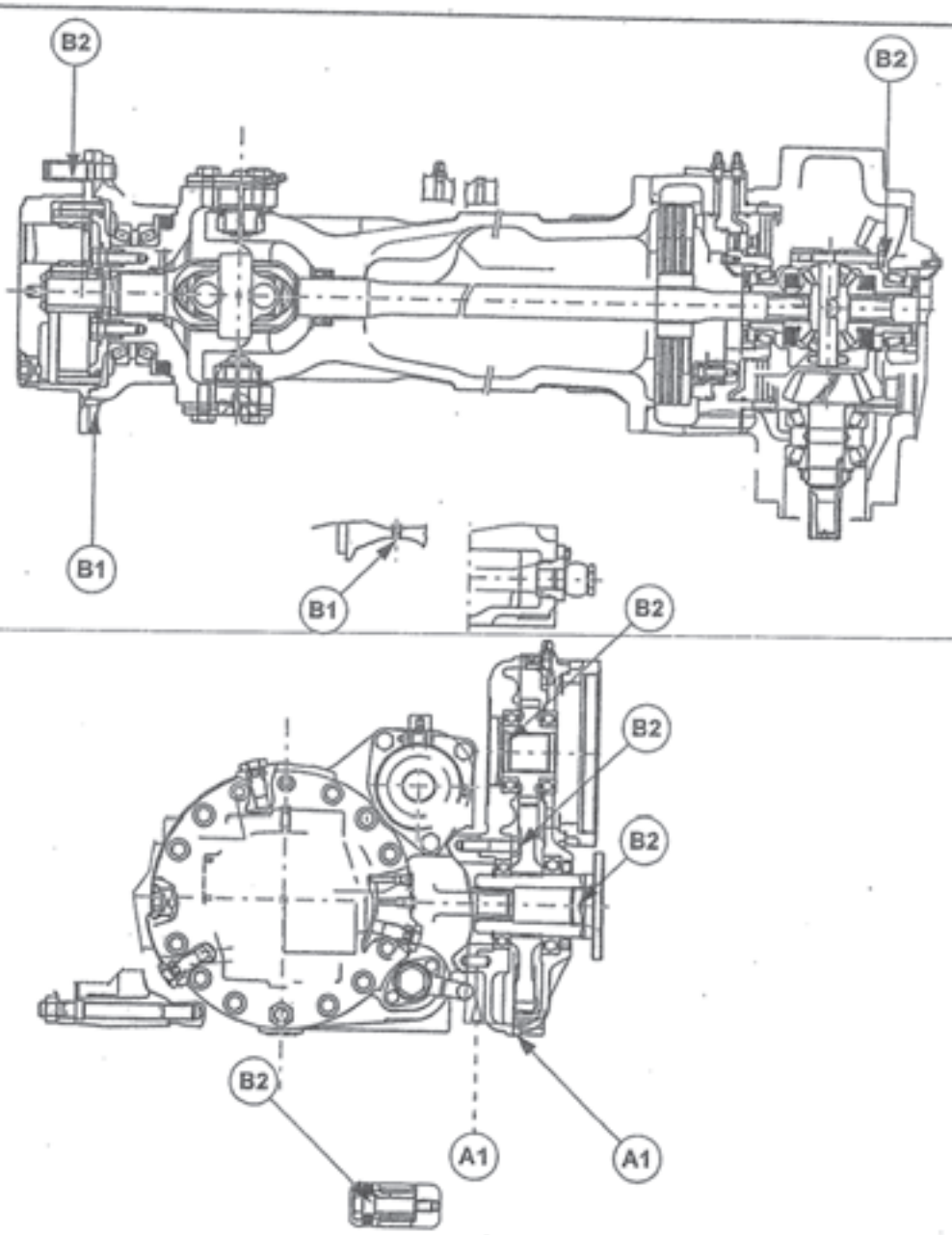
TIPO DIFFERENZIALE		DIFFERENTIAL TYPE
Standard	○	Standard
Limited Slip	●	Limited Slip
Limited Slip "Ball Type"	○	Limited Slip "Ball Type"
Bloccaggio meccanico 100% ad attuazione idraulica positiva o negativa	○	100% Mechanical lock, hydraulically controlled (positive or negative)
Con frizione multidisco in bagno d'olio ad attuazione idraulica	○	With multidisc clutch in oil bath hydraulically controlled
Bloccaggio meccanico 100% ad attuazione elettromagnetica	○	100% Mechanical, electromagnetically controlled
"No spin"	○	"No spin"

DESCRIZIONE	VALORI VALUES	DESCRIPTION
Riduzione coppia conica	2.384 / 1	Bevel gear ratio
Riduzione epicicloidale	6.00 / 1	Epicyclic ratio
Riduzione scatola di trasmissione T.B.	2.03 / 1	Transfer box ratio
Riduzione totale	29.05 / 1	Total reduction
Peso a secco	454 Kg	Dry weight
Rotazione in entrata		Input rotation
SENSO ORARIO	●	CLOCK WISE (C.W.)
SENSO ANTIORARIO	○	COUNTER CLOCK WISE (C.C.W.)
Rotazione in uscita		Output rotation
SENSO ORARIO	○	CLOCK WISE (C.W.)
SENSO ANTIORARIO	●	COUNTER CLOCK WISE (C.C.W.)
Angolo di sterzata	Max 33°	Steering angle
Convergenza	A $\frac{1}{8}$	Toe-in

DESCRIZIONE	VALORI *VALUES*	*DESCRIPTION*
Specifica olio IN PRESENZA DI DIFFERENZIALE LIMITED SLIP, USARE I TIPI DI OLIO INDICATI OPPORTUNAMENTE ADDITIVATI Nota: NON USARE OLIO DI SINTESI SENZA IL CONSENSO DEL COSTRUTTORE	SAE 80W - 90 EP to comply API GL4 - GL5 respectively MIL-L-2105 and MIL-L-2105D	*Oil Specification* *IN PRESENCE OF DIFFERENTIAL LIMITED SLIP, USE RECOMMENDED OIL ENRICHED IN ADDITIVES* *Note:* *DO NOT USE SYNTHETIC OIL WITHOUT CONSENT OF THE MANIFACTURER*
Capacità olio differenziale	10 litri/Liter	*Differential oil capacity*
Capacità olio riduttore epicicloidale	0.6 + 0.6 litri/Liter	*Epiciclic reduction gear oil capacity*
Grasso	POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2	*Grease*
Gioco di accoppiamento coppia conica	0.18÷0.25 mm	*Bevel gear set backlash*
Precarico cuscinetti pignone conico "P" (misurato sul D=34,8 mm senza anello di tenuta)	P= 9.2÷13.8 daN	*Pinion bearings preload "P" (measured D=34,8 mm without seal)*
Precarico totale cuscinetti corona-pignone "T" (misurato sul D=34,8 mm senza anello di tenuta)	T= (P+3.85)÷(P+5.80) daN	*Pinion-crown gear bearings total preload "T" (measured D=34,8 mm without seal)*
Pressione esercizio bloccaggio differenziale	---	*Differential lock working pressure*
Tipo freno	A dischi in bagno d'olio *Wet discs brake*	*Type of brake*
N° dischi freno (per lato)	3	*Number of brake discs (each side)*
N° controdischi freno (per lato)	4	*Number of brake counterdiscs (each side)*
Spessore nominale disco freno	4.83 mm	*Nominal brake disc thickness*
Spessore nominale controdisco freno	5/10.8 mm	*Nominal brake counterdisc thickness*
Usura max disco freno (per lato)	0.15 mm	*Maximum brake disc wearing (each side)*
Usura max controdisco freno	---	*Maximum brake counterdisc wearing*
Corsa nominale pistone freno	---	*Nominal brake piston stroke*
Specifica olio per attuazione freno	Mineral oil	*Oil specification for brake activation*
Volume olio per azionamento freni	24 cc	*Oil displacement for brakes actuation*
Pressione max di esercizio	44 bar	*Maximum operating pressure*
Tipo flangia pignone	SAE 1410	*Pinion flange type*

Sigillanti e collanti

Sealing compounds and adhesives

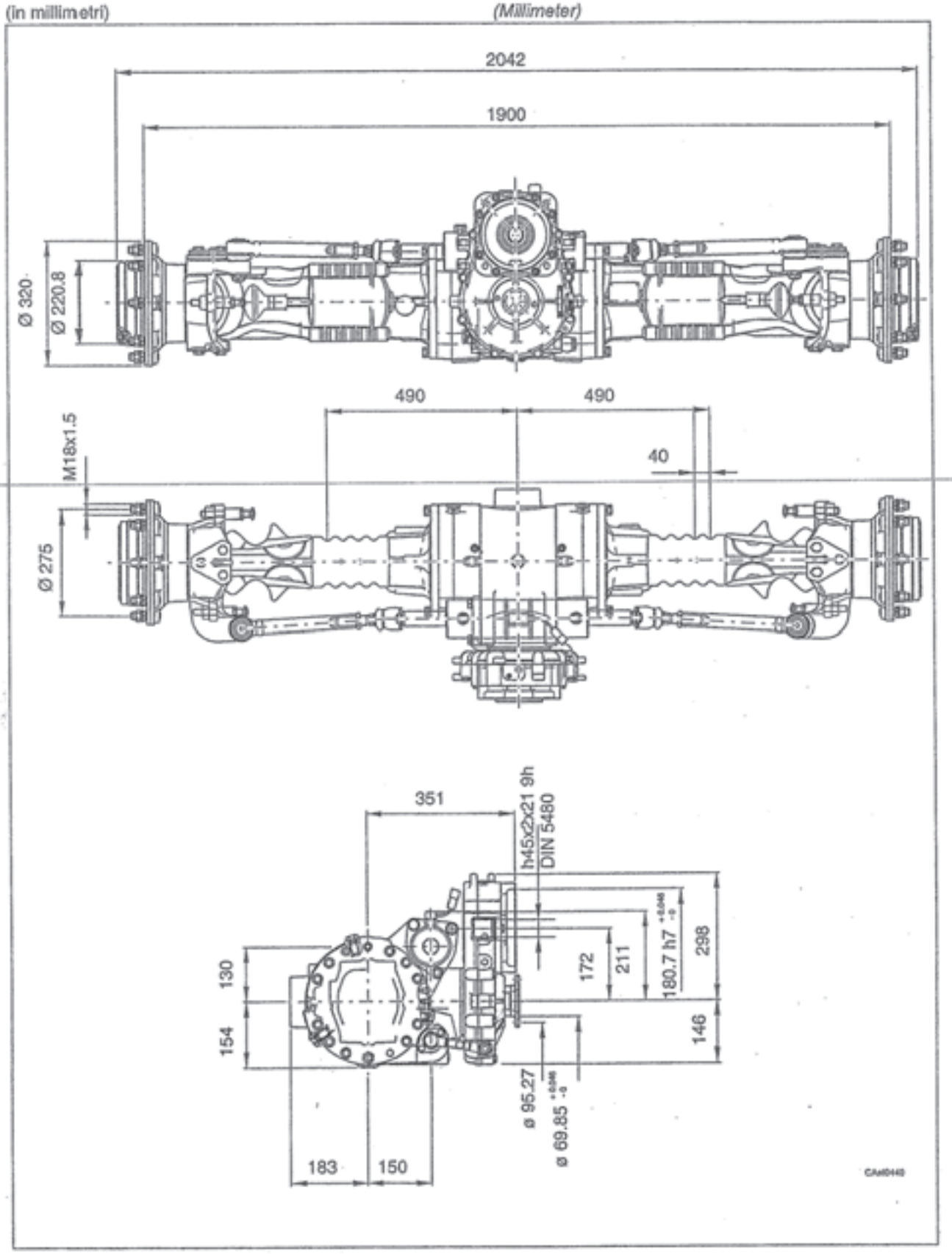


CA400662

A1= LOCTITE® 510	●	B2= LOCTITE® 270	●
A2= LOCTITE® 573	○	C1= LOCTITE® 405	○
A3= LOCTITE® 518	○	C2= LOCTITE® 496	○
B1= LOCTITE® 542	●	C3= LOCTITE® 638	○
◁ - - - - - -	Applicare sulle superifici a contatto *Apply on the contact surfaces*		
←	Applicare sulla filettatura delle viti / sui perni *Apply on bolt screws / on pins*		

Dimensioni d'ingombro
(in millimetri)

Overall dimensions
(Millimeter)



C.5 Rifornimento e verifiche

C.5 Filling and checks

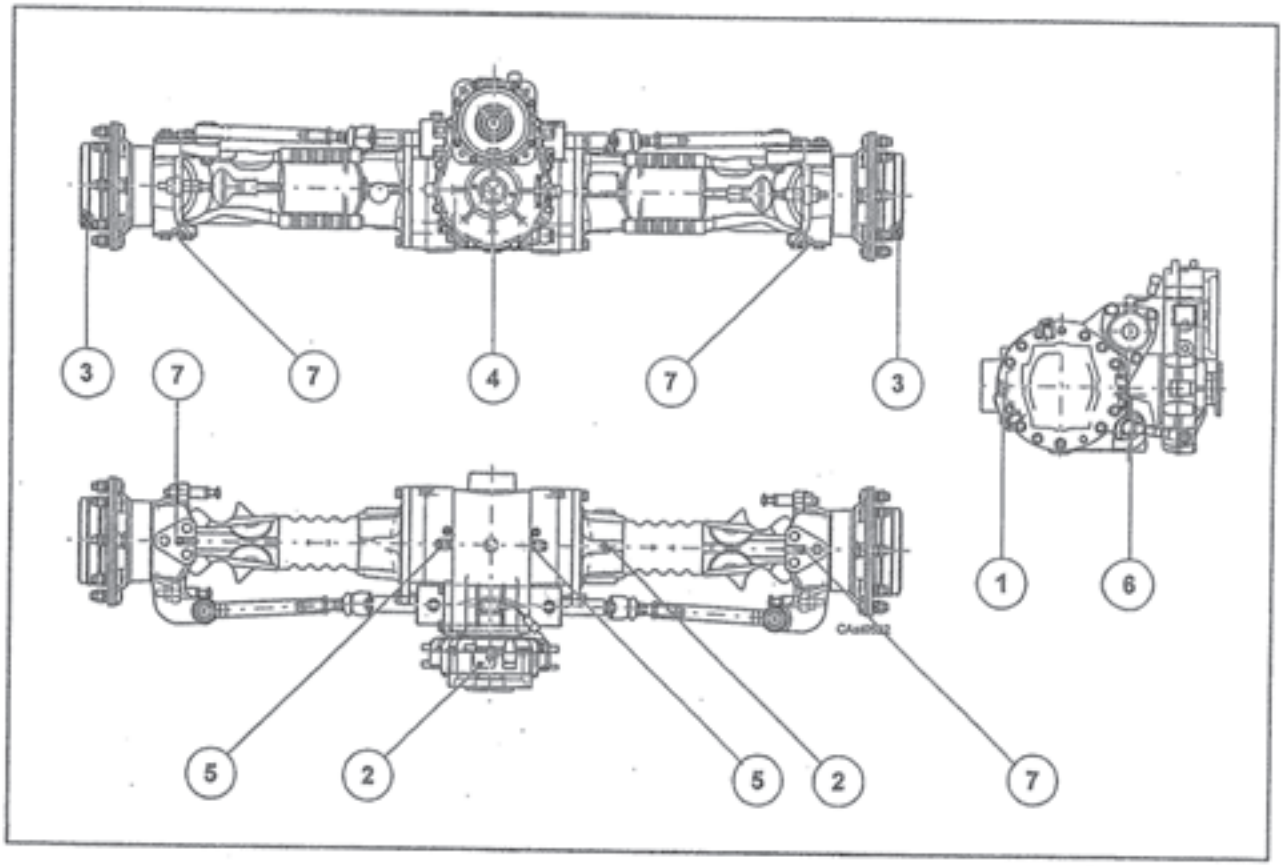
PUNTI DI LUBRIFICAZIONE	POSIZIONE / POSITION	LUBRIFICATION POINTS
TAPPO CARICO E LIVELLO OLIO DIFFERENZIALE	1	DIFFERENTIAL OIL FILLING AND LEVEL PLUG
SFIATO OLIO	2	OIL BREATHER
TAPPO CARICO, SCARICO E LIVELLO OLIO RIDUTTORE EPICICLOIDALE	3	FILL / DRAIN AND LEVEL PLUG OF EPICYCLIC REDUCTION GEAR OIL
TAPPO SCARICO OLIO DIFFERENZIALE	4	DIFFERENTIAL OIL DRAIN PLUG
TAPPO SPURGO FRENI	5	BRAKE BLEED PLUG
CONNESSIONE OLIO FRENI	6	SERVICE BRAKE OIL PORT
PUNTI DI INGRASSAGGIO	7	GREASING POINTS

Controlli periodici:

Il livello del lubrificante nell'assale deve essere a filo del tappo di controllo (1) e (3), altrimenti provvedere al rabbocco con olio dello stesso tipo.
Nel caso in cui si riscontri una perdita o altro che determini l'abbassamento del livello, è opportuno intervenire immediatamente onde evitare possibili danni agli organi meccanici.
Per scaricare l'olio dell'assale svitare il tappo (4 e 3).

Routine checks:

In the axle, lubricant should be flush with control plug (1) and (3). If not, make up level with the same oil.
If leakage or any other factor determining fall in the oil level is found, then it is advisable to check immediately, in order to avoid damages to the mechanical parts.
Loosen and remove the drain plug for oil draining (4 and 3).



C.6 Programma di lubrificazione — *C.6 Service schedule*

OPERAZIONE	▲ PRIMO INTERVENTO *FIRST TIME*	◆ AD OGNI STAGIONE OD OGNI 1500 ORE[1] *SEASONALLY OR EVERY 1500 OPERATING HOURS*[1]	*OPERATION*
CAMBIO OLIO ASSALE	150 - 200 ore/*hours* ●	◆ ■	*AXLE OIL CHANGE*
OPERAZIONI DI LUBRIFICAZIONE	▲ ■	◆ ■	*LUBRICATION WORKS*
CONTROLLO ED EVENTUALE RABBOCCO OLIO	50 - 100 ore/*hours* ■	mensilmente/*monthly* ●	*CHECK AND IN CASE ADJUST OIL LEVEL*
PULIZIA TAPPO MAGNETICO SCARICO OLIO	150 - 200 ore/*hours* ■	ad ogni cambio olio/ *every oil change* ●	*CLEAN MAGNETIC OIL PLUGS*
PULIZIA SFIATO OLIO	▲ ■	mensilmente/*monthly* ●	*CLEAN OIL BREATHER*
INGRASSAGGIO	150 - 200 ore/*hours* ●	settimanalmente/*weekly* ●	*GREASING*

legenda

● operazioni eseguibili solamente da personale autorizzato dal costruttore

■ operazioni eseguibili solamente da personale addestrato

[1] quale delle due condizioni si verifica prima

remarks

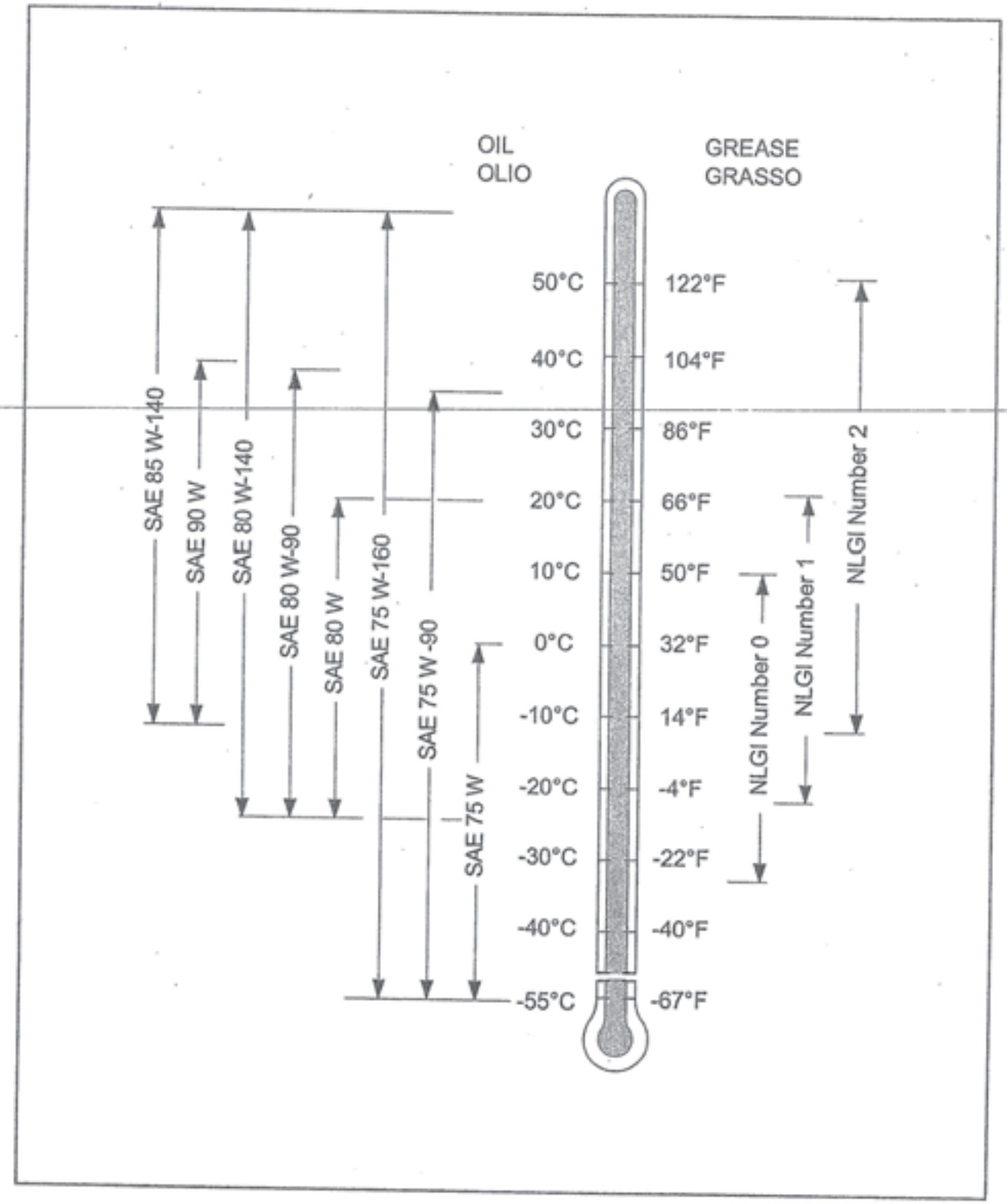
● *operation performed only by personnel authorized by the manufacturer*

■ *operation performed only by trained personnel*

[1] *which of both conditions comes first*

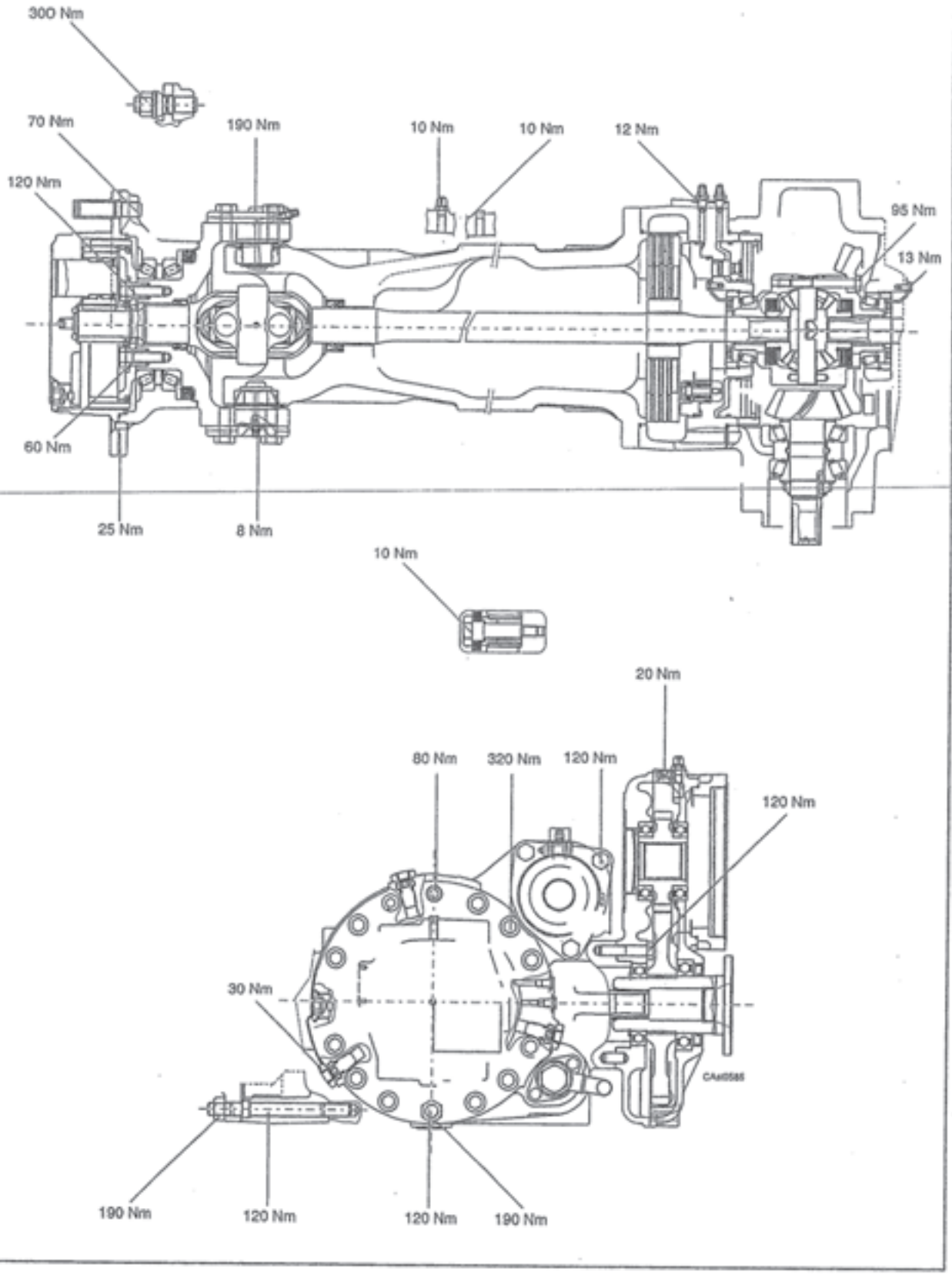
C.7 Lubrificazione / ingrassaggio: gradazioni e relativi campi di applicazione

C.7 Lubrication / greasing: grades and application range



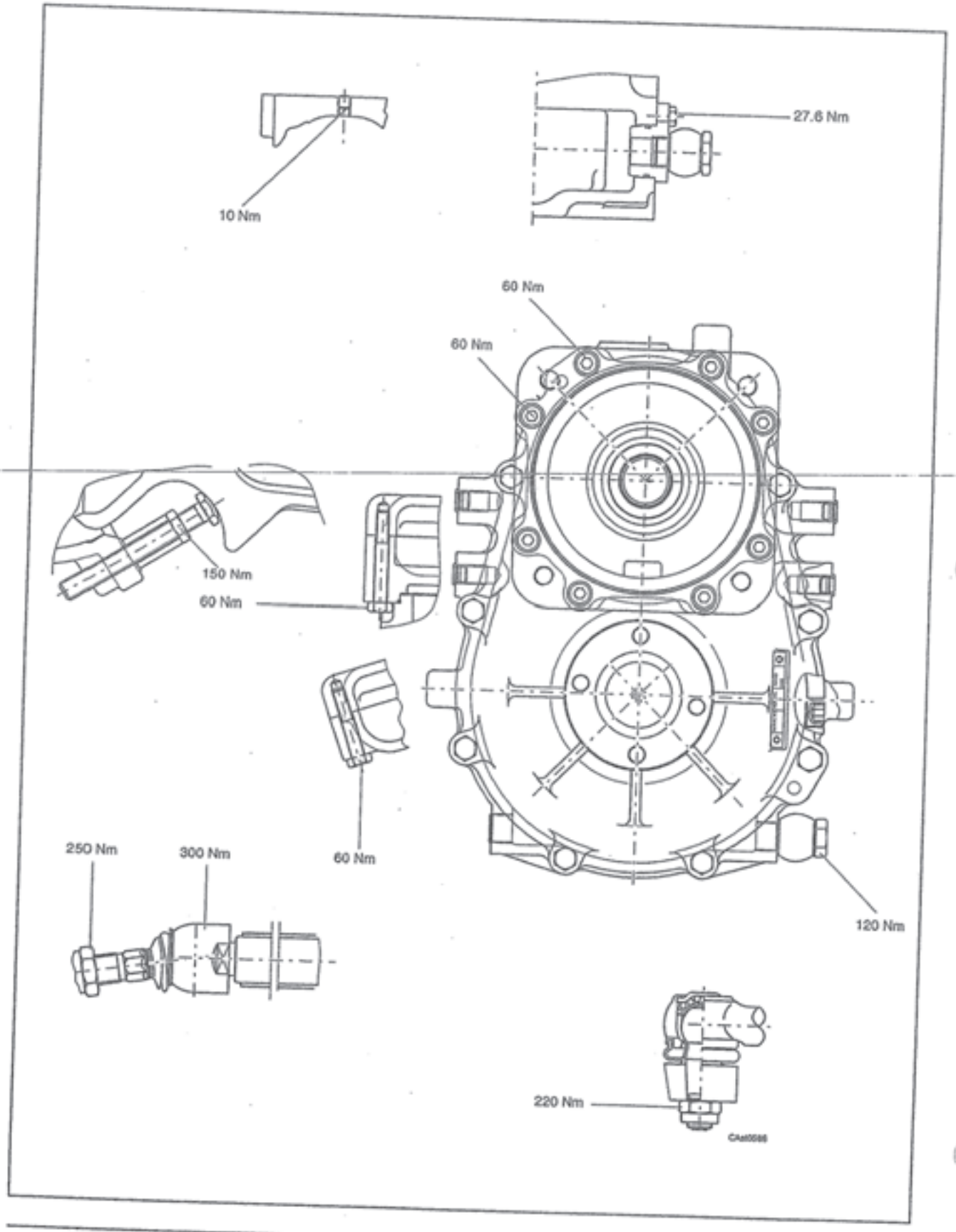
C.8 Coppie di serraggio

C.8 Tightening torques



Coppie di serraggio

Tightening torques



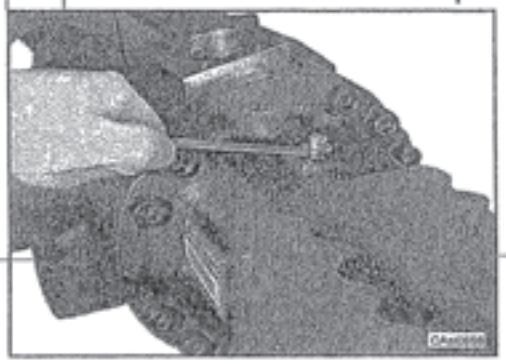
C.9 Controlli generali

Le descrizioni di smontaggio e montaggio presuppongono che il gruppo sia già stato rimosso dal veicolo e posizionato su un adatto banco di lavoro.
Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

C.9 General checks

The disassembly/assembly instructions presume that the unit has been removed from the vehicle and positioned on a suitable workbench.
Some of the following pictures may not show exactly your axle, but the procedure is the same.

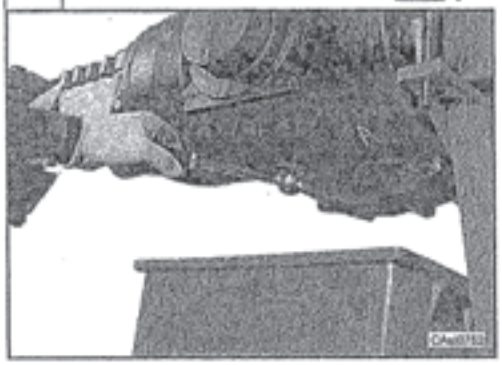
1



Prima di effettuare l'operazione di scarico dell'olio, svitare l'apposito sfiato per eliminare eventuale pressione interna. Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. C.8).

Before draining the oil, loosen the breather to release possible internal pressure, then tighten the plug with a torque wrench to the prescribed torque (Sec. C.8).

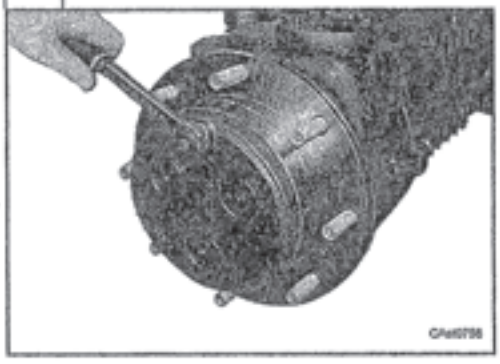
2



Per effettuare lo scarico dell'olio dal corpo centrale svitare il tappo del foro di scarico.
Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. C.8).

Drain the oil from the appropriate plug, then tighten the plug with a torque wrench to the prescribed torque (Sec. C.8).

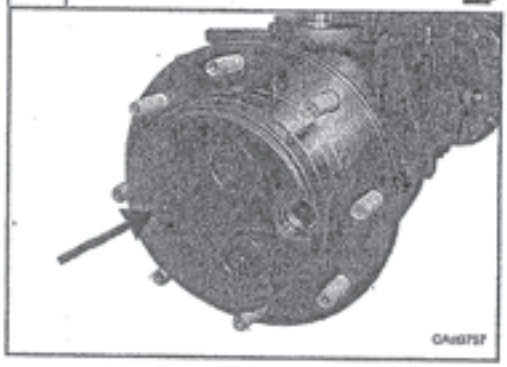
3



Prima di effettuare l'operazione di scarico o rabbocco dell'olio, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro in modo da eliminare l'eventuale pressione interna, quindi rimuoverlo completamente.

Before draining the oil, position the wheel hub so that the filer cap is in the highest point, then loosen the plug to release possible internal pressure.

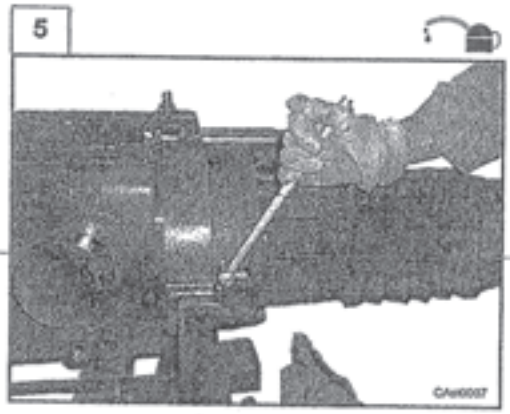
4



Ruotare gradualmente il mozzo fino a disporlo con il foro all'altezza dell'asse ruota in modo che la linea di livello dell'olio sia orizzontale.
Verificare il livello dell'olio ed eventualmente rabboccare.
Riavvitare il tappo con una chiave dinamometrica serrandolo alla coppia prevista (Sez. C.8)

Position the wheel hub so that the filer cap is on the centre line of the horizontal axis.
Check oil level and top up if necessary.
Tighten the plug with a torque wrench to the prescribed torque (Sec. C.8).

5



Prima di agire sul tappo dell'olio, svitare l'apposito sfiato per eliminare l'eventuale pressione interna.
Verificare il livello dell'olio (alla soglia del foro) ed eventualmente rabboccare.
Riavvitare il tappo con una chiave dinamometrica serrandolo alla coppia prevista (Sez. C.8)

Before draining the oil, loosen the breather to release possible internal pressure.
Check oil level and top up if necessary.
Tighten the plug with a torque wrench to the prescribed torque (Sec. C.8).

D OPERAZIONI DI SMONTAGGIO

D DISASSEMBLY OPERATIONS

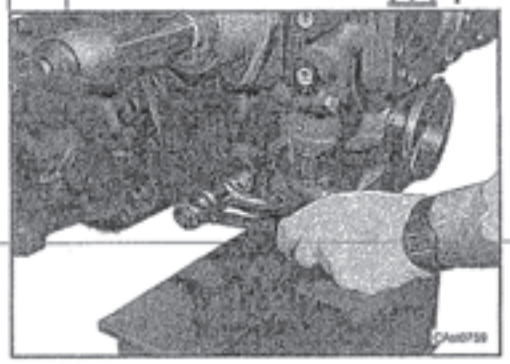
D.1 Smontaggio scatola trasmissione

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.1 Disassembling transmission box

Some of the following pictures could not show exactly your axle, but the procedure is the same.

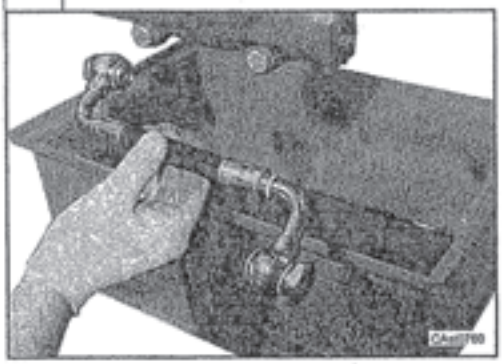
1



Prima di intervenire sul gruppo effettuare lo scarico dell'olio.
Svitare le viti di fissaggio del tubo ricircolo olio, facendo attenzione a non essere investiti da getti d'olio.

Drain the oil before carry out any operations on the unit.
Unscrew the fastening screws of the oil recirculating pipe being careful not to be hit by oil spouts.

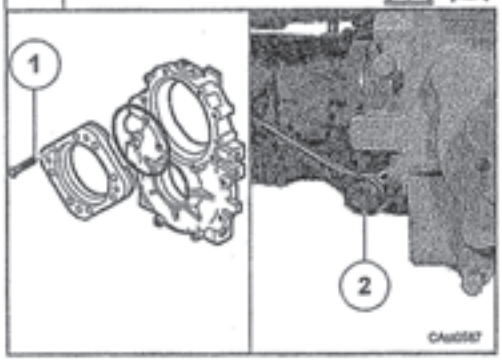
2



Rimuovere il tubo di ricircolo olio dalla scatola di trasmissione e dal corpo dell'assale.
Recuperare la vite forata, il tubo e le relative rondelle.

Remove the oil recirculating pipe from the transmission box and from the axle body .
Collect the drilled screw, the pipe and the washers.

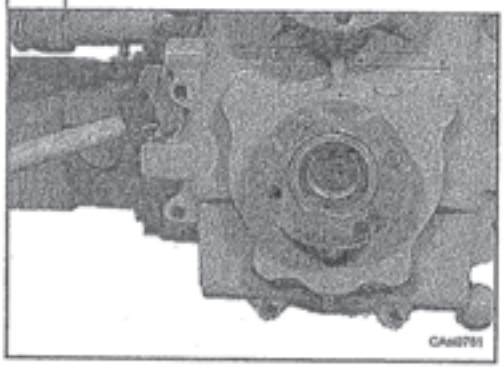
3



Attenzione: assicurare la semiscatola ad un paranco mediante funi o cinghie.
Rimuovere la flangia motore, svitando le relative viti (**1**) di fissaggio.
Rimuovere l'anello OR dalla flangia motore.
Svitare le viti di fissaggio dalla semiscatola (**2**).

***Warning**: Secure the half box to a hoist by means of ropes or belts.*
Remove the engine flange by unscrewing the fastening screws (1).
Remove the O-ring from the engine flange.
Unscrew the half box fastening screws (2).

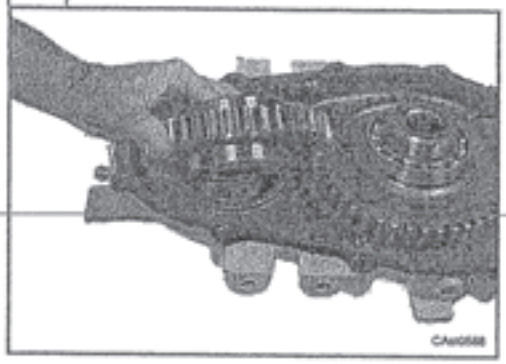
4



Rimuovere le viti di fissaggio della semiscatola.
Rimuovere la semiscatola battendo con un martello in materiale tenero sulle zone predisposte.

Remove the fastening screws of the half box.
Remove the half box by beating on the fitting parts with a hammer made of soft material.

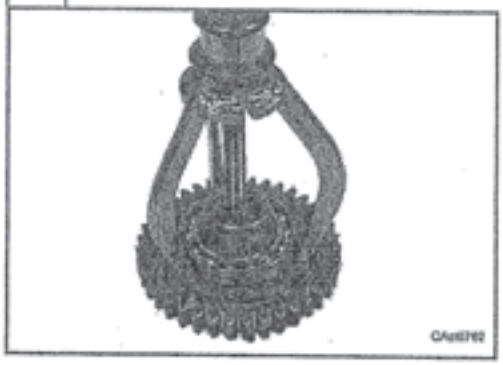
5



Recuperare la ruota dentata con i cuscinetti.

Remove the gearwheel with the bearings.

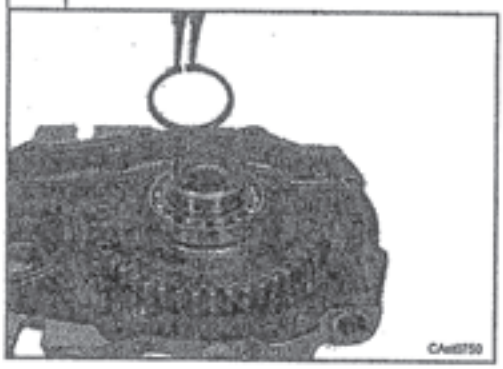
6



Posizionare la ruota dentata sul banco di lavoro.
Estrarre i cuscinetti con estrattore a tre punti di presa.

Position the gearwheel on the workbench.
Take the bearings out with a three-hold extractor.

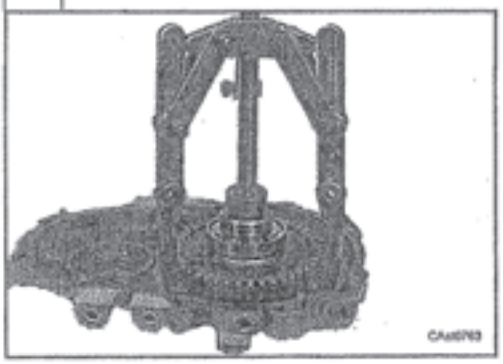
7



Togliere l'anello d'arresto dall'albero flangiato inferiore con pinza apposita da commercio.

Remove the snap ring from the lower flanged shaft with suitable pliers.

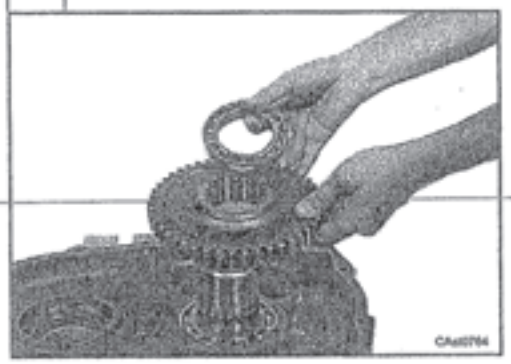
8



Estrarre l'ingranaggio ed il cuscinetto a sfere dall'albero inferiore, utilizzando un estrattore a tre punti di presa che agisca sull'ingranaggio.

Take the gear and the ball bearing out of the lower shaft, using a special three-hold extractor.

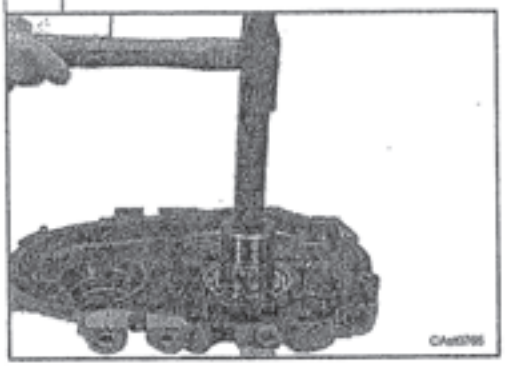
9



Recuperare il cuscinetto e l'ingranaggio inferiore.

Remove the bearing and the lower gear.

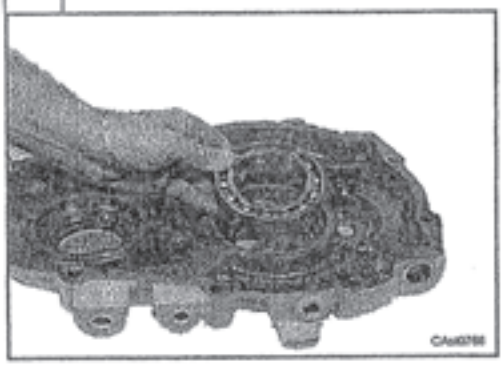
10



Assicurarsi che l'albero con flangia sia libero di scorrere.
Estrarre l'albero, battendo all'estremità del codolo con un martello ed un battitoio.

Be sure that the flanged shaft can slide out freely.
Take the shaft out, by beating on the end with a hammer and a suitable tool to be beaten.

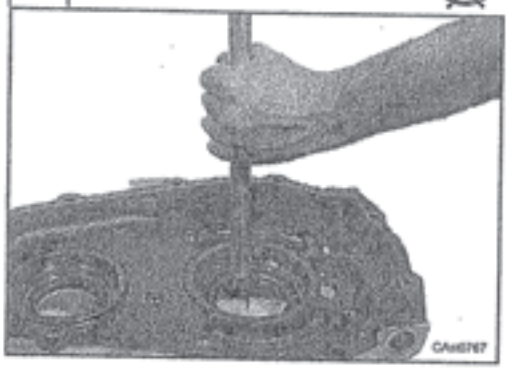
11



Rimuovere il cuscinetto inferiore.

Remove the lower bearing.

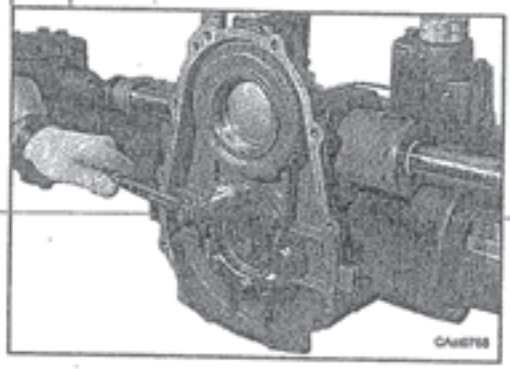
12



Rimuovere dalla semiscatola l'anello di tenuta con un martello e un battitoio.
Nota: operazione distruttiva per l'anello di tenuta.
Controllare lo stato di usura di tutti i particolari smontati e dove necessario, sostituirli.

Remove the oil seal from the half box with a hammer and a suitable tool to be beaten.
***Note:** this is a destructive operation for the oil seal.*
Check wear conditions of all the disassembled parts and, if necessary, replace them.

13



Rimuovere la semiscatola fissata al corpo dell'assale svitando le viti di fissaggio.

Remove the half box that is fixed on the axle body, by unscrewing the fastening screws.

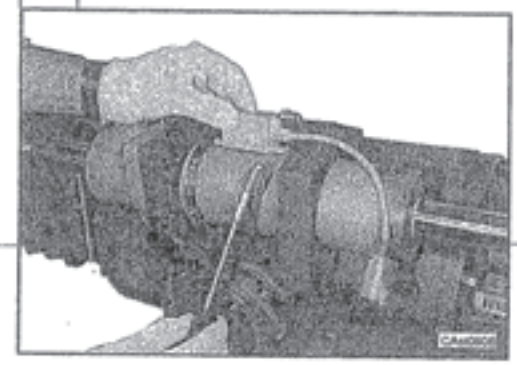
D.2 Smontaggio gruppo cilindro sterzo

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.2 Steering cylinder group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

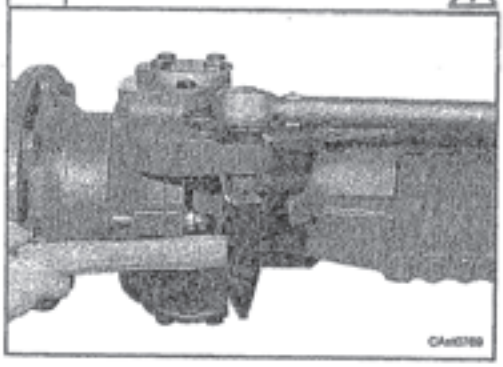
1



Rimuovere il sensore magnetico induttivo di sterzata, allentando le viti delle fascette di bloccaggio.

Remove the inductive magnetic steering sensor, by unloosing the locking clamps' screws.

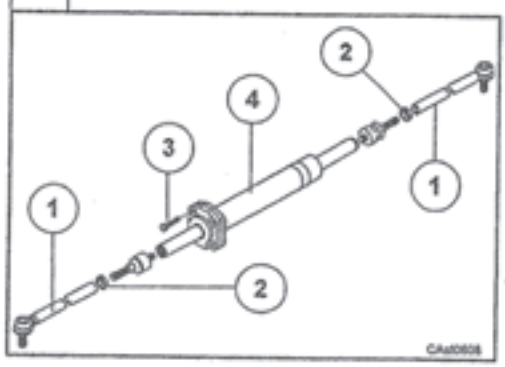
2



Allentare il dado di fissaggio dell'asta guida di qualche giro fino a portarlo oltre la base del perno filettato.
Con un martello battere sul dado per staccare l'asta guida dalla calotta.
Attenzione: non colpire l'estremità del perno filettato.
Nota: questa operazione è distruttiva per il dado.

Loose the guide rod locknut of some turns till it is over the base of the threaded pin.
Beat on the nut with a hammer in order to disjoin the guide rod from the swivel housing.
***Warning:** don't beat on the end of the threaded pin.*
***Note:** this is a destructive operation for the nut.*

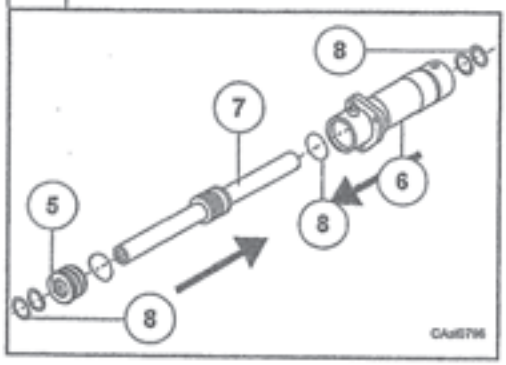
3



Rimuovere il tirante (1) dell'asta guida allentando con chiave adatta il dado di bloccaggio (2), e controllarne poi le condizioni.
Svitare le viti di fissaggio (3) del martinetto (4), quindi sfilarlo dalla sua sede, se necessario aiutandosi con un martello di gomma.
Rimuovere solo i particolari che devono essere revisionati e/o sostituiti.

Remove the guide rod link (1) by unloosing the tie nut (2) with a suitable wrench, then check its conditions.
Unscrew the fastening screws (3) of the cylinder (4), then take the cylinder out of its housing and, if necessary, use a rubber hammer.
Remove only that parts need to be overhauled and/or replaced.

4



Staccare la testata (5) dal corpo del cilindro (6).
Sfilare la testata e lo stelo (7) dal corpo cilindro. Recuperare tutti gli anelli di tenuta (8), sia dal corpo cilindro che dallo stelo.

Detach the cylinder head (5) from the cylinder case (6).
Remove off the cylinder head and the rod (7) from the cylinder case.
Remove all the sealings and O-rings (8), both from the cylinder head and the rod.

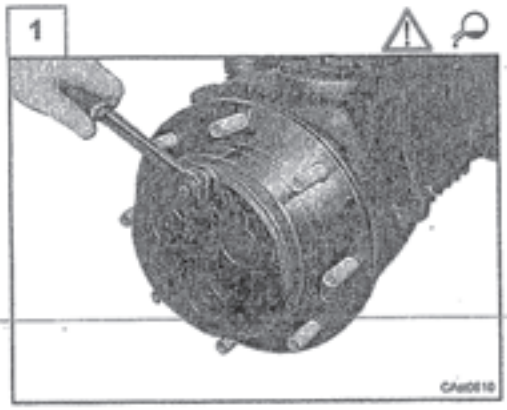
D.3 Smontaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.3 Epicyclic reduction gear disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

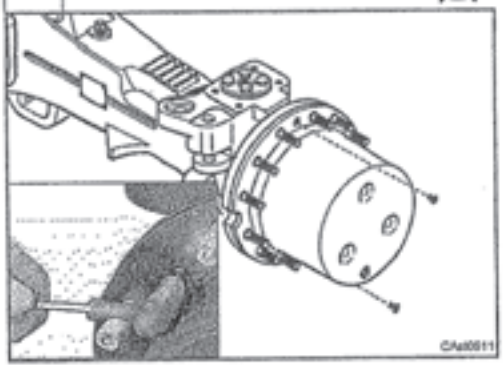
1



Prima di effettuare l'operazione di scarico dell'olio, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro per eliminare l'eventuale pressione interna, quindi rimuoverlo completamente.
Ruotare il mozzo fino a portare il foro nel punto più basso.
Scaricare completamente l'olio.

Before draining the oil, position the wheel hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, then remove it completely. Turn the wheel hub upside-down till the hole is in the lowest point.
Drain the oil completely.

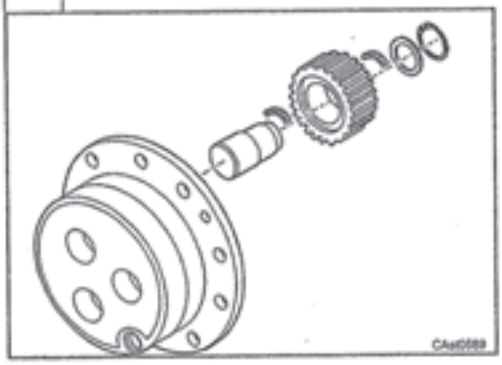
2



Svitare e togliere le due viti di fissaggio del treno portasatelliti con una chiave da commercio.
Rimuovere il treno portasatelliti dal mozzo ruota.
Posizionare il treno portasatelliti su di un piano e verificarne le condizioni di usura.
Recuperare l'anello OR e controllare le sue condizioni.

Unscrew and remove both fastening screws of the planetary carrier with a wrench.
Remove the planetary carrier from the wheel hub.
Position the planetary carrier on a workbench and check its wear conditions.
Remove the O-ring and checkits conditions.

3



<u>Per eseguire l'eventuale sostituzione degli ingranaggi satelliti:</u>
- rimuovere l'anello d'arresto di ogni satellite;
- rimuovere le rondelle ed estrarre gli ingranaggi satelliti dai perni;
- recuperare i relativi rullini verificandone le condizioni.

Nota: con nuovi satelliti è consigliabile montare rullini nuovi.

<u>To carry out any possible replacements of the planetary gears:</u>
- remove the snap ring on every planetary gear;
- remove the washers and take the planetary gears out of the pins;
- collect the needle bearings, checking their conditions.
***Note:** with new planetary gears is advisable to assembly new roller bearings.*

D.4 Smontaggio gruppo mozzo ruota

Prima di smontare il mozzo ruota, assicurarlo con una cinghia o una fune ad un paranco od altro sistema di sostegno, per evitarne la caduta accidentale che potrebbe danneggiare sia l'operatore che il gruppo.

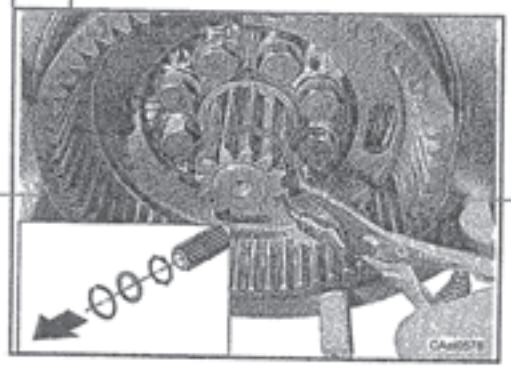
Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.4 Wheel hub group disassembly

Before disassembling the wheel hub, it is advisable to secure it with a belt or a rope on a hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

Some of the following pictures may not show exactly your axle, but the process is the same

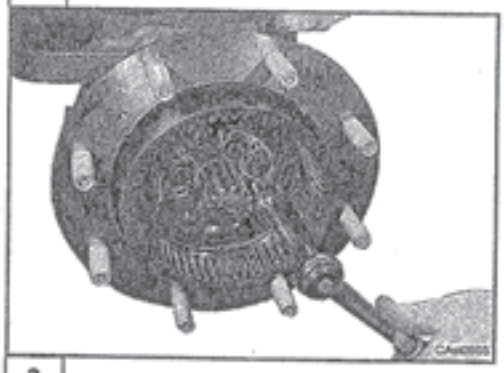
1



Rimuovere l'anello d'arresto, con una pinza adatta, dal semiasse.

Remove the snap ring from the U-Joint shaft using suitable pliers.

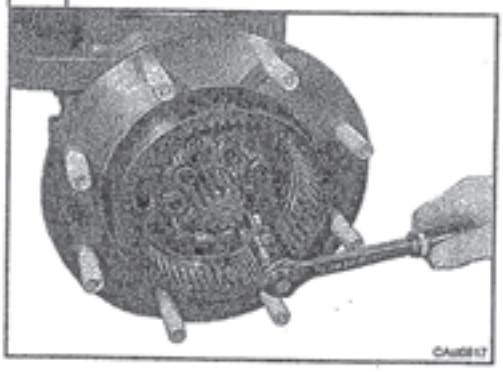
2



Svitare e togliere le viti di fissaggio del mozzo-fermo corona.

Unscrew and remove the fastening screws from the wheel carrier group.

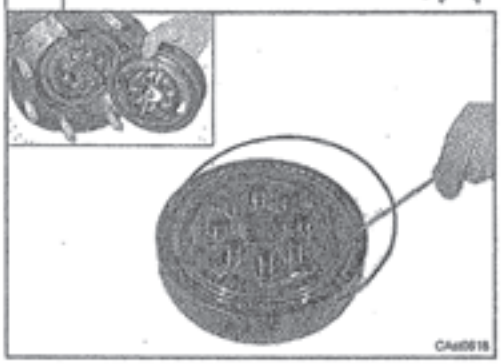
3



Per sfilare il mozzo-fermo corona dalla sua sede, recuperare almeno due delle viti appena tolte ed avvitarle nei fori filettati di estrazione.

In order to remove the wheel carrier group from its housing, screw at least two of the just removed screws in the threaded extraction holes.

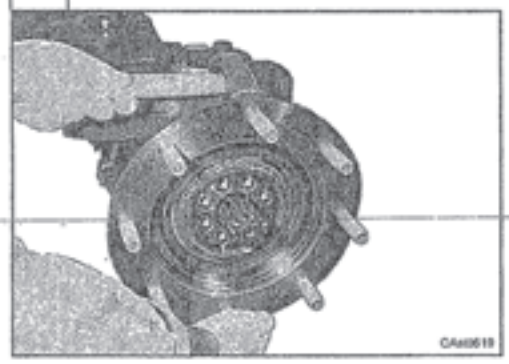
4



Estrarre e rimuovere il mozzo-fermo corona completo di corona epicicloidale. Rimuovere l'anello di arresto d'acciaio e separare il mozzo-fermo corona dalla corona epicicloidale. Verificare lo stato di usura dei particolari. Solo se necessario, togliere le bussole di centraggio del mozzo-fermo corona con un martello e l'attrezzo. CA715027.

Extract and remove the wheel carrier together with the epicyclic ring gear. Remove the steel lock ring and disjoin the wheel carrier from the epicyclic ring gear. Check the wear conditions of the components. Only if necessary, remove the centering bushes of the hub lock ring gear with a hammer and the special tool CA715027.

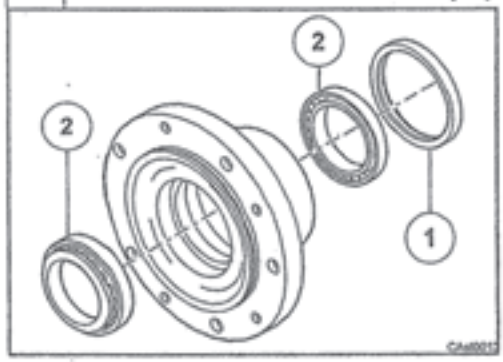
5



Sfilare il mozzo ruota, facilitando lo smontaggio con leve e martello.
Nota: recuperare la pista interna del cuscinetto.

Remove the wheel hub, using levers and a hammer to facilitate the operation.
***Note:** collect the bearing cone.*

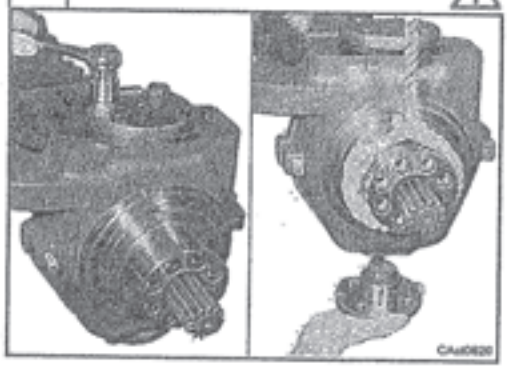
6



Posizionare su di una superficie piana il mozzo ruota ed estrarre l'anello di tenuta (1) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Estrarre le piste esterne dei cuscinetti (2), da entrambi i lati del mozzo ruota, con un battitoio ed un martello.Togliere la pista interna del cuscinetto dal codolo della calotta, utilizzando un estrattore da commercio.

Position the wheel hub on a flat surface3 and take the seal ring out (1) with a lever.
***Note:** this is a destructive operation for the seal ring.*
Take the bearing cups out (2), on both sides of the hub, using a hammer and a suitable tool to be beaten. Remove the bearing cone from the swivel housing end, using a suitable extractor.

7



Svitare e togliere le viti di fissaggio del perno snodo superiore ed inferiore.
Pericolo: prima di rimuovere i perni snodo, assicurare la calotta con una cinghia o una fune ad un paranco od altro sistema di sostegno.
Rimuovere i perni.
Nota: recuperare le molle a tazza dal'assale.

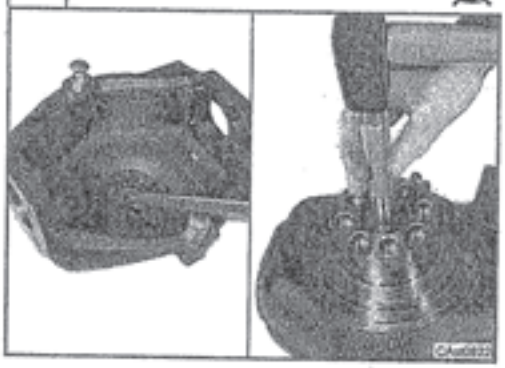
Unscrew and remove the fastening screws from the upper and lower king pin.
***Danger:** before removing the king pins, secure the swivel housing with a belt or a rope to a hoist or any other supporting device.*
Remove the king pins.
***Note:** collect the belleville washers.*

8

Sfilare la calotta dal trave e dal semiasse corto del doppio giunto.

Remove the swivel housing from the axle beam and from the short shaft of the U-Joint.

9



Posizionare la calotta su di una superficie piana ed estrarre l'anello di tenuta con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Girare la calotta ed estrarre la bronzina utilizzando un battitoio ed un martello.

Position the swivel housing on a flat surface and take the seal ring out with a lever.
***Note**: this is a destructive operation for the seal ring.*
Turn the swivel housing and take the bush out, using a drift and a hammer.

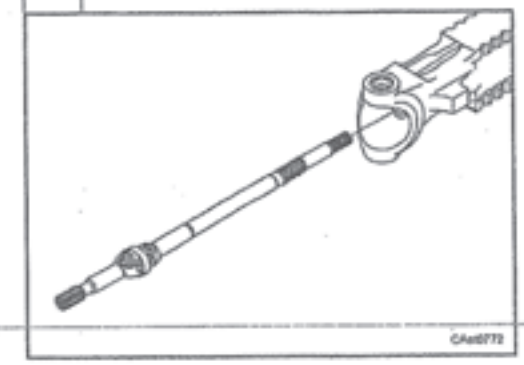
D.5 Smontaggio trombe trave e gruppi freno

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.5 Axle beam trumpets and brake groups disassembly

Some of the following pictures may not show your axle, but the process is the same.

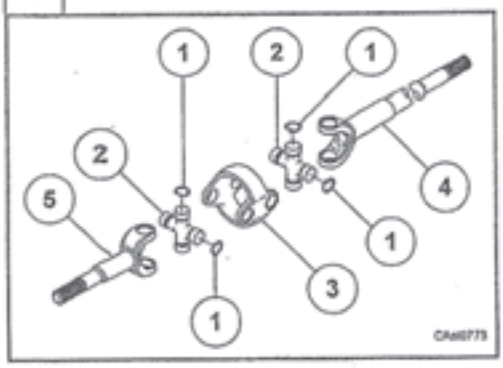
1



Estrarre dal trave il doppio giunto completo.

Remove the complete double-joint from the beam

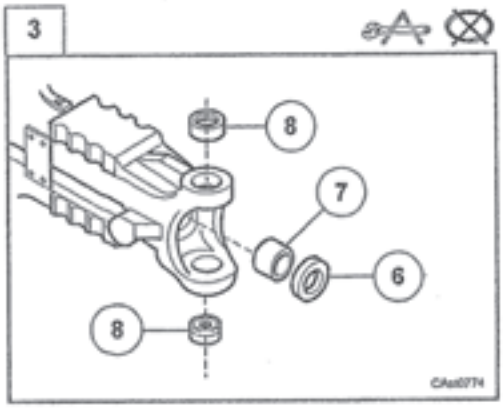
2



Per sostituire un componente del doppiogiunto, rimuovere con pinza adatta gli anelli d'arresto (1) di arresto delle crocere (2).
Rimuovere il corpo centrale (3) facendo attenzione a non deformarlo o rovinarlo durante l'estrazione dalle crocere (2).
Togliere il semiasse lato differenziale (4) e il semiasse lato ruota (5).

To replace a component of the double joint, using a suitable pair of pliers, remove the snap rings (1) supplied to stop the spider (2).
Remove the central body (3), taking care not to mis-shape or damage it when with drawing it from the spider (2).
Remove the half-axle on the differential-gear side (4) and the half-axle on the wheel side (5).

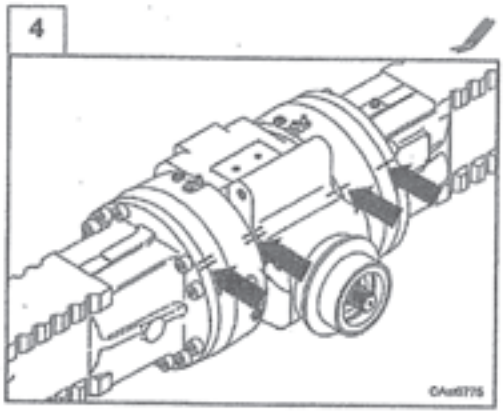
3



Dopo aver sfilato il doppio giunto dal trave estrarre l'anello di tenuta (6) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Per eseguire la sostituzione della bronzina (7) all'interno del trave è necessario tagliarla, con un cesello.
Estrarre le boccole superiore ed inferiore (8) dalle sedi dei perni snodo con estrattore da commercio.

Once the U-Joint has been removed from the axle beam, extract the seal ring out of the axle beam (6) with a lever.
***Note:** this is a destructive operation for the seal ring.*
In order to replace it inside the axle beam, the bushing (7) needs to be cut and destroyed with a chisel.
Take the upper and lower bushing (8) out of the king pin'housings with a suitable extractor.

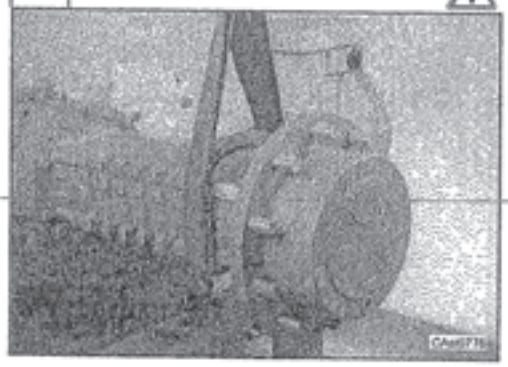
4



Fare dei segni di riferimento indelebili sul corpo trave e sulle flange supporto differenziale, per identificare con sicurezza parte destra e parte sinistra.

Put alignment marks on the axle beam body and on the differential supporting flanges, in order to identify the right side and the left side with certainty.

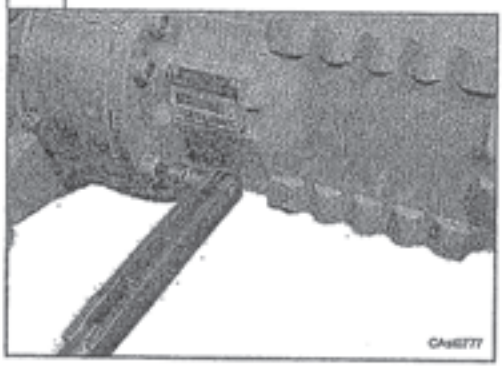
5



Disporre l'assale su supporti adatti a sostenere sia il corpo centrale che le due trombe, anche dopo la loro separazione, o assicurare i tre gruppi separatamente con funi o cinghie ad un sistema di sollevamento.

Position the axle on supports fitted to hold either the central body or the two beam trumpets, even after their disjunction, or secure the three disjointed groups to a lifting device with ropes or belts.

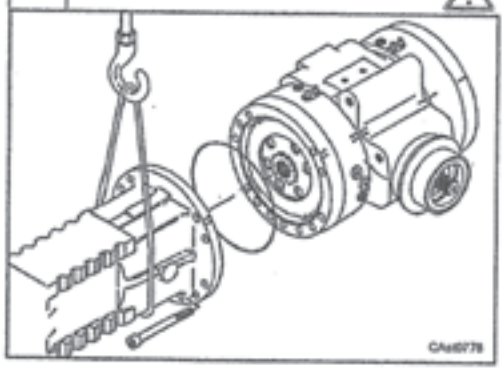
6



Svitare le viti di fissaggio per smontare la tromba trave.

Unscrew the fastening screws to disassemble the axle beam trumpet.

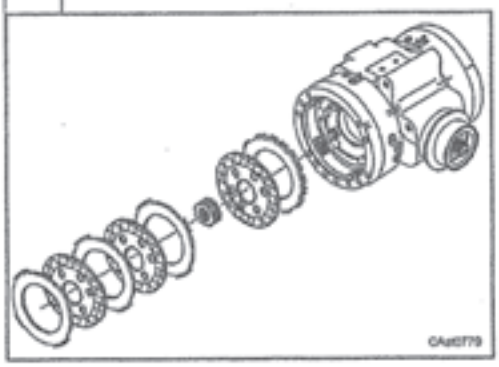
7



Staccare la tromba trave.
Attenzione: rimossa la tromba il gruppo dischi e controdischi freno è libero.
Recuperare il relativo anello OR.

Remove the axle beam trumpet.
***Warning:** once the axle beam trumpet has been removed, the brake disks and counterdisks are free.*
Collect the O-ring.

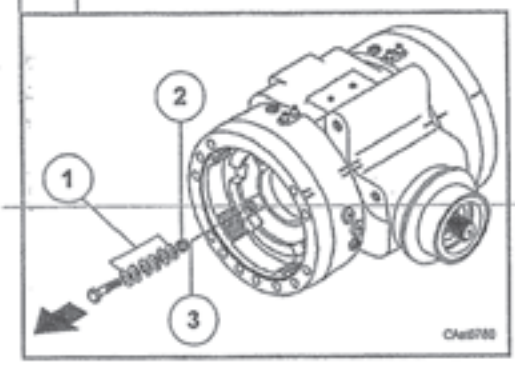
8



Sfilare tutti i componenti del freno dischi, controdischi e manicotto.

Remove all components: brake discs, fixed discs and sleeve.

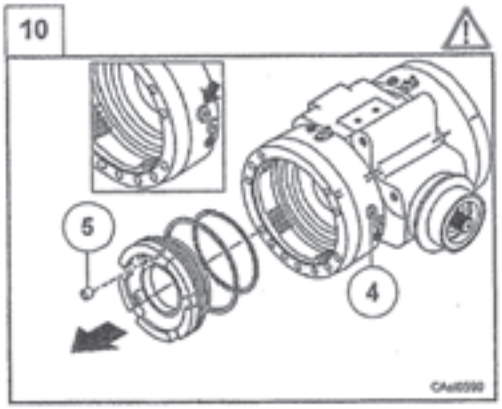
9



Svitare e togliere le viti del self-adjust ed estrarre le molle a tazza (1) la bussola (2) e la molla a tazza (3).

Undo and remove the self-adjust bolts and remove the belleville springs (1), bush (2) and belleville washer (3).

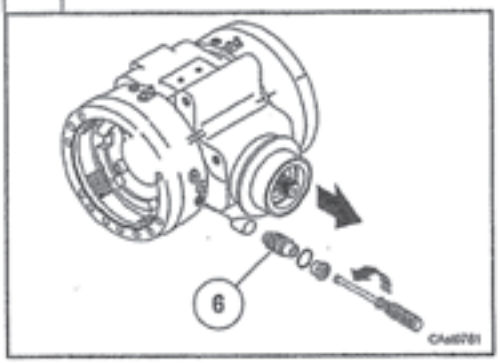
10



Applicare aria od olio in pressione attraverso il foro di mandata del freno negativo (4) per espellere il pistone. Utilizzare la minima pressione necessaria per l'espulsione. Rimuovere gli anelli OR e controllare le condizioni. Rimuovere le 3 boccole (5) del self adjust dai fori del pistone.
Attenzione: Attenzione all'espulsione!

Apply air or oil pressure through the brake oil inlet port (4) in the positive acting brake assembly to remove the piston. Use the minimum pressure needed to remove the piston. Remove the O-Ring rings and inspect for wear. Remove the 3 self-adjust split bushings (5) from the piston bores.
***Warning:** exercise extreme care during diassembly!*

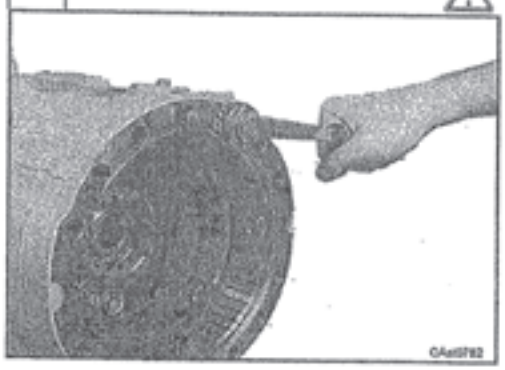
11



Svitare alternativamente le 3 viti speciali (6) fino a rimuoverle completamente.
Togliere e recuperare tutti i particolari della vite freno parcheggio (vedi figura)

Unscrew alternately three special (6) screws to remove them completely.
Take away and collect all the particulars of the parking brake screw (see figure).

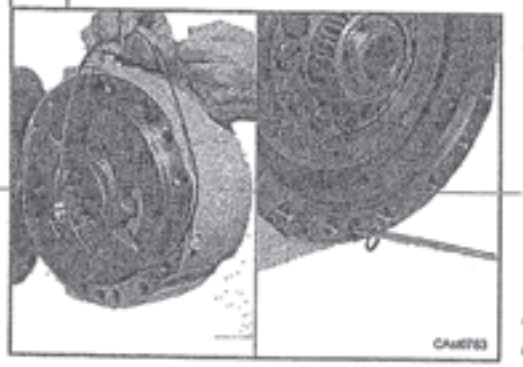
12



Assicurare la flangia freno ad un paranco con funi o cinghie di sicurezza. Svitare la vite di fissaggio superiore e la vite prigioniera inferiore. Rimuovere la flangia supporto differenziale dal corpo centrale, completa di ghiera di registro gioco coppia conica.
Pericolo: questa operazione libera la scatola differenziale, che accidentalmente potrebbe cadere.

Secure the brake flange to a hoist with ropes or safety belts. Unscrew the upper fastening screw and the lower stud bolt. Remove the differential supporting flange from the central body, together with the bevel gear backlash-adjusting ring nut.
***Danger:** this operation frees the differential box, that accidentally could fall.*

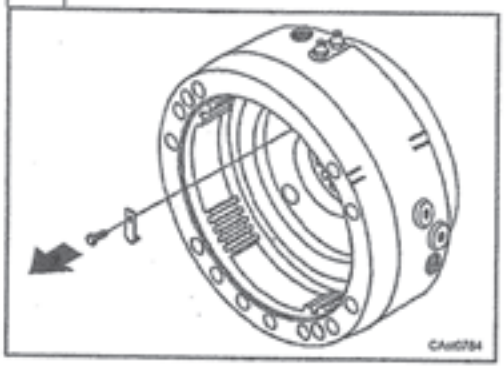
13



Rimuovere l'anello OR dalla sua sede sulla flangia e l'anello OR dal foro passaggio olio, controllarne le condizioni.

Remove the O-ring from its housing and from oil pipe hole and check its conditions.

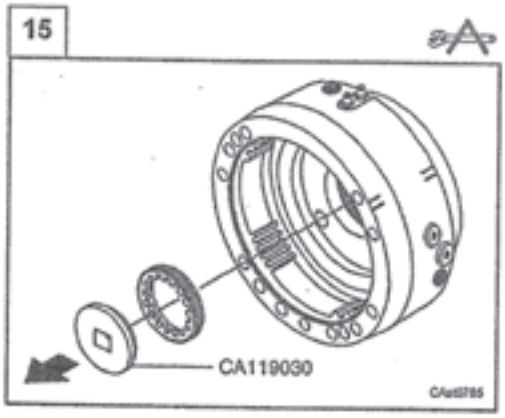
14



Svitare e togliere la vite ed il fermo ghiera.

Undo and remove the bolt and lock nut retainer.

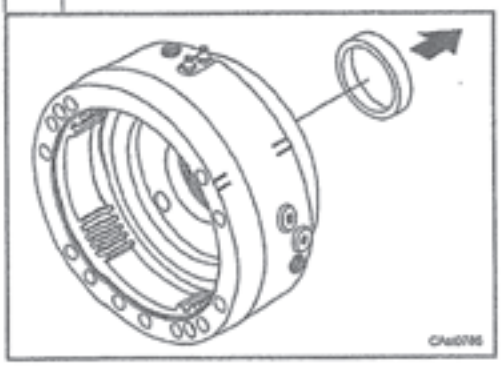
15



Svitare e togliere la ghiera dalla flangia freno con l'attrezzo speciale CA119030

Undo and remove the lock nut from the brake flange using special tool CA119030

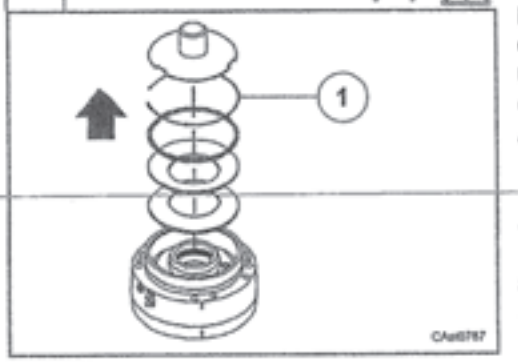
16



Togliere la pista esterna del cuscinetto dalla flangia freno con un battitoio

Use a driver to remove the outer cup of the brake flange bearing

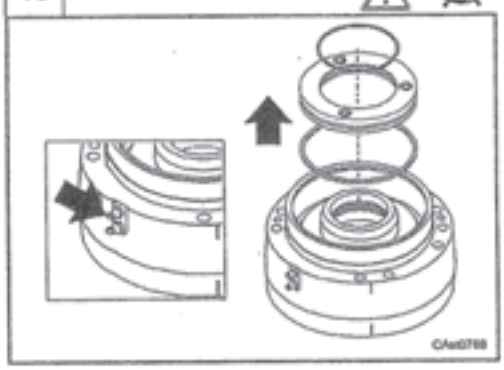
17



Posizionare la flangia freno sotto l'azione di una pressa e con l'ausilio dell'attrezzo CA715056 liberare l'anello (1); togliere l'anello. Eseguire un rilascio della spinta della pressa in modo lento e graduale. Quindi estrarre il manicotto, le molle a tazza ed il pistone.
Attenzione: Operazione pericolosa per l'operatore.

Position the brake flange under the press and, using special tool CA715056, free circlip (1). Relase the load of the press in slowly and gradually.
Now remove the sleeve, belleville discs and piston.
Warning : *Exercices extreme care.*

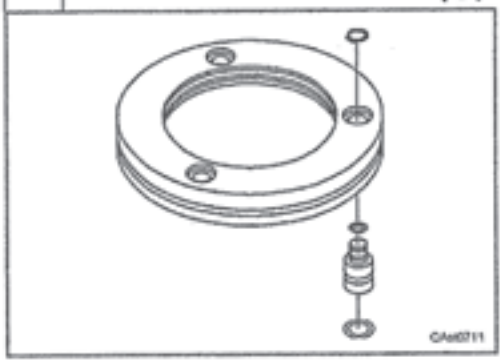
18



Utilizzare il foro di mandata del freno negativo per espellere il pistone dalla flangia freno. Utilizzare la minima pressione d'olio o aria necessaria per l'espulsione. Recuperare il pistone e rimuovere gli anelli OR e controllare le condizioni.
Attenzione: Attenzione all'espulsione!

Use the brake oil inlet port in the negative acting brake assembly to push out the piston. Use the minimum air or oil pressure necessary to dislodge the piston.
Remove the O-Rings and inspect for wear.
Warning: *Exercise extreme care during disassembly!*

19



Togliere l'anello d'arresto del pistone, ed estrarre il perno di spinta.
Nota: Recuperare gli anelli OR e controllare le condizioni.

Remove the circlip from piston and extract the thrust pin.
Note: *Remove snap ring the O-rings and inspect for wear.*

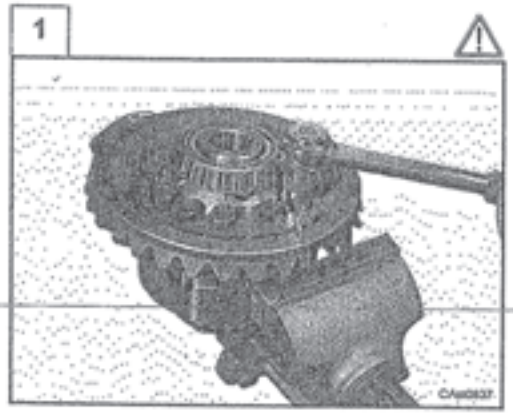
D.6 Smontaggio gruppo differenziale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.6 Differential group disassembly

Some of the following pictures may not show your axle, but the process is the same.

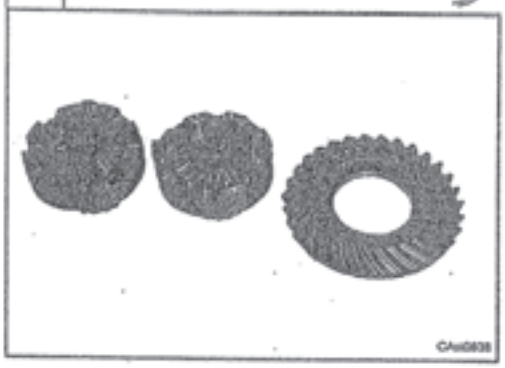
1



Recuperare il differenziale e posizionarlo in una morsa.
Svitare tutte le viti di fissaggio della corona conica.
Attenzione: questa operazione libera anche le due semiscatole differenziale, non disperdere i componenti.

Collect the differential and put it in a clamp.
Unscrew all the fastening screws of the bevel gear crown.
Warning: *this will make both differential half boxes free, so take care not to drop the internal components.*

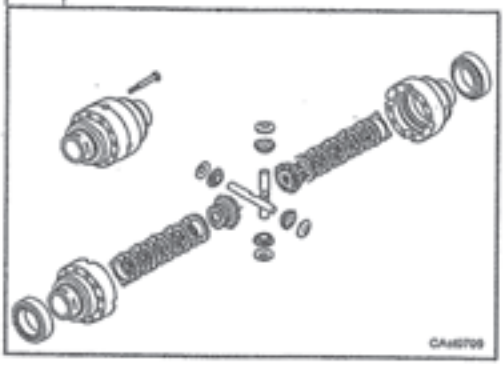
2



Disassemblare la scatola differenziale in due semiscatole complete dei rispettivi elementi.
Nota: fare dei segni di riferimento sulle due semiscatole prima di separarle, per ripristinare la loro posizione relativa in fase di montaggio.

Disassemble the differential box in two half boxes complete with the relative components.
Note: *mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.*

3



Disassemblare tutti i particolari.
Verificare le condizioni di funzionalità e lo stato di usura dei componenti.
Per estrarre il cuscinetto dalla semiscatola differenziale, utilizzare due leve oppure un estrattore a tre punti di presa da commercio.

Disassemble all the components.
Check the operating and wear conditions of the components.
Take the bearing out of the differential half box, using two levers or a three-hold extractor.

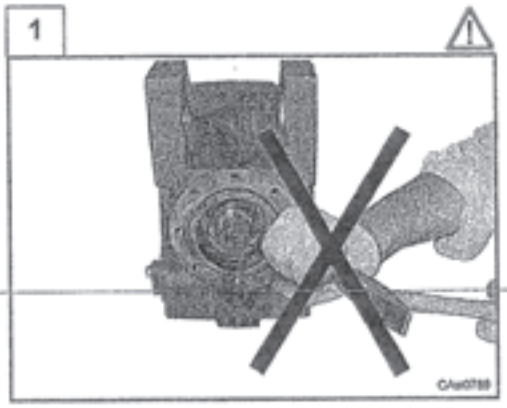
D.7 Smontaggio gruppo pignone

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.7 Pinion group disassembly

Some of the following pictures may not show your axle, but the process is the same.

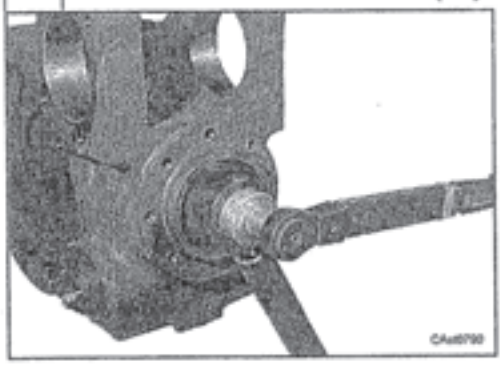
1



Posizionare il corpo centrale su di un piano stabile prima di procedere allo smontaggio.
Non tentare di sollevare la parte cianfrinata.

Position the central body on a steady plane, before disassembling it. Do not lift the caulked side of the ring nut.

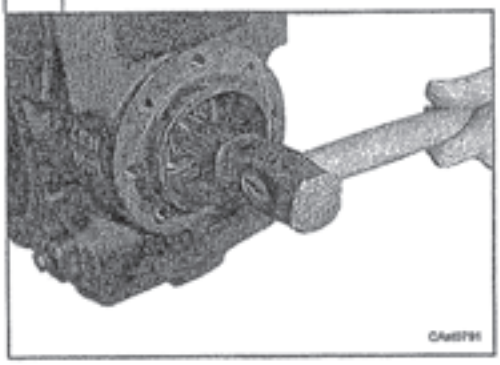
2



Per evitare seri danni alla filettatura del pignone conico, svitare la ghiera con gli attrezzi speciali CA119099 e CA715022.

In order to avoid serious damages to the bevel pinion thread, unscrew the ring nut with the special tools CA119099 and CA715022.

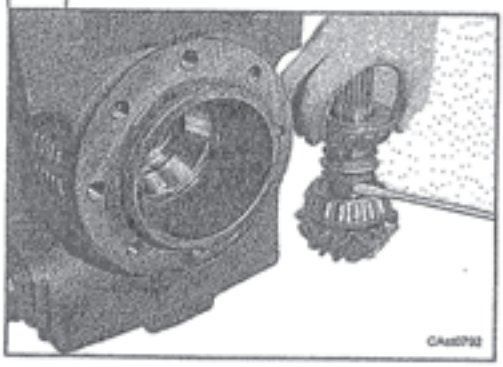
3



Dopo aver sfilato la rondella fermo ghiera, estrarre il pignone conico dalla sua sede battendo con un martello di materiale tenero sull'estremità del codolo scanalato.

Once the ring nut washer has been removed, take the pinion out of its housing, by beating with a hammer made of soft material on the splined end.

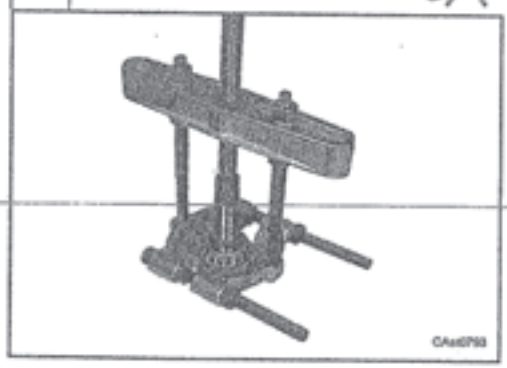
4



Tolto il pignone conico recuperare le rondelle, il distanziale elastico e le piste interne dei cuscinetti a rulli conici.
Nota: quando il distanziale elastico viene rimosso deve essere sostituito con un distanziale nuovo.

Once the bevel pinion has been removed, collect the washers, the elastic spacer and the cones of the taper roller bearing.
***Note:** when the elastic spacer is removed, it should be replaced by a new one.*

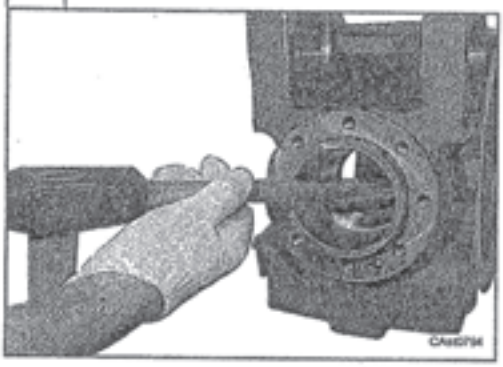
5



Estrarre il cuscinetto dal codolo del pignone conico utilizzando un estrattore a ghigliottina da commercio.
Recuperare lo spessore di registro posto sotto il cuscinetto e verificarne le condizioni di usura.

Take the bearing cone out of the bevel pinion end, using a suitable extractor.
Remove the adjusting shim placed under the bearing and check its wear conditions.

6



Estrarre le piste esterne dei cuscinetti a rulli conici dal corpo centrale utilizzando uno scalpelletto ed un martello.

Take the cups of the taper roller bearing out of the central body, using a chisel and a hammer.

E OPERAZIONI DI MONTAGGIO

E ASSEMBLY OPERATIONS

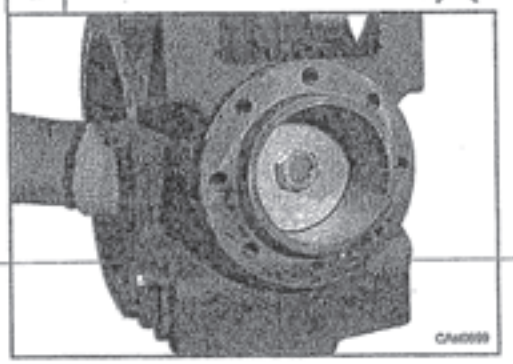
E.1 Montaggio gruppo pignone

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.1 Pinion group assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

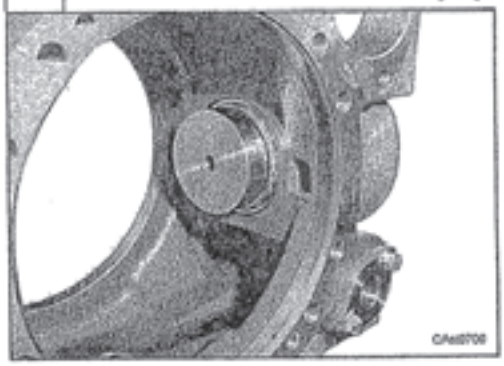
1



Posizionare il corpo centrale su un banco di lavoro.
Piantare le piste esterne dei cuscinetti a rulli conici sulle proprie sedi con l'ausilio delle attrezzature comprese nel kit CA715401.

Position the central body on a workbench.
Insert the cups of the taper roller bearings on their housings using the special tools included on the kit CA715401.

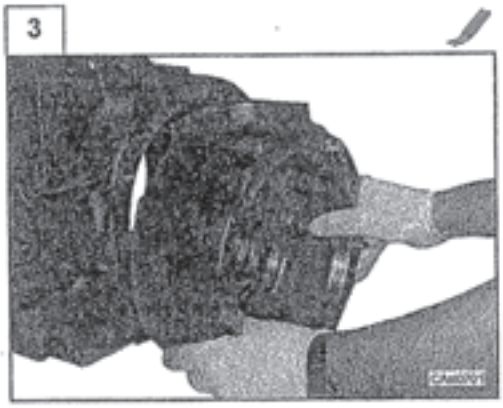
2



Per la rilevazione della distanza si utilizza il kit composto dalle attrezzature CA715040 e CA715041, dette "falso pignone" e "falsa scatola differenziale".
Inserire nelle sedi per i cuscinetti appena montate, il falso pignone CA715040 con i rispettivi cuscinetti e la ghiera.
Serrare fino ad eliminare il gioco senza eccedere.

In order to measure the distance, the kit composed of the special tools CA715040 and CA715041, respectively called "false pinion" and "false differential box", is used.
Insert the false pinion with CA715040, together with its bearings and its ring nut, in the just mounted housings for the bearings.
Tighten without exceeding, till the backlash is eliminated.

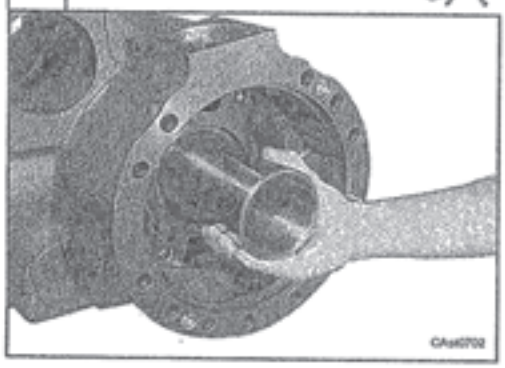
3



Verificare il corretto posizionamento delle flange destra e sinistra utilizzando i riferimenti riportati sulle medesime e sul corpo centrale.
Montare le due flange freno fissandole con le rispettive viti (avvitarne almeno due diametralmente opposte per ogni flangia).

Check the correct positioning of the right and left flanges, using the reference marks on them and on the central body.
Assemble the two brake flanges and fix them with their screws (screw in at least two ones diametrically-opposed for each flange).

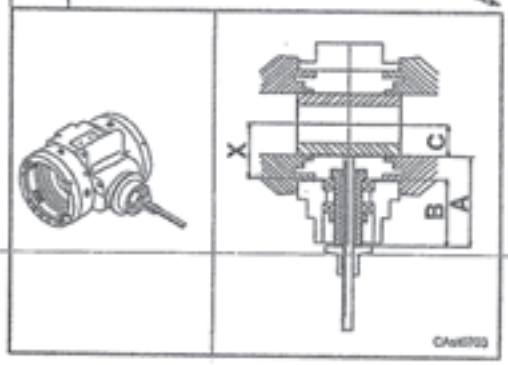
4



Introdurre nel corpo centrale la falsa scatola differenziale CA715041 per la rilevazione della distanza
Verificare che la falsa scatola sia inserita in entrambe le sedi delle flange freno.

Insert the false differential box with CA715041 into the central body to measure the distance.
Check that the false box is inserted in both brake flanges' housings.

5



Effettuare la misurazione, con un calibro di profondità, dall'apposito foro del falso pignone.
X = (distanza conica da rilevare)
A = (valore misurato)
B = (valore noto) = 100 mm
C = (valore noto) = 45 mm

$$(A + C) - B = X$$

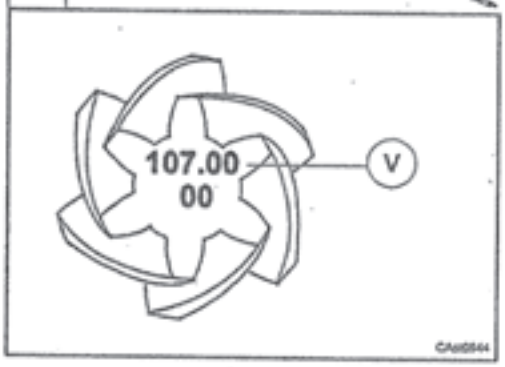
Esempio: A = 164.9 mm
perciò: X = [(164.9 + 45) - 100] mm
X = 109.9 mm

Carry out the measurement with a depth gauge through the suitable false pinion hole
X = (conical distance to be measured)
A = (measured value)
B = (known value) = 100 mm
C = (known value) = 45 mm

$$(A + C) - B = X$$

Example: A = 164.9 mm
therefore: X = [(164.9 + 45) - 100] mm
X = 109.9 mm

6



Per determinare lo spessore "S" necessario tra il pignone ed il cuscinetto è sufficiente sottrarre dal valore calcolato "X" il valore "V" stampigliato sulla testa del pignone (V=distanza conica prescritta).

$$S = X - V$$

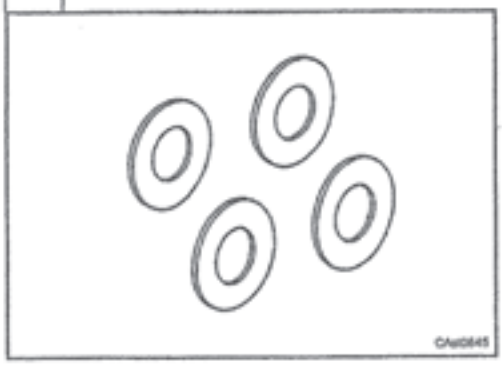
Esempio: grossezza spessore S = 109.9 - 107.00
= 2.9 mm

In order to determine the shim "S" necessary between the pinion and the bearing, you should subtract the "V" value stamped on the pinion head (V=requested conical distance) from the "X" calculated value.

$$S = X - V$$

Example: thickness S = 109.9 - 107.00
= 2.9 mm

7

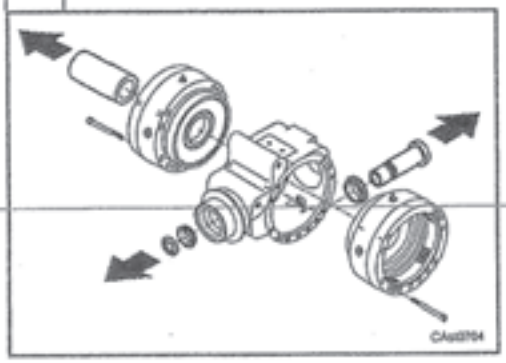


Scegliere tale spessore tra la gamma di spessori a disposizione (vedi tabella GAMMA SPESSORI) ed inserirlo sul codolo sotto la testa del pignone.

Choose the suitable shim between the available shims range (See SHIM RANGE table) and insert it on the end under the pinion head.

GAMMA SPESSORI - SHIM RANGE										
Spess./Thick.	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Q.ty	---	---	---	---	---	---	---	---	---	---

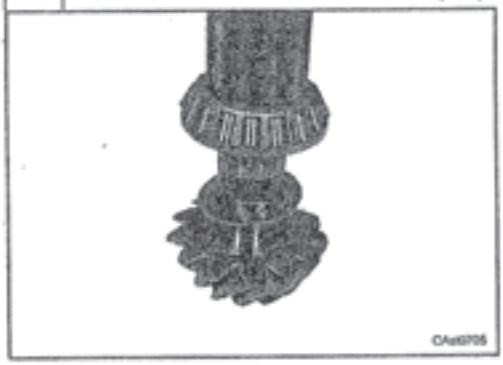
8



Rimuovere il falso pignone, i cuscinetti e la ghiera dal corpo centrale. Smontare la falsa scatola differenziale dalle flange e successivamente svitare le viti per rimuovere le flange.

Remove the false pinion, the bearings and the ring nut from the central body.
Disassemble the false differential box from the flanges and then unscrew the screws to remove the flanges.

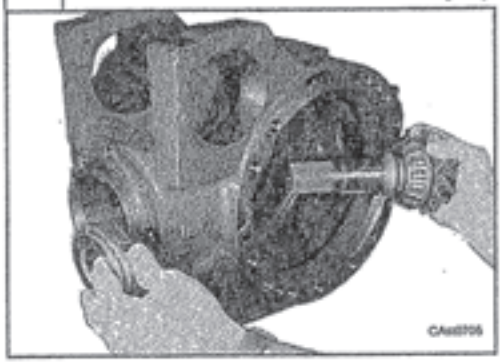
9



Inserire sull'albero del pignone lo spessore adatto (scelto in precedenza) con lo smusso rivolto verso l'ingranaggio. Piantare il cuscinetto nell'albero del pignone sotto l'azione di una pressa con il battitoio CA715179, assicurandosi che sia ben assestato.
Inserire sull'albero gli spessori ed un nuovo distanziale elastico.
Nota: utilizzare sempre un distanziale elastico **nuovo.**

Insert the suitable shim (chosen before) on the pinion shaft with chamfer against the gear. Force the bearing into the pinion shaft and with CA715179 special tool under a press, making sure that it is well set. Insert the shims and the new elastic spacer into the shaft.
***Note:** use always a **new** elastic spacer.*

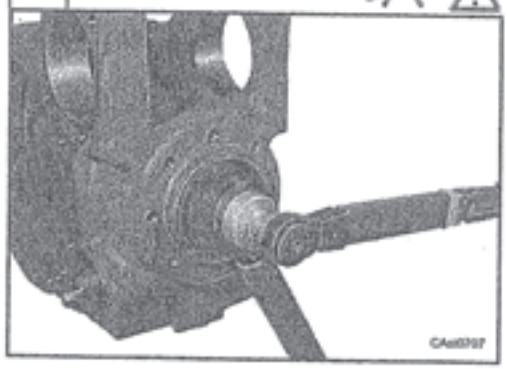
10



Inserire il gruppo pignone conico nella sede del corpo centrale ed il secondo cuscinetto sul codolo pignone.
Eseguire il piantaggio del cuscinetto, utilizzando il battitoio CA715179 ed un martello.
Si consiglia di contrapporre un azione resistente alla forza battente (ad esempio con una mazza).

Insert the bevel pinion unit into the central body housing and the second bearing cone into the pinion end.
In order to force the bearing into position use the special tool CA715179 and a hammer.
It is advisable to oppose a resistant action against the beating force (e.g. with a sledge hammer).

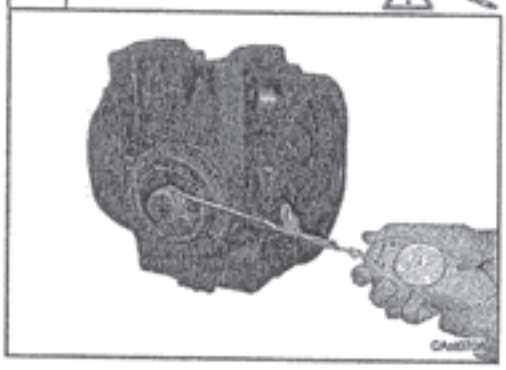
11



Inserire sull'albero del pignone una nuova rondella fermo ghiera e la ghiera di serraggio.
Avvitare la ghiera utilizzando le chiavi per ghiera CA1 19099 e fermo pignone CA715022.
Attenzione: la coppia di serraggio è data dalla misurazione del precarico sui cuscinetti.
Serrare la ghiera progressivamente.
Se il serraggio è eccessivo il distanziale elastico dovrà essere sostituito e la procedura ripetuta.
Al momento di verificare il precarico è opportuno dare piccoli colpi con martello in materiale tenero alle estremità del pignone per favorire l'assestamento dei cuscinetti

Insert into the pinion shaft e new ring nut washer and the ring nut retainer.
Screw the ring nut in, using the wrench for ring nut CA119099 and for pinion retainer CA715022.
***Warning:** The torque setting is given by the preloading measurement on bearings.*
Tighten the ring nut step by step. If it is tightened too much, the elastic spacer should be replaced and the procedure repeated.
When you check the preloading, it is advisable to beat the pinion ends with a hammer made of soft material slightly to favour the bearing setting.

12



Effettuare la misurazione del precarico (P) dei cuscinetti conici dell'albero del pignone, utilizzando un dinamometro a funicella, avvolta sul diametro di 34,70 ÷ 34,80 mm del codolo scanalato.
La regolazione si effettua aumentando gradualmente il serraggio della ghiera, facendo attenzione a non eccedere.
Attenzione: tutti i precarichi devono essere misurati senza anello di tenuta.
Ottenuto il prescritto valore di precarico, cianfrinare la ghiera utilizzando martello e scalpello.

P=9.2÷13.8 daN

Carry out the preloading measurement (P) of the pinion taper roller bearings, using a dynamometer whose cord is wound on the 34.70 ÷ 34.80 mm diameter of the pinion spline.
The adjustment is carried out by increasing the ring nut torque setting gradually, being careful not to exceed.
***Warning:** all preloadings should be measured without the seal ring.*
Once you got the requested preloading value, caulk the ring nut, using a hammer and a chisel.

P=9.2÷13.8 daN

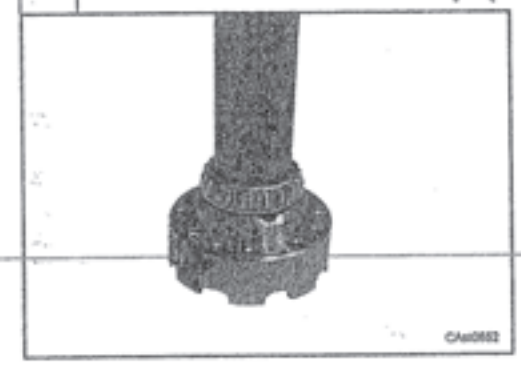
E.2 Montaggio gruppo differenziale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.2 Differential group assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

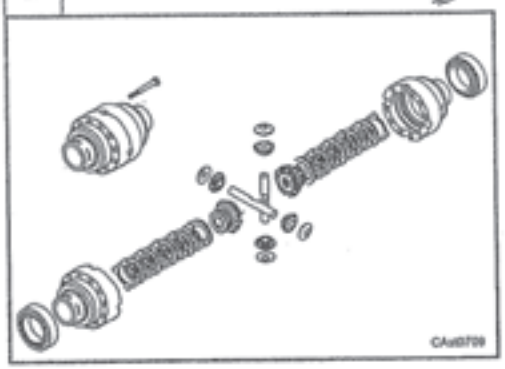
1



Montare le piste interne dei nuovi cuscinetti a rulli conici sulle semiscatole, utilizzando il battitoio CA119230 ed un martello.

Assemble the cones of the new taper roller bearings on the half boxes, using the special tool CA119230 and a hammer.

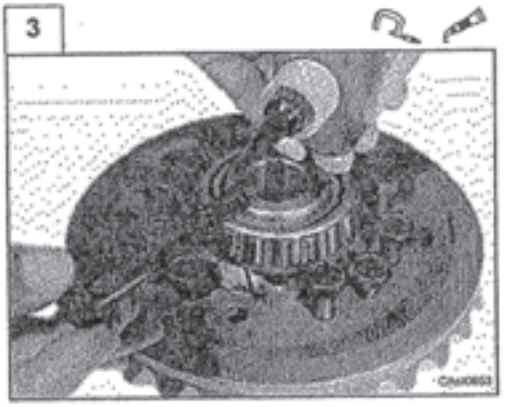
2



Posizionare una semiscatola su di un banco di lavoro e montare tutti i suoi componenti interni (planetari, satelliti, ralle di rasamento, perni, dischi e controdischi), come in figura.
Unire le due semiscatole, allineando i riferimenti praticati sulle stesse.

Position a half box on a workbench and assemble all its inner components (sun gears, planetary gears, thrust washers, pins, discs and counterdiscs) as per figure.
Join the two half boxes, aligning the reference marks made upon them.

3



Posizionare la corona conica e fissare il tutto, dopo aver applicato Loctite® 270 sul filetto, serrando le viti alla coppia prevista (Sez. C.8).

Position the ring bevel gear, apply Loctite® 270 on the thread and then fix the whole by tightening the screws to the requested torque (Sec. C.8).

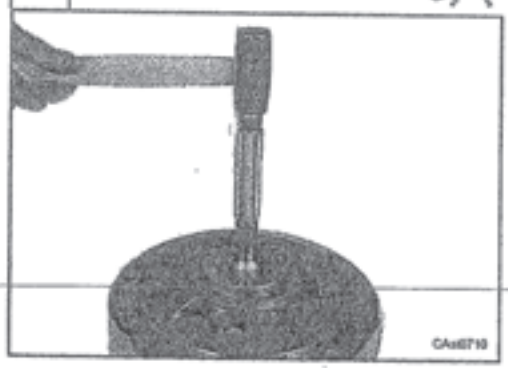
E.3 Montaggio flange freno e scatola differenziale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.3 Brake flange and differential housing assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

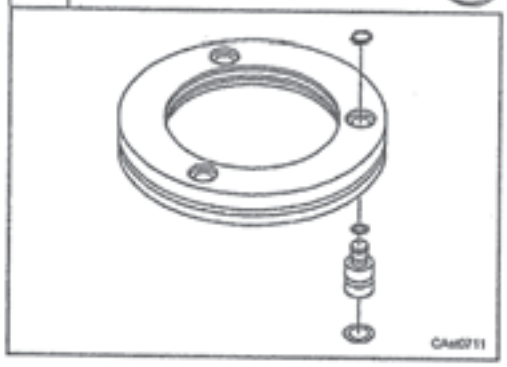
1



Posizionare la flangia su di una superficie piana e piantare la pista esterna del cuscinetto a rulli conici con il battitoio CA715299, il manicotto intercambiabile CA119033 ed un martello.

Position the flange on a flat surface and force the cup of the taper roller bearing in position, using the special tool CA715299, interchangeable handle CA119033 and a hammer

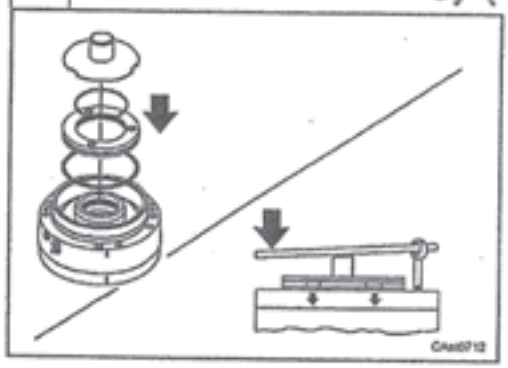
2



Montaggio pistone freno negativo.
Inserire i tre perni di spinta con i relativi anelli OR e anelli d'arresto nel pistone.

Assembling the negative acting brake piston.
Insert the three thrust pins with their O-rings and circlips into the piston.

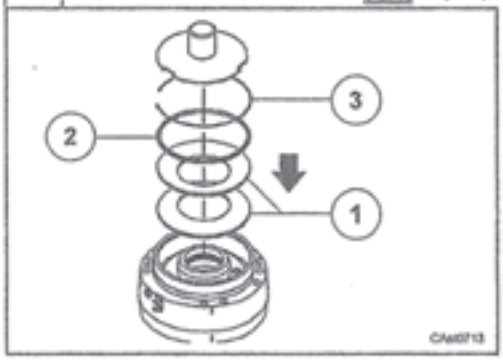
3



Dopo aver steso un leggero strato di grasso nelle superfici di contatto del pistone ed in special modo negli anelli OR già montati, posizionare il pistone sulla flangia freno e l'attrezzo CA715056 sopra il pistone e con una leva ancorata (magari da un golfare), fare pressione al centro dell'attrezzo; eseguire una pressione appena sufficiente a inserire il pistone sulla flangia freno.

Apply a thin film of grease to the piston contact surfaces and the O.rings already installed, provided with care. Place special tool CA715056 above the piston and, applying pressure to the centre of the tool with and anchored lever (using an eyebolt). Apply pressure just sufficient to locate the piston into the brake flange.

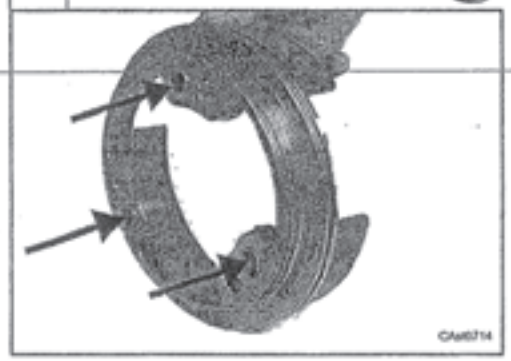
4



Dopo aver inserito il pistone freno negativo completo nella sua sede, posizionare la flangia freno sotto una pressa; inserire poi le molle a tazza (1) (in modo che l'ultima sia concava) il manicotto (2) (con la sede dell'anello verso l'esterno), ed infine posizionare l'attrezzo CA715056. Verificare il centraggio delle molle nella sede.
Sotto l'azione di una pressa schiacciare, il tutto fino a poter montare l'anello d'arresto (3).
Attenzione: operazione pericolosa per l'operatore.

After inserting the brake piston fully into its housing, place the flange under a press.
Locate the belleville springs (1) (the last disc on top must be concave side up) and the sleeve (2) (with the ring seat outermost), then position special tool CA715056.
Using a press, apply pressure on the entire assembly until ring (3) can be fitted. Ensure the belleville springs are centered in the housing.
Warning: dangerous operation.

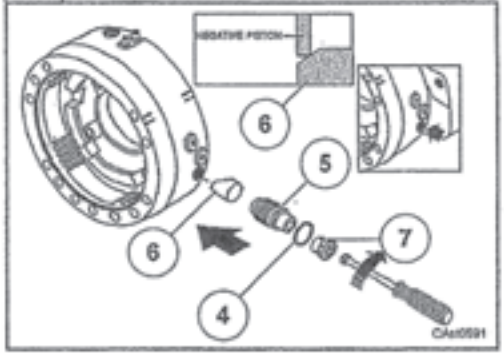
5



Recuperare il pistone freno.
Spingere le boccole nelle sedi del self-adjust fino a pareggiarle con la superficie interna di appoggio del pistone.
Montare gli anelli OR sul pistone e lubrificare con un leggero strato di grasso le superfici di contatto pistone flangia.

Collect the brake piston.
Push the bushes into the self-adjust housings till they are leveled with the piston supporting inner surface.
Assemble the O-rings on the piston and lubricate the faying surface piston/flange with a light layer of grease.

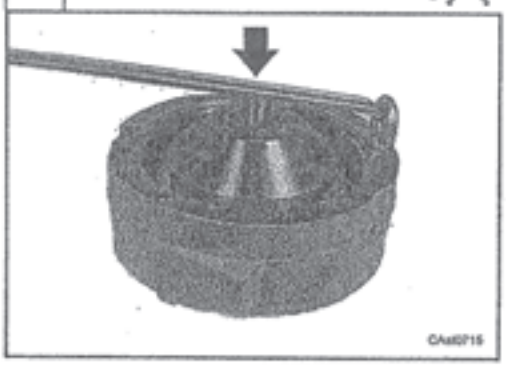
6



Ungere di grasso gli anelli OR (4) e montarli nelle viti (5). Installare le tre viti sblocco freno con relativi componenti, come in figura.
Nota: il piano inclinato della spina (6) deve essere appoggiato contro il pistone "negativo" (vedi ingrandimento). Applicare una pressione d'olio di circa 20 bar nel cilindro freno negativo, attraverso la mandata indicata, in modo da avvitare a fondo le tre viti di sblocco freno. Togliere la pressione dal cilindro freno negativo e lasciare appoggiare il pistone negativo all spina (6).
Serrare la vite (7) alla coppia prevista (Sez. C.8) con chiave dinamometrica.

Apply a light coating of grease to O-ring (4) and assemble them on the bolt (5). Fit the three brake-release bolts with their respective parts as in the figure.
***Note**: the flat surface (ramp) of the pin (6) must fully seat against the negative piston. Apply an oil pressure of about 20 bar in the negative brake cylinder, through the indicate, hydraulic connection, in order to screw completely the three screws of brake release. Drop the pressure from the negative brake cylinder and push the negative piston till the pin (6).*
Tighten the screw (7) to the prescribed torque (Sez. C.8) with dinamometric wrench.

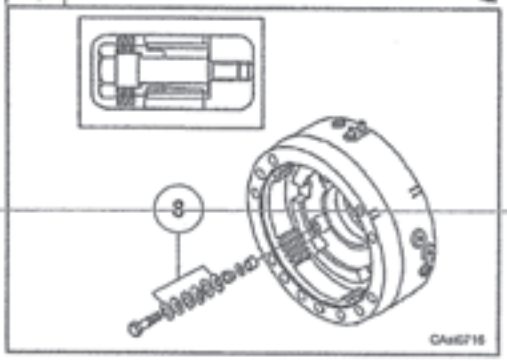
7



Dopo aver steso un leggero strato di grasso nelle superfici di contatto del pistone ed in special modo negli anelli OR già montati, inserire il pistone nella flangia freno e posizionare l'attrezzo CA715056 o un disco piano sul pistone. Con la leva ben ancorata, magari ad un golfare, esercitare una pressione appena sufficiente ad inserire il pistone nella flangia freno.

Apply a slight coat of grease on the piston surfaces and especially on the O.rings already inserted, insert the piston into the brake flange and position the special tool CA715056 or a disk on the piston and with a lever anchored to an eyebolt, exert a pressure just enough to insert the piston into the brake flange.

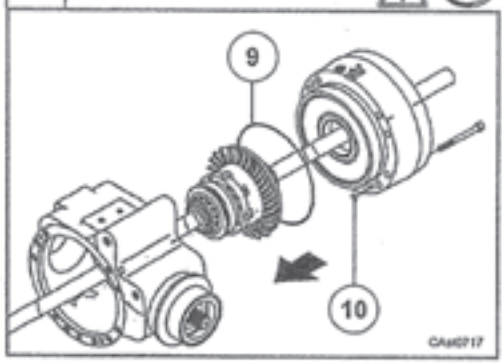
8



Recuperare i componenti dei kit self-adjust e montarli nel pistone come indicato nella figura.
Nota: fare particolare attenzione al corretto senso di montaggio delle molle a tazza (8).
Avvitare le viti di fissaggio del kit self-adjust e serrarle, con chiave dinamometrica, alla coppia di serraggio prevista (sez. C.8).

Take the components of the self-adjst kit and fit them on the piston as shown in the figure.
***Note:** be particulary careful regarding correct installation direction of the (1) cup springs.*
Screw the securing screws of the self-adjust kit and tighten them with a torque-wrench to the specified tightening torque (sec. C.8).

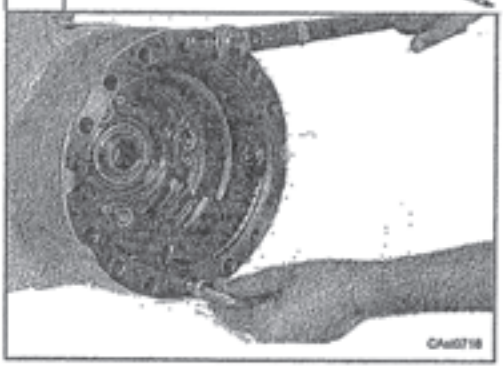
9



Inserire sulla flangia freno un nuovo anello OR (9).
Sostenere il gruppo scatola differenziale usando un tubo, posizionando per prima la flangia freno dal lato della corona conica.
Attenzione: rispettare il corretto lato di montaggio della corona conica, che può essere inserita invertita. Prima del montaggio posizionare un nuovo anello (10) su foro passaggio olio.

Insert a new O-ring on the brake flange (9).
Support the differential box with a tube, positioning first the brake flange on the side of the ring bevel gear.
Caution: respect the correct assembly side of the ring bevel gear, that could be assembled inverted. Insert, before the assembly, a new-ring (10) on the oil hole.

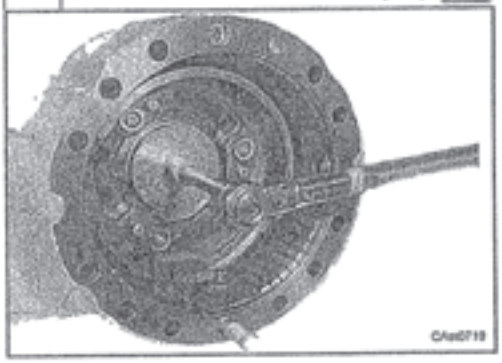
10



Montare e serrare la vite superiore e la vite prigioniera (inferiore) di fissaggio della flangia freno con chiave dinamometrica alla coppia prevista (Sez. C.8).

Assemble and tighten the upper fastening screw and the lower fastening stud bolt of the brake flange with dynamometric wrench to the requested torque (Sec. C.8).

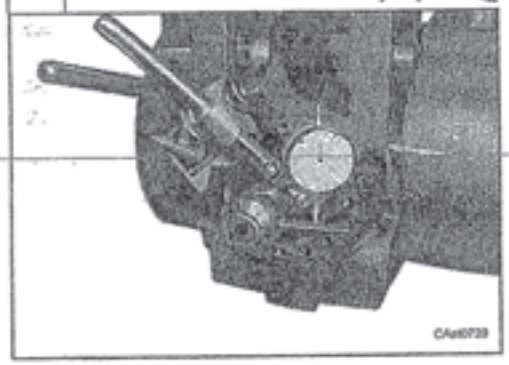
11



Dopo aver verificato il corretto lato di assemblaggio della scatola differenziale, montare la seconda flangia freno dal lato opposto alla corona conica. Inserire ed avvitare le ghiere di registrazione del gioco pignone-corona, utilizzando la chiave CA119030 fino ad eliminare il gioco dei cuscinetti, quindi procedere al rilievo del gioco pignone-corona.
Nota: serrare le ghiere progressivamente senza eccedere.

Once the correct assembly side of the differential box it has been checked, assemble the second brake flange on the opposite bevel gear side. Insert and screw the adjusting ring nuts of the pinion-ring, using the wrench with CA119030 till the bearing backlash is eliminated. Then measure the pinion-ring gear backlash.
***Note:** tighten the ring nuts step by step without exceeding.*

12



Montare l'attrezzo speciale CA715055 sul codolo del pignone.
Muovere il codolo del pignone alternativamente ed annotare il gioco fra pignone e corona, rilevato con un comparatore, in modo che il palpatore sia a contatto ed a 90° con la superficie della staffetta dell'attrezzo speciale in corrispondenza della tacca di riferimento.
Verificare se il valore del gioco rilevato rientra nel campo predefinito:

0.18÷0.25mm

Effettuare la registrazione agendo sulle due ghiere con l'apposito attrezzo CA119030.

Registrare le ghiere ricordando che:
- se il **gioco rilevato è inferiore** al campo di tolleranza dato, avvitare la ghiera dal lato opposto alla corona e svitare la ghiera opposta della stessa quantità;
- se il **gioco rilevato è superiore** al campo di tolleranza dato, avvitare la ghiera dal lato della corona e svitare la ghiera opposta della stessa quantità.

Assemble the special tool CA715055 on the pinion end.
Move the pinion end alternatively and note the pinion-ring gear backlash, measured with a comparator, so that the feeler is in contact and at 90° with the bracket surface of the special tool in correspondance with the reference mark.

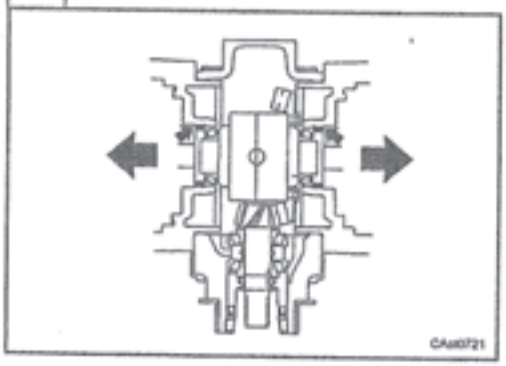
Check if the measured backlash value is within the requested range:

0.18÷0.25mm

Carry out the adjustment by operating on the two ring nuts with the appropriate tool CA119030.

Adjust the ring nuts, remembering that:
*- if the **measured backlash is less** than the given tolerance range, screw the ring nut from the side opposite to the ring gear and unscrew the opposite one of the same measure;*
*- if the **measured backlash is higher** than the given tolerance range, screw the ring nut from the side of the ring gear and unscrew the opposite one of the same measure.*

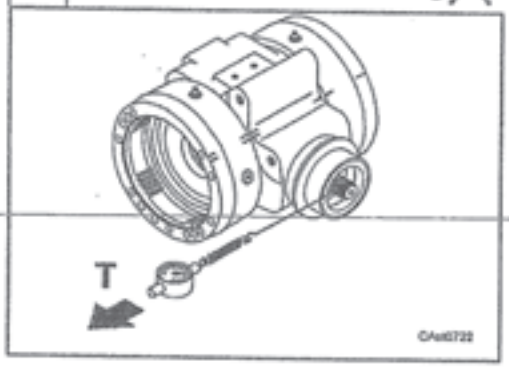
13



Effettuata la registrazione del gioco pignone-corona verificare anche che ci sia un minimo di precarico sui cuscinetti della scatola differenziale. Ripetere l'intera sequenza delle operazioni citate fino al raggiungimento delle condizioni indicate.

Once you have carried out the adjusting of the pinion-ring gear backlash, check also that there is a minimum preloading on the differential box bearings.
Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.

14



Stabilito il gioco pignone-corona, misurare il precarico totale (T) dei cuscinetti (sistema pignone-corona), utilizzando un dinamometro a funicella avvolta sul diametro 34,70 ÷ 37,80 mm sul codolo scanalato del pignone.
Il valore misurato deve rientrare nel seguente campo

T=(P+3.85)÷(P+5.80) daN

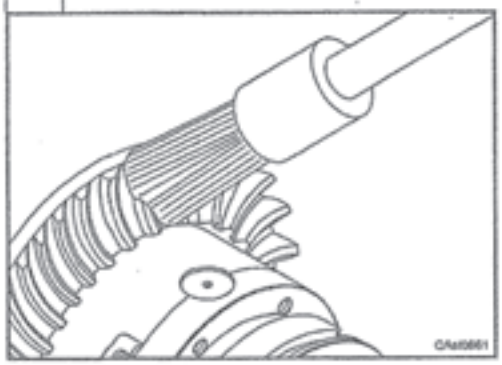
dove P è il precarico effettivo misurato sul pignone (Sez. "Montaggio gruppo pignone").
Attenzione: tutti i precarichi vanno misurati senza anello di tenuta.
Se la misurazione non rientrasse nel campo prescritto, controllare bene l'assemblaggio di ogni singolo componente ed intervenire sulle ghiere di registrazione del supporto differenziale:
- se il **precarico totale è inferiore** al campo dato, avvitare della stessa quantità le due ghiere, tenendo inalterato il valore del gioco pignone-corona;
- se il **precarico totale è superiore** al campo dato, svitare della stessa quantità le due ghiere, tenendo
inalterato il valore del gioco pignone-corona.

Once the pinion-ring gear backlash has been established, measure the total preloading (T) of the bearings (pinion-ring gear system), using a dynamometer whose cord is wound on the diameter 34.70 ÷ 37.80 mm of the pinion spline shaft.
The measured value should be within the following range.

T=(P+3.85)÷(P+5.80) daN

*where **P** is the preloading effectively measured on the pinion (Sec. "Pinion assembly").*
***Warning:** all the preloadings should be measured without the seal ring.*
If the measurement is not within the requested range, check well the assembly of each component and operate on the adjusting ring nuts of the differential support:
*- if the **total preloading is less** than the given range, screw the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged;*
*- if the **total preloading is higher** than the given range, unscrew the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged.*

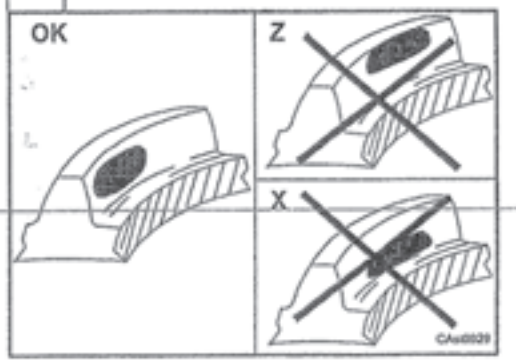
15



INFORMAZIONE GENERICA
Per verificare l'impronta di contatto dei denti della coppia conica, sporcare con minio la corona e rilevare il contatto.
L'esame dell'impronta di contatto deve essere eseguito sempre sui denti della corona conica e su ambedue i fianchi.

GENERIC INFORMATION
To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.

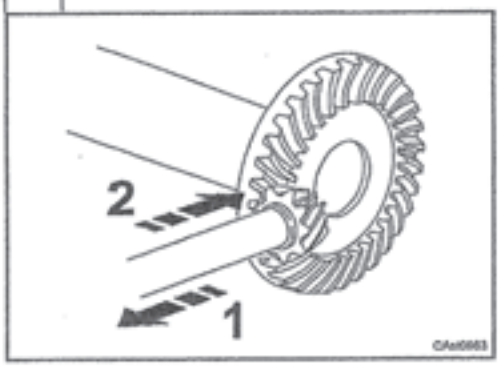
16



OK -> Contatto corretto.
Se la registrazione della coppia conica è ben fatta, il segno del contatto sulle superfici delle dentature risulterà regolare.
Z -> Eccessivo contatto sulla cresta del dente.
Avvicinare il pignone alla corona ed allontanare poi la corona dal pignone per regolare il gioco.
X -> Eccessivo contatto alla base del dente.
Allontanare il pignone dalla corona ed avvicinare poi la corona al pignone per regolare il gioco.

OK -> Correct contact.
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.
Z -> Excessive contact on the tooth tip.
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.
X -> Excessive contact at the tooth base.
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.

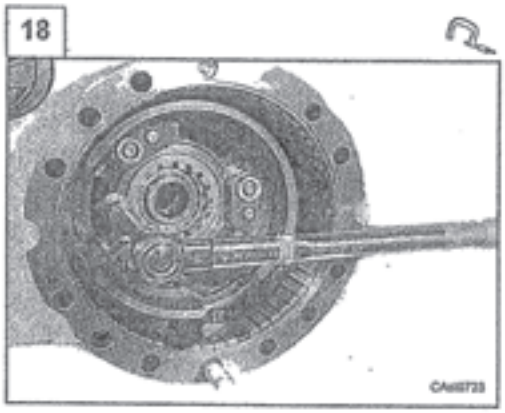
17



Spostamenti per le correzioni:
1 -> spostare il pignone per modifica contatto tipo X
2 -> spostare il pignone per modifica contatto tipo Z

Movements to correct.
1 -> move the pinion for type X contact adjustment
2 -> move the pinion for type Z contact adjustment.

18



Inserire il fermo ghiera ruotando la ghiera il minimo indispensabile per allinearla al fermo.
Inserire la vite di fissaggio del fermo ghiera ed avvitarla con una chiave dinamometrica alla coppia prevista (sez. C.8).

Insert the ring nut retainer turning the ring nut slightly in order to align it to the retainer.
Screw in and tighten the screw of the ring nut retainer with a dynamometric wrench to the requested torque (sec. C.8).

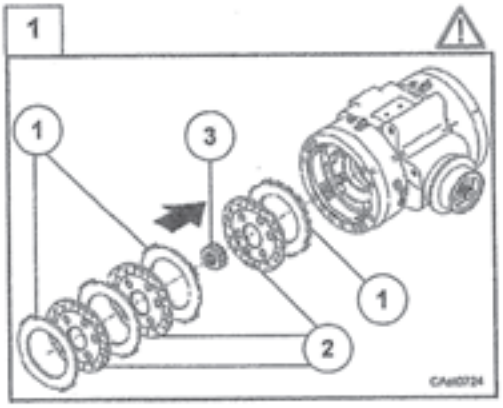
E.4 Montaggio gruppo trave e gruppi freno

E.4 Axle beam trumpets and brake groups asselmbly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

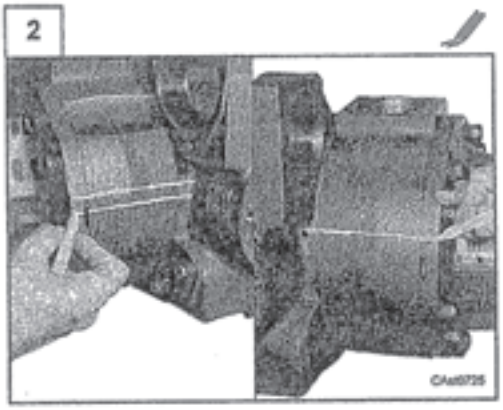
1



Verificare che il disco di attrito ed i controdischi non presentino tracce di bruciatura; in caso contrario sostituirli. Verificare inoltre l'usura del disco di attrito (sez. C.4) e sostituirlo se necessario.Rimontare tutti gli elementi del gruppo freno all'interno della flangia come indicato in figura rispettando la sequenza: controdisco (1), disco freno (2) manicotto (3) con la sede per l'anello d'arresto verso l'interno ed i restanti dischi e controdischi (2) e (1).
Nota: Se si installano nuovi dischi freno, prima del montaggio, immergerli nell'olio prescritto.
Attenzione: il gruppo dischi e controdischi freno è libero.

Check that the friction disc and the counterdiscs do not present any sign of burning; on the contrary, replace them. Furthermore check friction disc wear (sec. C.4) and if necessary replace them.Reassemble all the components of the brake group inside the flange as per the sequenze in the figure: drive-plate (1), disc (2), coupling (3), with the snap ring housing inward disc and drive-plate (2) e (1).
***Note:** if new brake discs (2) are installed, before assembling, they should be dipped in the required oil.*
***Warning:** the discs and counterdiscs unit are free.*

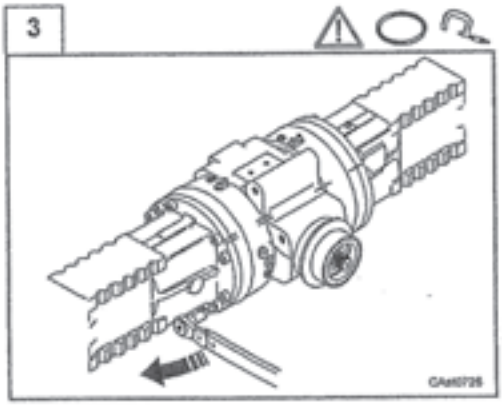
2



Prima del montaggio, verificare i segni di riferimento eseguiti in fase di smontaggio per il corretto posizionamento delle trombe trave.

In oder to place precisely the axle beam trumpets, before assembly, check the reference marks carried out during disassembly.

3



Inserire un nuovo anello OR nella sua sede sulla tromba trave. Montare la tromba sulla flangia, facendo attenzione all'allineamento dei fori di fissaggio.
Attenzione: Sostenere oppurtunamente i gruppi come già indicato nella fase di smontaggio. Avvitare e serrare le viti di fissaggio della tromba con una chiave dinamometrica alla coppia prevista (sez. C.8).

Insert a new O-ring into the axle beam trumpet housing. Assemble the axle beam trumpet on the flange, being careful to the fastening holes' alignment.
***Warning:** support the groups properly as already pointed out for disassembly phase. Screw in and tighten the fastening screws of the axle beam trumpet with a dynamometric wrench to the requested torque (sec. C.8).*

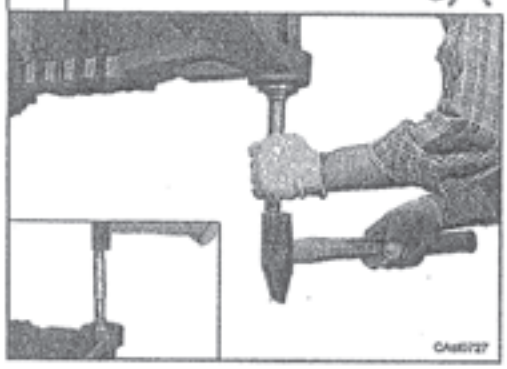
E.5 Montaggio gruppo trave

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.5 Axle beam group assembly

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

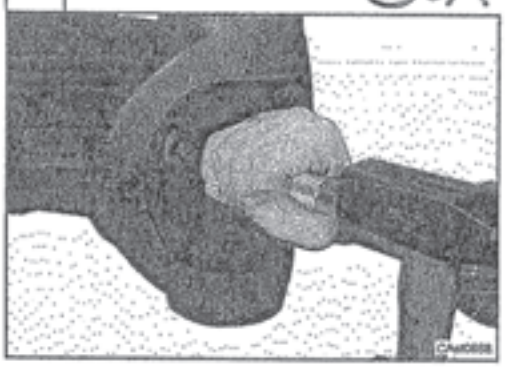
1



Montare la boccola del perno snodo superiore nel trave utilizzando il battitoio CA715034 ed un martello.
Infilare la pista esterna della rotula sferica sulla parte inferiore del trave con il battitoio CA715034 e un martello.
Nota: per facilitare il montaggio, si consiglia di raffreddare la pista esterna della rotula sferica a temperature inferiori a -100°C.

Assemble the upper king pin bush on the axle beam with the special tool CA715034 and a hammer. Insert the cup of the ball bearing on the lower part of the axle beam with the special tool CA715034 and a hammer
***Note:** To make the assembly easier, it is necessary to cool the cup of the ball bearing at a temperature less than 100°C.*

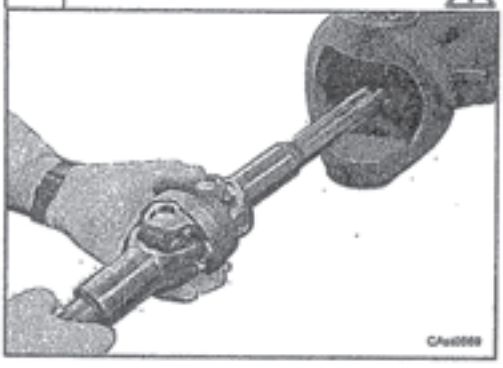
2



Montare nel trave la bronzina con il battitoio CA715157 ed un martello.
Riempire per 3/4 la camera dell'anello con grasso, applicare pasta sigillante sulla sua superficie esterna.
Montare l'anello di tenuta nel trave con il battitoio CA715402 ed un martello.

Assemble the bush on the axle beam with the special tool CA715157 and a hammer.
Fill 3/4 of the ring cavity with grease and apply sealing compound on its outer surface.
Assemble the seal ring on the beam with the special tool CA715402 and a hammer.

3



Lubrificare la boccola ed il labbro dell'anello di tenuta.
Inserire il doppio giunto all'interno del trave.
Attenzione: non rovinare la tenuta.

Lubricate the bush and the seal ring lip.
Insert the U-Joint inside the axle beam.
***Warning:** be careful not to damage the seal.*

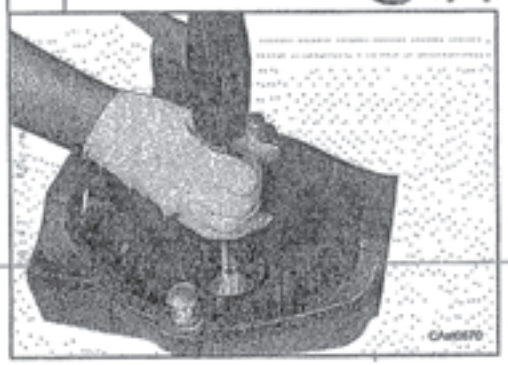
E.6 Montaggio gruppo mozzo ruota

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.6 Wheel hub group assembly

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

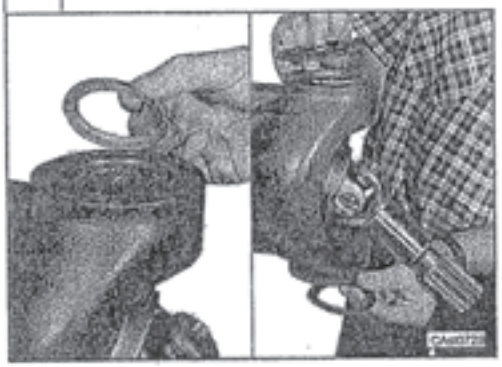
1



Piantare la bronzina nella calotta con il battitoio CA119097 ed un martello o una pressa.
Riempire la camera dell'anello di tenuta per 3/4 con grasso. Applicare pasta sigillante sulla superficie metallica esterna e montare l'anello di tenuta nella calotta con il battitoio CA715360 ed un martello.

Force the bush in the swivel housing with the special tool CA119097 and a hammer or a press.
Fill 3/4 of the gasket cavity with grease. Apply sealing compound on the outer metallic surface of the seal and assemble the seal ring on the swivel housing with the special tool CA715360 and a hammer.

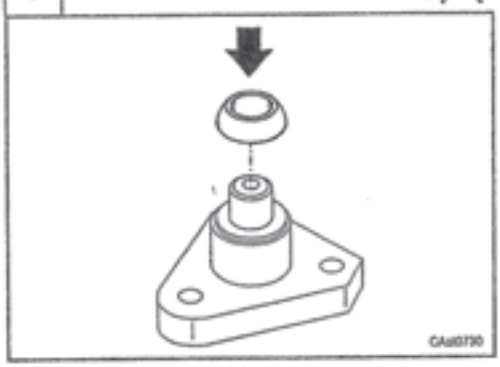
2



Montare lo spessore sotto la molla a tazza nella parte superiore.
Ingrassare bene le sedi dei perni snodo con grasso specifico (Sez. C.4)
Posizionare le molle a tazza sulle sedi perni snodo.

Put the shim under the Belleville washer on the upper part.
Grease well the king pin housings with specific grease (Sec. C.4).
Position the Belleville washers on the king pin housings.

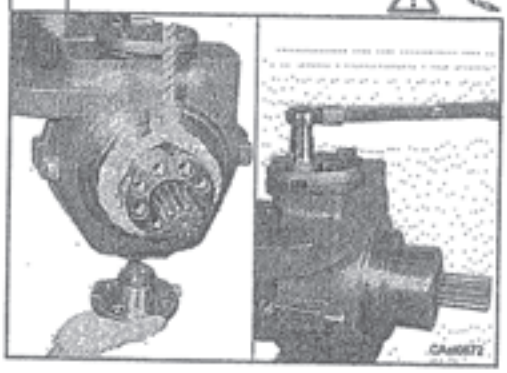
3



Posizionare il perno snodo inferiore su di un banco di lavoro e montare la pista interna della rotula sferica con il battitoio CA715035 sotto l'azione di una pressa.

Position the lower king pin on a workbench and assemble the cone of the spherical joint with the special tool CA715035 under a press.

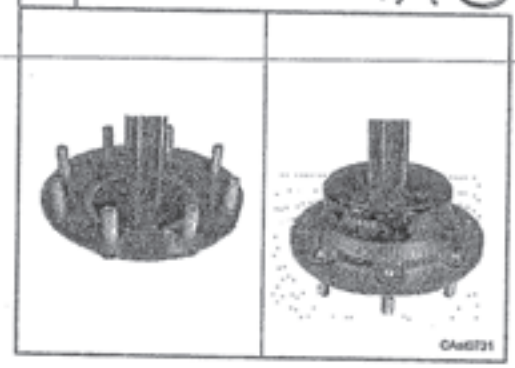
4



Pericolo: assicurare il gruppo calotta con una fune.
Lubrificare il labbro dell'anello di tenuta nella calotta ed avvolgere l'estremità scanalata di semiasse con del nastro adesivo sottile, per non danneggiare l'anello di tenuta.
A montaggio avvenuto, rimuovere tutto il nastro protettivo.
Inserendo il semiasse nella calotta, assemblare la calotta al trave.
Montare i due perni snodo inferiore e superiore e serrare le viti del supporto con chiave dinamometrica alla coppia prevista (Sez. C.8).
Nota: assicurarsi che le molle a tazza rimangano nella loro posizione.

Danger:*secure the swivel housing group with a rope.*
Lubricate the seal ring lip and protect the splined end of the axle shaft by winding it with thin adhesive tape to avoid damage to the seal ring.
After assembly, remove completely the adhesive tape.
Assemble the swivel housing on the axle beam.
Assemble the two king pins, the upper and the lower, and tighten the retaining screws with dynamometric wrench to the requested torque (Sec. C.8).
Note: *make sure that the Belleville washers remain in their position.*

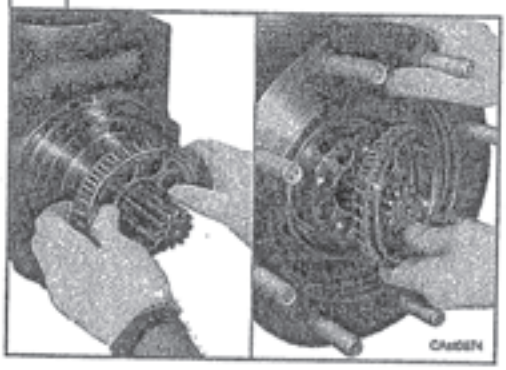
5



Posizionare il mozzo ruota su di un banco di lavoro e piantare le due piste esterne dei cuscinetti a rulli conici con il battitoio CA715026 sotto l'azione di una pressa o di un martello.
Applicare la pasta sigillante sulla circonferenza esterna della tenuta ed inserire l'anello di tenuta nel mozzo ruota con il battitoio CA119143 ed un martello.

Position the wheel hub on a workbench and force the two cups of the taper roller bearings in position with the special tool CA715026 under a press or with a hammer.
Apply the sealing compound on the seal outer circle and insert the seal ring into the wheel hub with the special tool CA119143 and a hammer.

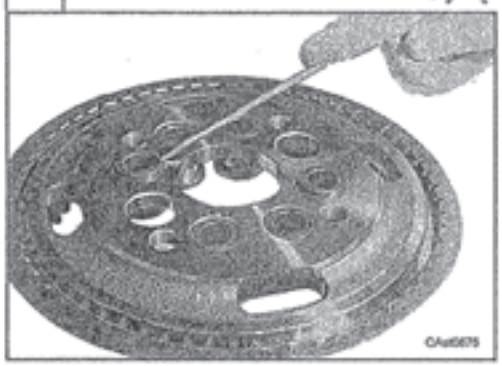
6



Montare la pista interna del cuscinetto a rulli conici sul codolo della calotta.
Montare il mozzo ruota sulla calotta e piantare l'altra pista interna del cuscinetto a rulli conici.

Assemble the cone of the taper roller bearing on the swivel housing end.
Assemble the wheel hub on the swivel housing and force the other cone of the taper roller bearing in position.

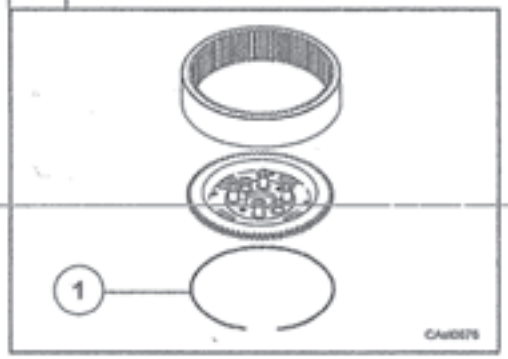
7



Posizionare il mozzo fermo corona su banco di lavoro e piantare le boccole a filo con battitoio CA715027.
Almeno due boccole (diametralmente opposte) devono essere piantate leggermente oltre il filo per essere utilizzate come spine di centraggio.

Position the wheel carrier on a workbench and force the bushes to the carrier surface level with the special tool CA715027.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

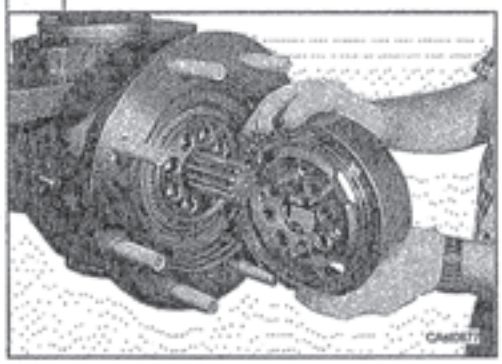
8



Preassemblare il gruppo mozzo fermo corona, corona epicicloidale, con lo speciale anello d'arresto indicato in figura (1).

Preassemble the wheel carrier group, epicyclic ring gear, with the special snap ring shown in the figure (1).

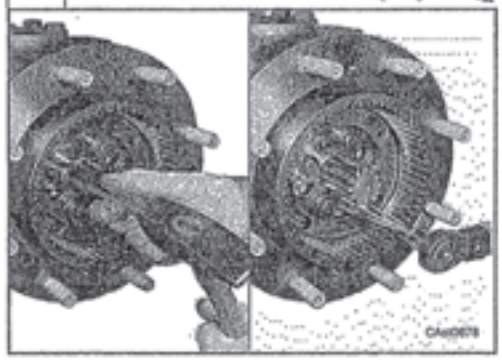
9



Montare il gruppo mozzo fermo corona sul mozzo ruota utilizzando le due boccole sporgenti come spine di centraggio.

Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins.

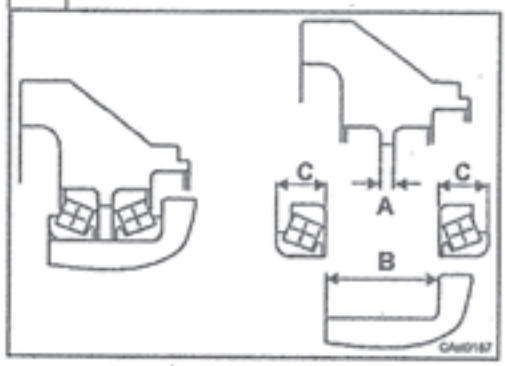
10



Piantare con il battitoio CA715027 ed un martello tutte le bussole di centraggio mozzo fino a battuta.
Montare le viti di fissaggio mozzo fermo corona e serrare alla coppia prevista (Sez. C.8).

Force all the hub dowel bushes completely with the special tool CA715027 and a hammer.
Assemble the wheel carrier fastening screws and tighten to the requested torque (Sec. C.8).

11

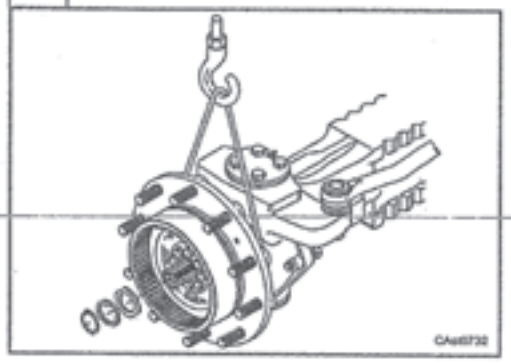


La speciale esecuzione "Set Right" dei cuscinetti non richiede specifiche registrazioni del precarico o del gioco. In ogni caso, prima del montaggio di nuove parti, controllare le dimensioni indicate

A = 8.450 ÷ 8.500
B = 54.775 ÷ 54.825
C = 23.070 ÷ 23.172

The special operation "Set Right" of the bearings does not require specific registrations of preloading or backlash. Anyway, before assembling new components check the indicated dimensions.

12



Infilare nel semiasse del doppio giunto le ralle, lo spessore e bloccare alla fine con l'anello d'arresto.

Insert the ring and the shim into the axle shaft of the U-Joint and lock with the snap ring.

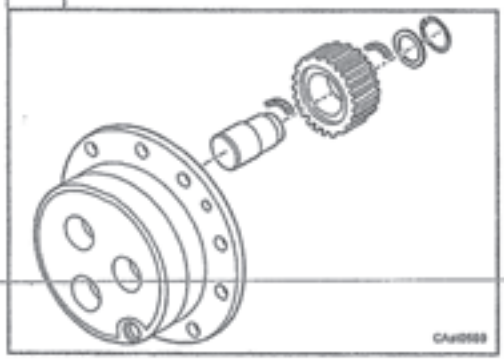
E.7 Montaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.7 Epicyclic reduction gear assembly

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

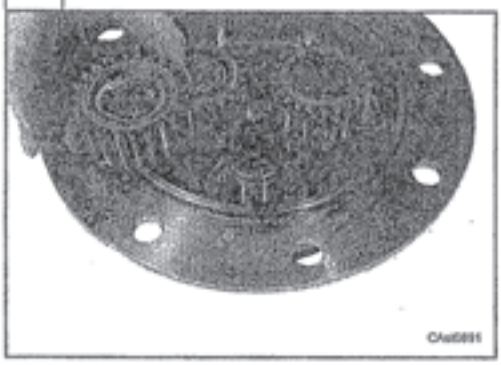
1



Recuperare tutti i componenti del riduttore epicicloidale.

Collect all the components of the epicyclic reduction gear.

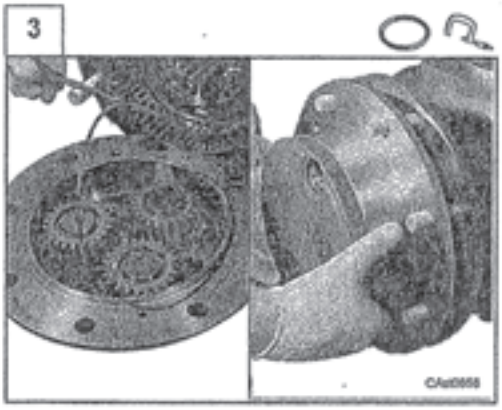
2



Posizionare su un banco di lavoro il treno porta satelliti.
Inserire nei perni del treno portasatelliti: i satelliti epicicloidali, i rullini inferiori, i rullini superiori, le ralle e gli anelli d'arresto.

Position the planetary carrier on a workbench.
Insert the planetary gear, the lower needle bearings, the upper needle bearings, the trust washers and the snap ring in the planetary carrier pins.

3



Inserire un nuovo anello OR sul riduttore epicicloidale.
Montare il gruppo riduttore epicicloidale sul mozzo ruota.
Avvitare le viti di fissaggio e serrare con chiave dinamometrica alla coppia prevista (Sez. C.8).

Assemble a new O-ring on the epicyclic reduction gear.
Assemble the epicyclic reduction gear on the wheel hub.
Screw in the fastening screws and tighten with dynamometric wrench to the requested torque (Sec. C.8).

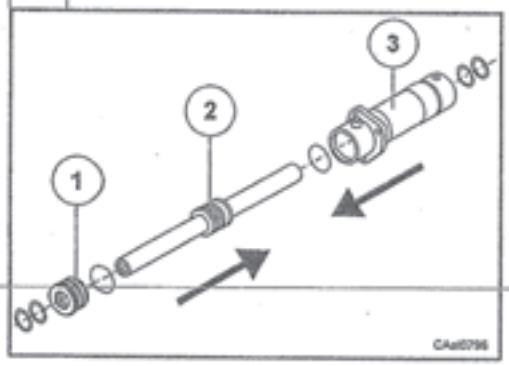
E.8 Montaggio gruppo cilindri sterzo

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.8 Steering cylinders group assembly

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

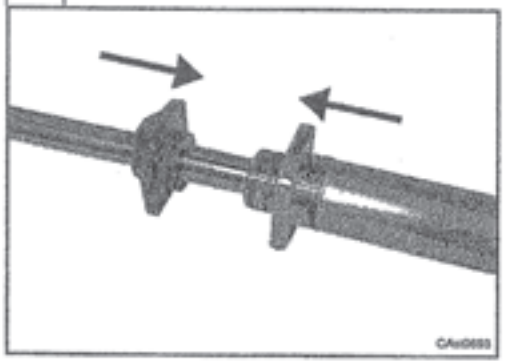
1



Montare nuovi anelli di tenuta sulla testata del cilindro (1), sul pistone (2) e nel corpo cilindro (3).

Assemble new seal rings on the cylinder head (1), on the piston (2) and on the cylinder body (3).

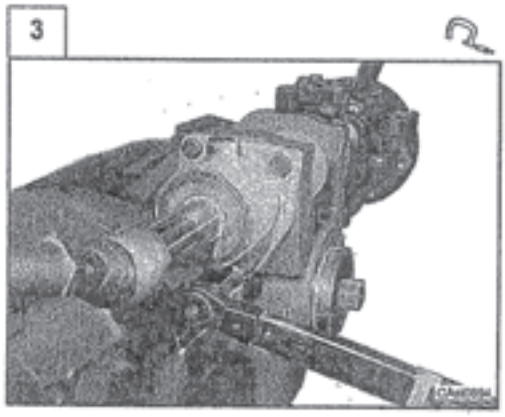
2



Infilare lo stelo premontato nel corpo cilindro.

Slide pre-assembled rod into the cylinder body.

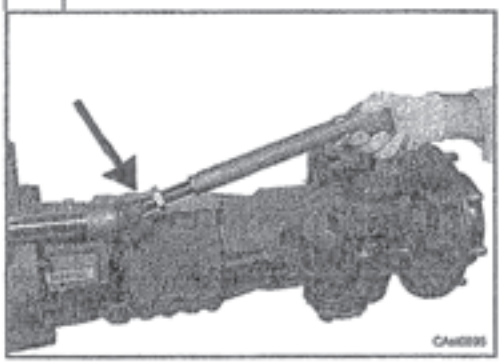
3



Montare alle estremità dello stelo del martinetto le aste guida serrandole con chiave dinamometrica alla coppia prevista (Sez. C.8).
Installare sul corpo centrale il cilindro sterzo, completo di aste guida già montate sullo stelo.
Montare e serrare le viti di fissaggio del cilindro sterzo con chiave dinamometrica alla coppia prevista (Sez. C.8)

Fit the guide rods to the ends of the cylinder rod and tighten with dynamometric wrench to the requested torque (Sez. C.8).
Install the steering cylinder on the central body, with guide rods already assembled on the stem.
Assemble and tighten the steering cylinder fastening screws with dynamometric wrench to the requested torque (Sec. C.8).

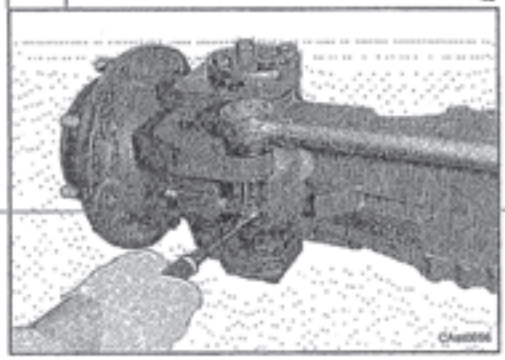
4



Avvitare o svitare l'asta guida di una quantità tale da poter infilare lo snodo sferico sulla calotta.
Nota: è importante svitare il dado di bloccaggio per eseguire questa operazione.

Screw in or out the guide rod so that the ball joint can be inserted into the swivel housing.
***Note**: it is important to unscrew the locking nut to carry out this operation.*

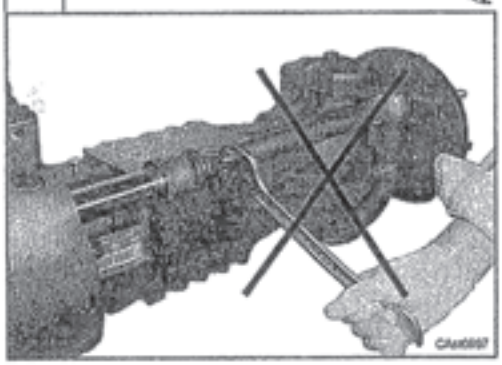
5



Inserire lo snodo sferico nella propria sede sulla calotta.
Montare e serrare il dado di fissaggio con chiave dinamometrica alla coppia prevista (Sez.C.8).

Insert the ball joint into its own housing on the swivel housing.
Assemble and tighten the lock nut with dynamometric wrench to the requested torque (Sec. C.8).

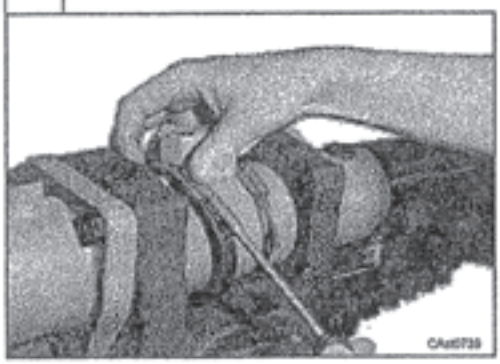
6



Non avvitare il dado di bloccaggio dell'asta guida fino a quando non si è effettuata la registrazione della convergenza.

Screw in the lock nut of the guide rod only when the toe-in adjustment has been carried out.

7



Rimontare il sensore e fissarlo al centro del cilindro per mezzo di fascette opportunamente serrate.
Nota: non serrare le fascette definitivamente fino a quando non vengono effettuate le registrazioni di convergenza e di sterzata.

Assemble and fix the sensor in the middle of the cylinder by means of properly tightened clamps.
***Note**: not tighten the clamps can be completely tightened only when the toe-in adjustment has been carried out and steering.*

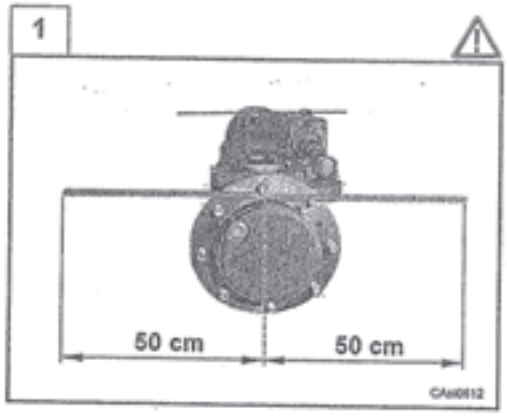
E.9 Registrazione convergenza

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.9 Toe-in adjustment

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

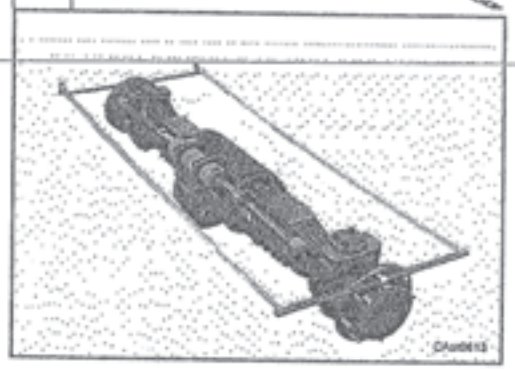
1



Montare 2 barre lineari uguali, lunghe 1 m, sui lati ruota, bloccandole con due dadi, sui prigionieri mozzo ruota.
Attenzione: Le due barre devono essere fissate alla loro mezzeria, in modo che siano perfettamente perpendicolari alla superficie di appoggio e parallele all'asse del pignone. Allineare al meglio le due barre.

Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.
***Warning:** The two bars should be fixed on their middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft. Align the two bars.*

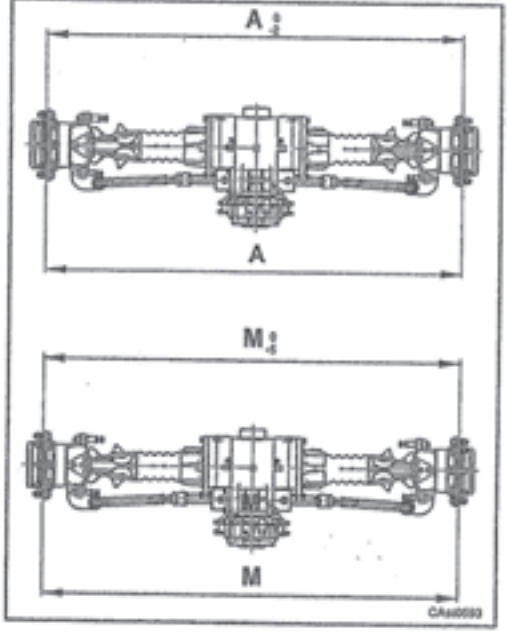
2



Rilevare con un metro a nastro, dai punti più estremi delle barre, la distanza millimetrica (M).
Nota: Prendere il valore minimo oscillando il punto di misurazione.

Measure the distance in mm. between the bar ends with a tapeline (M).
***Note:** Keep the minimum value, swinging the measurement point.*

3



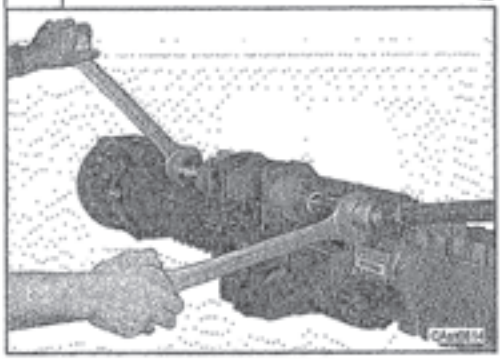
Verificare che la differenza tra le misurazioni alle estremità dei diametri dei mozzi ruota rientri nel campo di tolleranza richiesto (Vedi "convergenza" in sez. C.4).
Il valore della convergenza nominale (A) é riferito al diametro esterno della flangia dei mozzi ruota, quindi il valore della convergenza misurata (M) alle estremità delle barre deve essere rapportato alle loro proporzioni rispetto a tale diametro.

convergenza nominale (sez.C.4) = $A.^{\circ}_{2}$ **convergenza misurata =** $M.^{\circ}_{6}$

Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range (See "Toe-in" in sec. C.4)
The nominal toe-in (A) value is referred to the external diameter of the wheel hubs flange,therefore the measured toe-in value (M) at the bars ends must be related to the ratio between lenght of the bar anf flange diameter.

nominal toe-in (sec.C.4) = $A.^{\circ}_{2}$ ***measured toe-in =*** $M.^{\circ}_{6}$

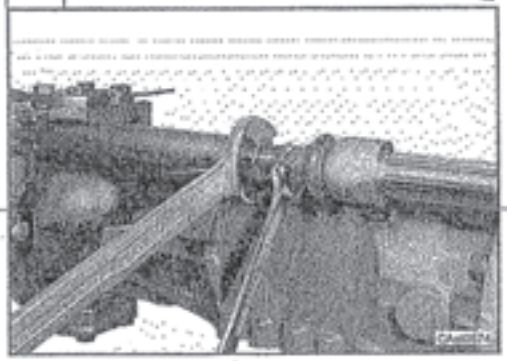
4



Nel caso che la convergenza non sia esatta agire con due chiavi sulle aste guida avvitando e svitando i due tiranti snodo equamente, in modo che alla fine rientri nella tolleranza prevista.

If toe-in is incorrect, operate with two wrenches on the guide rods screwing in and out the two joint tie rods equally till the toe-in is within the requested tolerance.

5



Eseguita la regolazione, avvitare i dadi di bloccaggio delle aste guida alla coppia di serraggio prevista (Sez. C.8)

After adjusting, screw in the lock nuts of the guide rods to the requested torque (Sec. C.8).

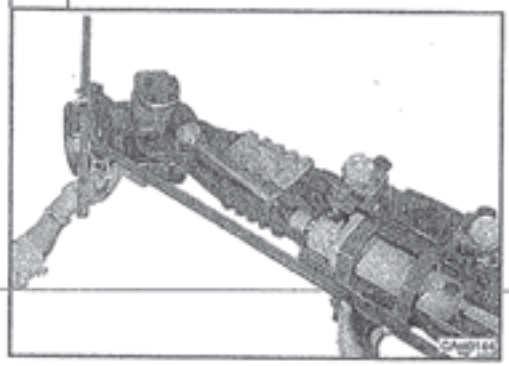
E.10 Registrazione angolo di sterzata

E.10 Steering angle adjustment

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

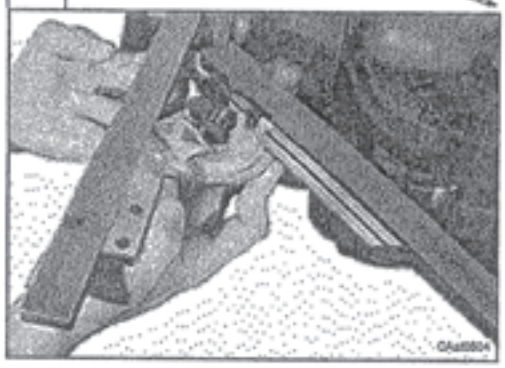
1



Utilizzare le stesse barre montate per la registrazione della convergenza ed una barra lunga appoggiata perfettamente alla parte lavorata del corpo centrale (lato pignone), in modo che al massimo della sterzata le due barre formino un angolo acuto.

Use the same bars assembled for the toe-in adjustment and a long bar perfectly leant over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

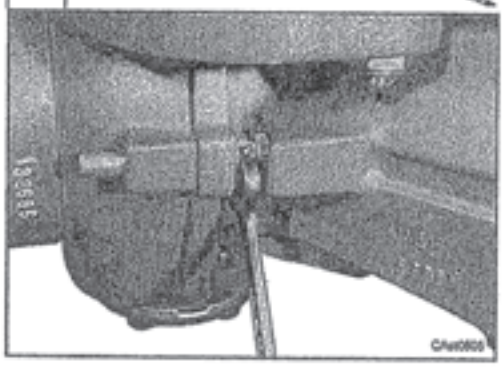
2



Regolare un goniometro all'angolo prescritto (Sez C.4) e posizionarlo sulla barra lunga.
Orientare un lato ruota fino a formare con le due barre l'angolo fissato dal goniometro.

Adjust a goniometer to the requested angle (Sec. C.4) and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the goniometer.

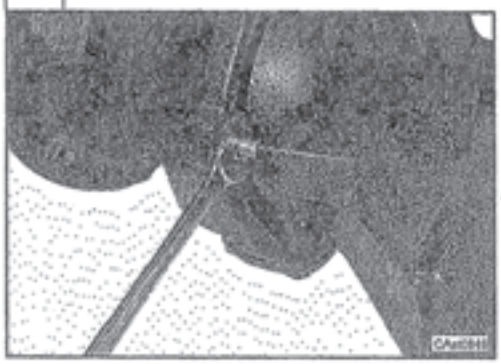
3



Effettuare la regolazione del fermo meccanico di sterzata, avvitando o svitando le apposite viti in battuta sul corpo trave (in figura), bloccandole poi con controdado alla coppia di serraggio prescritta (Sez. C.8).

Adjust the steering mechanical retainer, screwing in or out the special screws on the bar body (see figure), locking them with a locknut to the requested torque (Sec. C.8).

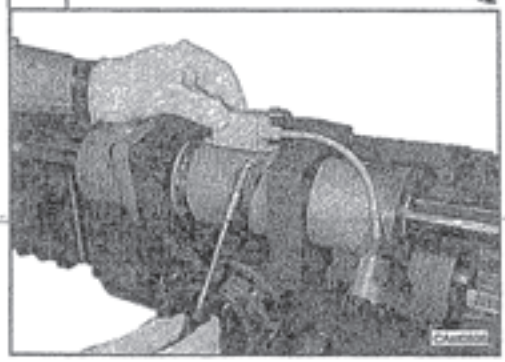
4



Ripetere l'operazione precedente sia nelle due viti della parte anteriore che nelle due viti della parte posteriore dell'assale.
Sterzare completamente dal lato opposto e ripetere le stesse operazioni.

Repeat the previous operation both in the two screws of the axle front part and in the two screws of the axle rear part.
Steer completely towards the other side and repeat the same operations.

5



Registrare il sensore di sterzata sul martinetto, eseguendo le seguenti operazioni:
1) allineare le ruote dell'assale quanto più possibile;
2) posizionare il sensore al centro del martinetto in modo che rimanga attivo solo quando la posizione delle ruote corrisponda al loro allineamento.

Adjust the steering sensor on the cylinder, carrying out the following operations:
1) align the axle wheels as much as possible;
2) position the sensor in the middle of the cylinder so that it activates only when the wheel position corresponds to their alignment.

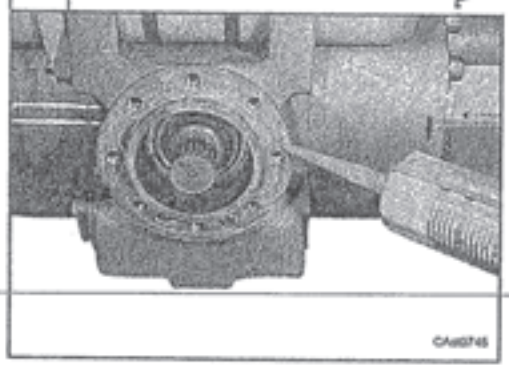
E.11 Montaggio scatola trasmissione

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.11 Transmission box assembly

Some of the following pictures could not show exactlyyour axle, but the procedure is the same.

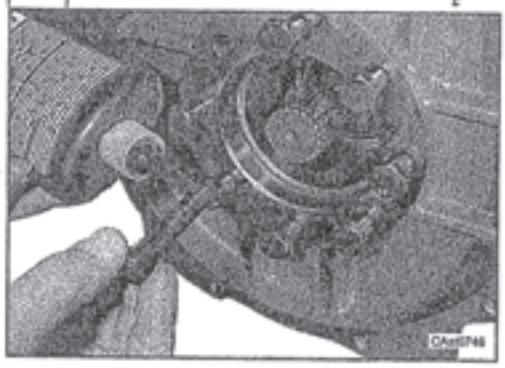
1



Dopo aver pulito accuratamente la superficie di contatto dell'assale con la scatola di trasmissione, stendere un filo di Loctite® 510 sul piano d'appoggio, come in figura.

After you have carefully cleaned the axle part in contact with the transmission box, apply a layer of Loctite® 510 on the supporting surface as per figure.

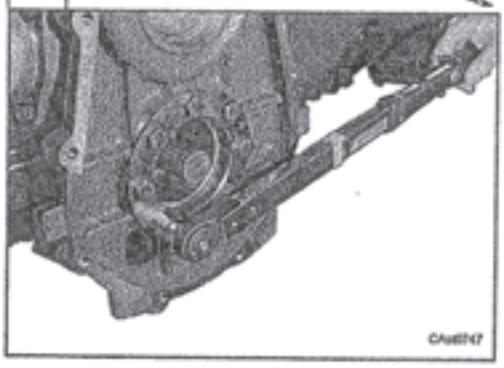
2



Montare la prima semiscatola facendo attenzione al centraggio della spina.
Stendere un velo di Loctite® 270 sul filetto delle viti di fissaggio prima di montarle.

Assemble the first half box, being careful to the pin centering.
Apply a layer of Loctite® 510 on the fastening screws' thread, before assembling them.

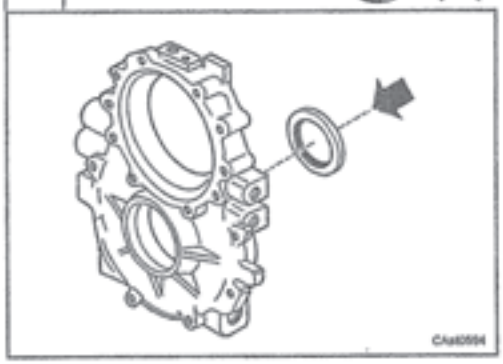
3



Serrare le viti di fissaggio della scatola di trasmissione con chiave dinamometrica alla coppia prevista (Sez. C.8).

Tighten the fastening screws of the transmission box with dynamometric wrench to the requested torque (Sec. C. 8).

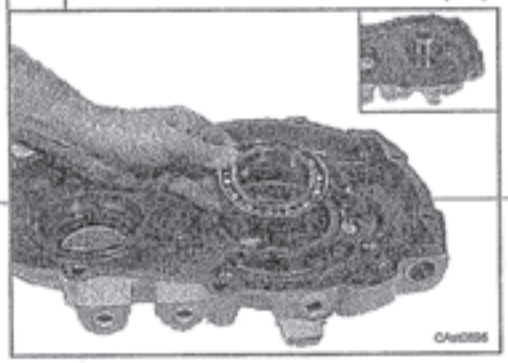
4



Posizionare l'altra semiscatola su una superficie piana. Montare l'anello di tenuta nella sua sede utilizzando il battitoio CA715038 (foro inferiore).

Locate the other half box on a flat surface. Fit the seal ring into its seat using the special tool CA715038 (lower drill).

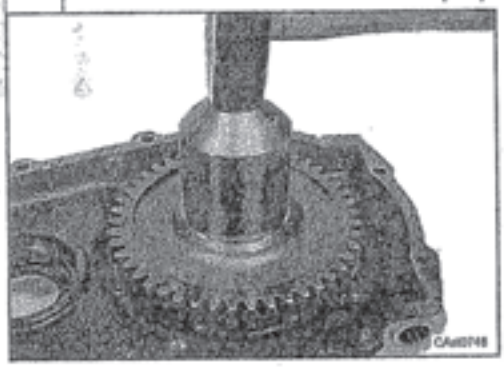
5



Capovolgere la semiscatola.
Posizionare il cuscinetto dell'albero flangiato inferiore nella relativa sede.

Overturn the half box.
Position the bearing of the lower flanged shaft in its housing.

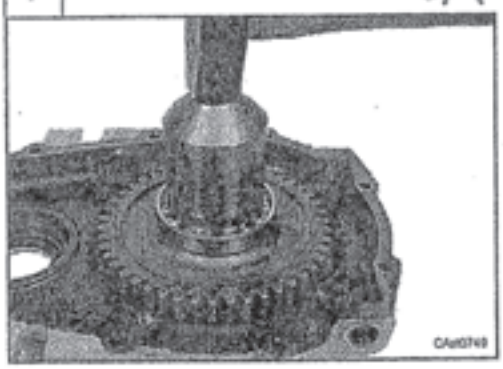
6



Inserire la ruota dentata sull'albero flangiato inferiore.
Piantare la ruota dentata ed il cuscinetto sottostante, utilizzando il battitoio CA715145.

Insert the gear wheel on the lower flanged shaft.
Force the gear wheel and the bearing below into position using the special tool CA715145.

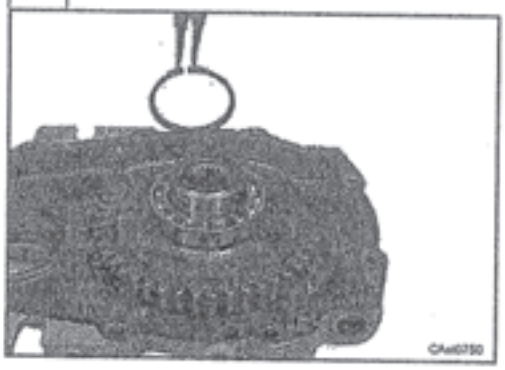
7



Piantare l'altro cuscinetto sull'albero flangiato inferiore, utilizzando il battitoio CA715145.

Force the other bearing on the lower flanged shaft, using the special tool CA715145.

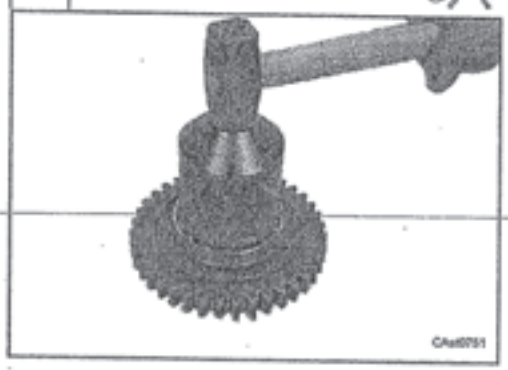
8



Per fissare il tutto, inserire l'anello d'arresto con apposita pinza sull'albero flangiato inferiore.

In order to fix the whole, insert the snap ring on the lower flanged shaft with suitable pliers.

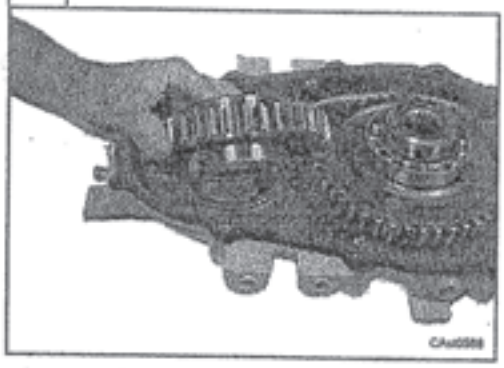
9



Posizionare la ruota dentata superiore sul banco di lavoro.
Montare i due cuscinetti sulla ruota mediante battitolo CA715403 e martello.

Position the upper gear wheel on the workbench.
Assemble the two bearings on the gear using the special tool CA715403 and a hammer.

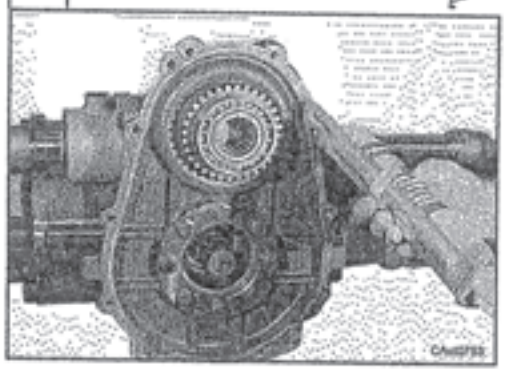
10



Montare, assestandolo con martello e battitolo, il gruppo ruota dentata-cuscinetti nella semiscatola.

Assemble the gear wheel-bearing group and set it with hammer and special tool into the half box.

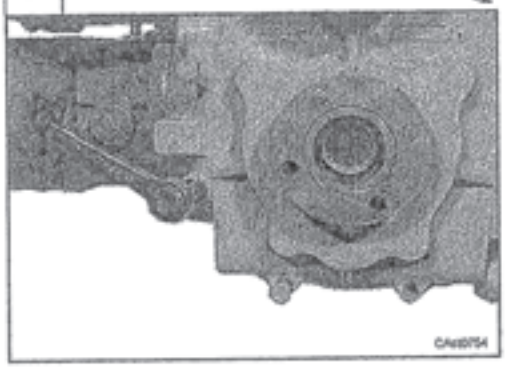
11



Dopo avere accuratamente pulito le superfici di contatto stendere uniformemente della Loctite® 510.

After having carefully cleaned the contact surfaces, lay off Loctite® 510 uniformly.

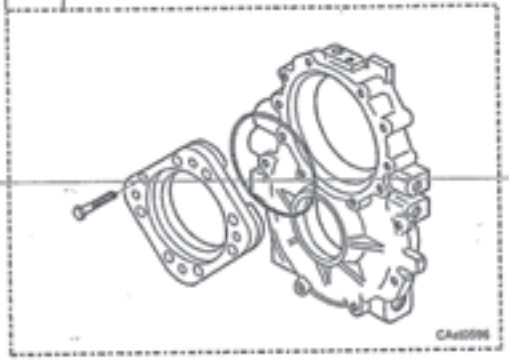
12



Montare la semiscatola su quella fissata all'assale facendo attenzione al centraggio della spina.
Avvitare le viti di fissaggio della scatola e serrarle con chiave dinamometrica alla coppia prevista (Sez. C.8).
Nota: utilizzare un martello di gomma per far aderire perfettamente le superfici delle due semiscatole.

Assemble the half box on the one fixed to the axle, being careful to the pin centering.
Screw in the box fastening screws and tighten them with dynamometric wrench to the requested torque (Sec. C.8).
***Note**: use a rubber hammer in order to let the two half boxes' surfaces adhere perfectly.*

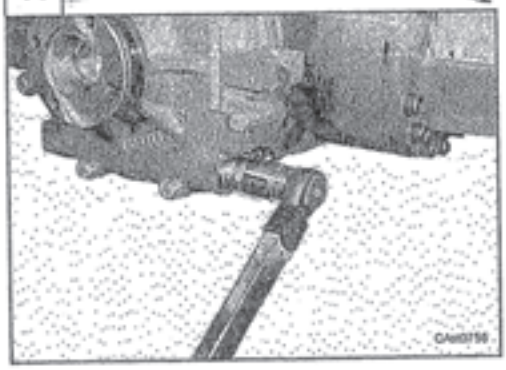
13



Montare sulla flangia motore il relativo OR ben lubrificato.
Assemblare la flangia motore avvitando le relative viti di fissaggio con chiave dinamometrica alla coppia prevista (Sez. C.8).

Grease the O-ring and fit it to the engine flange.
Assemble the engine flange by screwing the fastening screws with a torque wrench at the corrected torque (Sec. C.8).

14

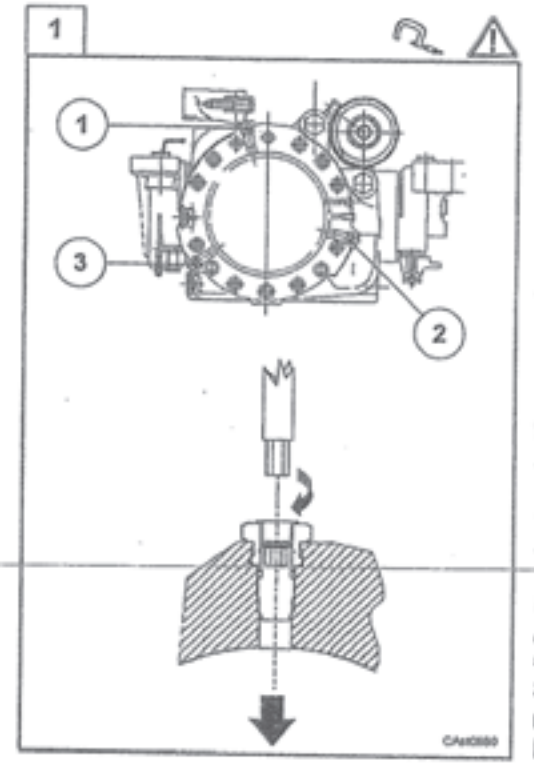


Ripristinare il collegamento oleo-idraulico tra assale e trasmissione.
Montare il tubo di ricircolo olio, le relative viti di fissaggio e serrarle con chiave dinamometrica alla coppia prevista (Sez. C.8).

Restore the hydraulic connection between axle and transmission .
Assemble the oil recirculating pipe, the relative fastening screws and tighten them with dynamometric wrench to the requested torque (Sec. C.8).

E.12 Sbloccaggio freno parcheggio (prima dello smontaggio)

E.12 Parking brakes release (before assembly)



Attrezzatura:
- chiave a punta esagonale 8 mm
- chiave a cricco reversibile da 3/8" + prolunga da 3"

Operazioni di emergenza:
Attenzione: BLOCCARE LE RUOTE. Il non farlo può essere molto pericoloso o addirittura mortale per l'operatore: il veicolo infatti potrebbe muoversi da solo.

Bloccare tutte equattro le ruote per impedire il movimento del veicolo una volta che il freno è stato disinserito.
Per disabilitare i freni di parcheggio è necessaria una chiave a brugola da 8 mm.
Fare un segno sulla testa delle viti per poter contare il numero di giri che ciascuna vite dovrà fare mentre eseguite la procedura.
Sdraiarsi sotto l'assale ed individuate le sei viti di rilascio (tre per ciascun lato) alla base dell'assale.
Avvitare alternativamente di 1/2 giro alla volta in senso orario le viti di rilascio freno (1), (2) e (3) fino a quando si inizia a sentire una certa resistenza.
Avvitare alternativamente di 1/2 giro alla volta le viti (1), (2) e (3) per **5 ÷ 5.5** giri.
Spostarsi da sotto il veicolo e liberare l'area circostante dal personale non coinvolto dalle operazioni.
Rimuovere con attenzione i ceppi di bloccaggio dalle quattro ruote e trainare il veicolo in un luogo sicuro.
Bloccare nuovamente le quattro ruote e continuare con le operazioni che necessitano.

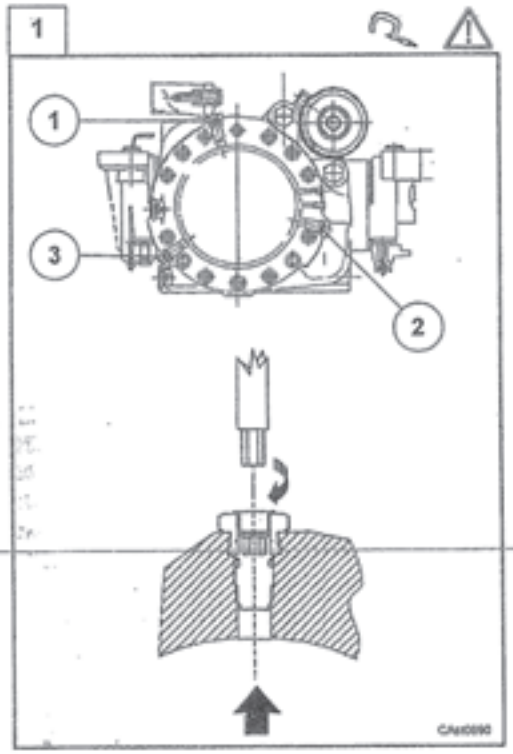
Tooling:
- 8 mm hex bit socket
- 3/8" reversible ratchet + 3" extension

Disabling Aall four wheels
***Warning:** BLOCK ALL FOUR WHEELS. Failure to do so could result in death or serious injury from vehicle roll away.*

Block all four wheels to prevent the vehicle from moving once the parking brake is disabled.
An 8 mm Allen head socket will be needed to properly disable the parking brakes.
Mark a line on the socket so you can accurately count the number of turn each bolt makes as you perform the procedure.
Lie down under the front axle and locate the six brake release bolts (three bolts per side) at the base of the front axle.
Alternately screw 1/2 turn brake release bolts (1), (2) and (3) inxard direction (clockwise) until you first begin to feel resistance.
*Alternately screw 1/2 turn the bolts (1), (2) and (3) inward direction of **5 ÷ 5.5** turns.*
To get out from under the vehicle and clear the area of an y unnecessary personnel.
Carefully remove the blocking from each of the four tires and tow the vehicle to asecure location.
Block all four wheels and continue following the procedure.

E.13 Riattivazione freno parcheggio (dopo il montaggio)

E.13 Re-activating parking brakes (after assembly)



Attenzione: BLOCCARE LE QUATTRO RUOTE. Il non farlo può essere molto pericoloso o addirittura mortale per l'operatore: il veicolo infatti potrebbe muoversi da solo.

Bloccare tutte e quattro le ruote, sdraiarsi sotto l'assale e, utilizzando la chiave dinamometrica, svitare alternativamente le viti di rilascio (1), (2) e (3) (in senso antiorario) di 1/2 giro.
Di nuovo svitare alternativamente di 1/2 giro le viti (1), (2) e (3) fino a quando la coppia si riduce bruscamente.
Continuare a svitare alternativamente le viti (1), (2) e (3) fino a quando si avverte che la testa della vite va a contatto con la vite speciale.
Riavvitare poi in senso inverso le viti (1), (2) e (3) di 1/4 di giro.
I freni di parcheggio sono a questo punto riattivati e le ruote anteriori bloccate.
Rimuovere quindi i ceppi dalle quattro ruote.
Verificare l'efficienza delo freno di parcheggio.
Rimuovere i cartelli di pericolo o di avviso dal volante e dalla chiave d'accensione.

Warning: *BLOCK ALL FOUR WHEELS. Failure to do so could result in death or serious injury from vehicle roll away.*

After you have locked all four wheels, lie down under the axle. Using the torque wrench, alternately unscrew brake release bolts (1), (2) and (3) outward direction (counterclockwise) 1/2 turn.
Again, alternately unscrew brake release bolts (1), (2) and (3) outward direction 1/2 turn until the torque drops off sharply.
Alternately unscrew brake release bolts (1), (2) and (3) outward direction (counterclockwise) until feel the bolts flange begin to contact against the special screw.
Screw the bolts (1), (2) and (3) inward direction 1/4 turn
The parking brakes should now be re-activated and the front wheels are locked.
Remove the blocking from the four tires.
Verify that parking brake words.
Remove any warning tags from the ignition lock key and from the steering wheel.

E.14 Prove dopo montaggio

Passo 1
A motore spento, sollevare l'assale (i) della ruota motrice sino a che i pneumatici si siano staccati da terra.

Passo 2
Ingranare la marcia in modo che il pignone sia bloccato.

Passo 3
Con l'aiuto di un'altra persona collocata al lato opposto, iniziare la prova di montaggio ruotando per quanto possibile entrambe le ruote nel senso di marcia avanti. (Entrambe le ruote dovrebbero bloccarsi dopo poco)

Passo 4
Con il pignone sempre bloccato, liberare la ruota di destra e ruotare la ruota di sinistra nel senso (marcia avanti).
Se il montaggio è corretto si dovrà verificare che la ruota giri liberamente senza eccessivi sforzi, e la ruota di destra ruoti in senso opposto.
Ripetere l'operazione nel senso opposto (retro marcia).

SE UNA DELLE RUOTE NON GIRA LIBERAMENTE IN ENTRAMBE LE DIREZIONI, ricontrollare passo passo il montaggio.
Controllare anche che i freni siano regolati in modo da consentirne il corretto funzionamento.

E.14 Testing after assembly

Step 1
With engine off, lift the axle (i) so that the tyres get away from the ground.

Step 2
Engage the gear so that the pinion gets blocked.

Step 3
With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward. (Both the wheels should get blocked after a while.)

Step 4
Keeping the pinion blocked, free the right wheel and rotate the left one in the line of march. Rotate the right wheels in the opposite direction.
The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.
Repeat the same operation in the opposite direction (reverse gear).

IF ONE WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.
Check and see that the brakes are regulated correctly and functioning properly.

RICERCA GUASTI

TROUBLESHOOTING

PROBLEMA	POSSIBILI CAUSE										
	1	2	3	4	5	6	7	8	9	10	11
- Vibrazioni delle ruote; resistenza del pneumatico anteriore; rottura dell'i semiassell.	•	•	•		•						•
- Difficoltà nello sterzare; il veicolo tende ad andare dritto mentre è in curva.	•	•	•	•							•
- Non vi è azione del differenziale; incoppamento in curva.	•			•	•						•
- Rumore eccessivo nella trasmissione.	•	•	•	•	•		•		•		•
- Usura eccessiva del pneumatico.	•	•	•	•	•	•	•				•
- Rumore di attrito.	•			•	•			•	•	•	•
- In marcia avanti si avvertono vibrazioni, rumore intermittente.	•	•	•		•						•

PROBLEMS	POSSIBLE CAUSES										
	1	2	3	4	5	6	7	8	9	10	11
- Wheel vibration; front tyre resistance; halfshaft breakage.	•	•	•		•						•
- Steering is difficult; vehicle goes straight while its turning.	•	•	•	•							•
- No differential action; jamming while steering.	•			•	•						•
- No differential action; jamming while steering.	•	•	•	•	•		•		•		•
- Uneven wear of tyre.	•	•	•	•	•	•	•				•
- Friction noise.	•			•	•			•	•	•	•
- Vibration during forward drive, intermittent noise.	•	•	•		•						•

1 Installazione scorretta / assale difettoso
Correggere l'installazione oppure, se il differenziale non supera una delle fasi di prova, ripararlo o sostituirlo.

2 Sovraccarico e/o distribuzione scorretta del peso
Togliere il peso in eccesso e ridistribuire il carico, rispettando le istruzioni relative al veicolo.

1 Incorrect installation / defective axle
Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

2 Overloading/ incorrect weight distribution
Remove excessive weight and redistribute load, following instructions related to the vehicle.

3 Raggio di rotazione dei pneumatici diversi

Un pneumatico con raggio più piccolo provoca un parziale slittamento della ruota quando si applica energia. L'altro pneumatico con raggio maggiore dovrà sopportare tutto il lavoro. Sostituire il pneumatico o regolare la pressione di entrambi sino a che il raggio di rotazione sia uguale.

4 Semiasse rotto

E' sconsigliato usare un veicolo con un solo semiasse. E' possibile tuttavia spostare il veicolo a vuoto con il differenziale bloccato per pochi metri.

5 Semiasse piegato

Sostituire i semiassi.

6 Differenziale bloccato

Funzionamento anomalo del differenziale e/o rottura del dispositivo di comando del bloccaggio di comando. Verificare l'installazione, eventualmente smontare e verificare i componenti.
I veicoli impostati per angoli di sterzata ampi, possono procedere a scatti, avere difficoltà di sterzo e provocare un consumo del pneumatico nelle curve strette.
Ridurre l'angolo di sterzata minimo e decelerare quando il motore inizia a procedere a scatti.

3 Different rotation radius of the tyres

If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied. The other tyre with bigger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyre.

4 Broken halfshaft

It is not advisable to operate the vehicle with a broken halfshaft. It is acceptable to move the vehicle (engine off unloaded) a few meters away only.

5 Bent halfshaft

Replace halfshaft.

6 Blocked differential

Abnormal functioning of the differential or breakage/ blockage of command device. Verify assembly and all components.
Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns. Reduce the steering angle to minimum and decelerate when the vehicle begins to kick.

7 Allineamento scorretto della ruota

Verificare l'integrità della struttura, e cuscinetti lato ruota.

8 Parti dell'assale consumate o difettose

Controllare le condizioni della corona dentata, dell'ingranaggio del pignone, dei cuscinetti, delle guarnizioni, ecc. Sostituire dove necessario.

9 Corpi estranei nella scatola dell'assale o montaggio scorretto di alcune sue parti

Controllare se vi sono corpi estranei. Controllare il montaggio delle parti dell'assale.

10 Regolazioni della coppia conica scorrette: parti di trasmissione consumate

(ingranaggi di trasmissione, giunti, ecc.). Sostituire o regolare secondo necessità.

11 Uso scorretto del prodotto

Rivedere le istruzioni rilasciate dal produttore del veicolo.

7 Incorrect wheel adjustment

Verify group integrity and wheel side bearings. Adjusting according.

8 Spoiled or worn out axle parts

Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.

9 Contamination in the axle box or incorrect assembly of parts

Look for foreign particles. Check assembly of the various parts of the axle.

10 Incorrect adjustment of bevel gear set: Parts of the transmission worn out.

(transmission gears, U joints, etc.)
Replace or adjust as required.

11 Incorrect use of the product

See the vehicle producer's instructions once again.

F.1 Controllo ed esame dei guasti

Questo capitolo offre una guida descrittiva ed esplicativa di problemi che si possono comunemente riscontrare sugli assali o di avarie che si possono verificare. La guida suggerisce anche le corrette procedure di riparazione.

Problema	Causa	Riparazione consigliata
Rottura verso l'estremità esterna del dente corona dentata	1. Carico dell'ingranaggio eccessivo rispetto a quello previsto 2. Regolazione ingranaggio scorretto (gioco eccessivo) 3. Dado del pignone allentato.	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente.
Rottura verso l'estremità interna del dente corona dentata	1. Urto da carico 2. Regolazione ingranaggio scorretto (gioco insufficiente) 3. Dado del pignone allentato	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente
Denti del pignone e della corona dentata erosi o rigati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Lubrificante errato o con additivi impoveriti 4. Cuscinetti del pignone consumati che provocano un gioco assiale del pignone e un contatto tra pignone e corona scorretto.	Sostituire corona dentata e pignone. Sostituire i cuscinetti del pignone facendo attenzione a sistemare correttamente la corona, il pignone e i precarichi dei cuscinetti. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti della corona e del pignone surriscaldati. Guardare se i denti dell'ingranaggio hanno perso la colorazione	1. Funzionamento prolungato a temperatura eccessiva. 2. Lubrificante scorretto 3. Livello dell'olio basso 4. Lubrificante sporco.	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti del pignone di comando butterati	1. Uso estremamente intenso 2. Lubrificazione insufficiente	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Corpo trave dell'assale piegato	1. Sovraccarico del veicolo 2. Veicolo incidentato 3. Urto da carico	Sostituire il corpo trave dell'assale
Cuscinetti consumati o butterati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Uso estremamente intenso 4. Consumo normale 5. Dado del pignone allentato.	Sostituire i cuscinetti. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Le guarnizioni perdono olio	1. Funzionamento prolungato con temperatura dell'olio eccessiva. 2. Guarnizione dell'olio montata male 3. Bordo della guarnizione tagliata o intaccata 4. Lubrificante sporco	Sostituire la guarnizione e la superficie di accoppiamento se danneggiata. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Usura eccessiva della scanalatura della flangia di entrata.	1. Uso intenso 2. Dado del pignone allentato 3. Gioco assiale del pignone	Sostituire la flangia Controllare che la scanalatura del pignone non sia eccessivamente consumata Sostituire corona dentata e pignone, se necessario.
Rottura per fatica del dente dell'ingranaggio del pignone. Guardare se la linea di frattura ad onda è ben delineata (linea di arresto).	1. Uso intenso 2. Sovraccarico continuo	Sostituire corona dentata e pignone.

Problema	Causa	Riparazione consigliata
Rottura denti pignone e corona	Carico d'urto dei componenti del differenziale	Controllare e/o sostituire altri componenti differenziale.
Scanalature dell'ingranaggio planetario consumate (gioco eccessivo)	Uso intenso	Sostituire il gruppo ingranaggi differenziale. Sostituire il semiasse, se necessario.
Superfici della ralla di rasamento consumate o graffiate	1. Lubrificazione insufficiente 2. Lubrificazione scorretta 3. Lubrificante sporco	Sostituire tutte le ralle graffiate e quelle con uno spessore di 0,1mm inferiore a quello di rosette nuove. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Diametro interno del cuscinetto a rulli conici del pignone consumato	1. Uso intenso 2. Gioco assiale del pignone eccessivo 3. Lubrificazione inadeguata 4. Lubrificante sporco	Sostituire il cuscinetto Controllare il gioco assiale del pignone Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Semiasse ritorto o rotto	Funzionamento intenso del veicolo, sovraccarico	Sostituire il semiasse
Semiasse spezzato presso la flangia ruota	1. Supporto della ruota allentato 2. Corpo trave piegato	Sostituire il semiasse Controllare la distorsione del corpo trave. Accertarsi che il sostegno della ruota non sia consumato o mal regolato.

F.1 Troubleshooting

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the repair correct procedures to be followed.

Problem	Cause	Action
Ring gear tooth broken at the outer side	1. Excessive gear load compared to the one foreseen 2. Incorrect gear adjustment (excessive backlash) 3. Pinion nut loosened	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set backlash
Ring gear tooth broken side	1. Load bump 2. Incorrect gear adjustment (insufficient backlash) 3. Pinion nut loosened	Replace bevel gear set Follow carefully the recommended operations for the adjustment of bevel gear set backlash.
Pinion or ring gear teeth or worn	1. Insufficient lubrication 2. Contaminated oil 3. Incorrect lubrication or depleted additives 4. Worn out pinion bearings that cause an incorrect pinion axle backlash and wrong contact between pinion and ring.	Replace bevel gear set. Follow carefully the recommended operations for the adjustment of bevel gear set backlash. Use correct lubricants, fill up to the right levels and replace according to the recommended program.
Overheated ring and pinion teeth. See if gear teeth have faded	1. Prolong ed functioning at high temperatures 2. Incorrect lubrication 3. Low oil level 4. Contaminated oil	Replace bevel gear set. Use proper lubrication, fill up to right level and replace at recommended program.
Pinion teeth pitting	1. Excessive use 2. Insufficient lubrication	Replace bevel gear set. Use correct lubrication, fill up to the right level and substitute at recommended intervals
Axle beam body bent	1. Vehicle over loaded 2. Vehicle's accident 3. Load bump	Replace axle beam body
Worn out or pitted bearings	1. Insufficient lubrication 2. Contaminated oil 3. Excessive use 4. Normal wear out 5. Pinion nut loosened	Replace bearings. Use correct lubrication fill up, to the right level and replace at recommended intervals
Oil leakage form gaskets and seals	1. Prolonged functioning at high temperature of the oil 2. Oil gasket assembled incorrectly 3. Seal lip damaged 4. Contaminated oil	Replace the gasket or seal and matching surface if damaged. Use correct lubrication and replace at recommended intervals.
Excessive wearing out of input flange spline	1. Exhaustive use 2. Pinion nut loosened 3. Pinion axle backlash	Replace the flange. Check that the pinion spline is not excessively worn out. Replace bevel gear set if required.
Fatigue failure of pinion teeth See if the fracture line is well defined (wave lines, beach lines)	1. Exhaustive use 2. Continuos overload	Replace bevel gear set
Pinion and ring teeth breakage	1. Crash load of differential components	Check and/or replace other differential components.

Problem	Cause	Action
Side gear spline worn out. Replace all scratched washers (Excessive backlash)	Excessive use	Replace differential gear group. Replace halfshaft if required
Thrust washer surface worn out or scratched.	1. Insufficient lubrication 2. Incorrect lubrication 3. Contaminated oil	Use correct lubrication and fill up to right level. Replace at intervals recommended. Replace all scratched washers and those with 0.1mm thickness lower than the new ones.
Inner diameter of tapered roller bearing worn out.	1. Excessive use 2. Excessive pinion axial backlash 3. Insufficient lubrication 4. Contaminated oil	Replace bearing. Check pinion axial backlash. Use proper lubrication, fill up to right level and replace at recommended intervals.
Bent or broken halfshaft.	Vehicle intensively operated or overloaded	Replace
Halfshaft broken at wheel side	1. Wheel support loosened 2. Beam body bent	Replace Check that wheel support is not worn out or wrongly adjusted.

F.2 Diagnosi per problemi all'assale

Problema	Causa	Riparazione consigliata
Rumore durante la guida	1. Gioco tra corona dentata e pignone eccessivo 2. Pignone e corona dentata consumati 3. Cuscinetti del pignone consumati 4. Cuscinetti del pignone allentati 5. Gioco assiale del pignone eccessivo 6. Cuscinetti del differenziale consumati 7. Cuscinetti del differenziale allentati 8. Eccessiva scentratura della corona dentata 9. Livello lubrificante basso 10. Lubrificante di grado povero od errato 11. Semiasse piegato	1. Regolare 2. Sostituire 3. Sostituire 4. Regolare 5. Regolare 6. Sostituire 7. Regolare 8. Sostituire 9. Rabboccare 10. Sostituire 11. Sostituire
Rumore durante l'andatura in folle	1. I rumori provenienti dall'assale con il veicolo in movimento di solito si sentono durante l'andatura in folle anche se non molto forti 2. Errato gioco tra pignone e corona (il rumore che si sente decelerando sparisce all'aumentare della velocità). 3. Usura scanalatura pignone o flangia entrata	1. Regolare o sostituire (vedere sopra) 2. Regolare 3. Sostituire
Rumore intermittente	1. Corona dentata danneggiata 2. Bulloni della scatola del differenziale allentati	1. Sostituire coppia conica 2. Serrare a coppia
Rumore costante	1. Danni sui denti della corona dentata o del pignone 2. Cuscinetti usurati 3. Scanalature del pignone consumate 4. Semiasse piegato	1. Sostituire coppia conica 2. Sostituire 3. Sostituire 4. Sostituire
Rumore in curva	1. Satelliti planetari differenziale consumati 2. Scatola differenziale e/o perni del differenziale consumati 3. Ralle di rasamento del differenziale consumate 4. Scanalature del semiasse consumate	1. Sostituire 2. Sostituire 3. Sostituire 4. Sostituire

F.2 Axle problem and diagnosis

Problem	Cause	Action
Noise while driving	1. Excessive backlash between pinion and ring gear 2. Worn out pinion and gear ring 3. Worn out pinion bearings 4. Pinion bearings loosened 5. Excessive axial pinion backlash 6. Worn out differential bearings 7. Differential bearings loosened 8. Ring gear out of roundness 9. Low lubricant level 10. Poor or wrong lubricant 11. Bent halfshaft	1. Adjust 2. Replace 3. Replace 4. Adjust 5. Adjust 6. Replace 7. Adjust 8. Replace 9. Oil level 10. Replace 11. Replace
Noise while driving in neutral	1. Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud. 2. Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed) 3. Pinion or input flange worn out	1. Replace or adjust (see above) 2. Replace 3. Adjust
Intermittent noise	1. Ring gear damaged 2. Differential box bolts loosened	1. Replace bevel gear set 2. Tighten to torque
Constant noise	1. Ring gear teeth or pinion damaged 2. Worn out bearings 3.Pinion spline worn out 4. Bent halfshaft	1. Replace bevel gear set 2. Replace 3. Replace 4. Replace
Noise while seering	1. Worn out differential gears 2. Worn out differential box or spider 3. Differential thrust washers worn out 4. Half shaft spline worn out	1. Replace 2. Replace 3. Replace 4. Replace

G ATTREZZI SPECIALI

G *SPECIAL TOOLS*

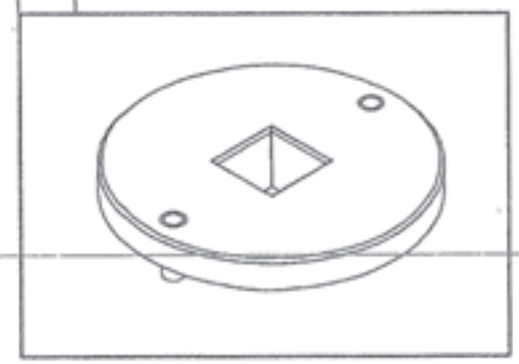
G.1 Attrezzi speciali

Battitoi e tamponi per il montaggio di tenute, cuscinetti e bronzine devono essere utilizzati con il manico intercambiabile CA119033; se ne raccomanda l'uso abbinato ad un'impugnatura di sicurezza per la protezione delle mani (da commercio).

G.1 Special tools

The special drifts/pad used to assembly the seals, bearings and bushes should always be used with the interchangeble handle CA119033; its use is recommended togheter with a suitable safety handle in order to protect the hands.

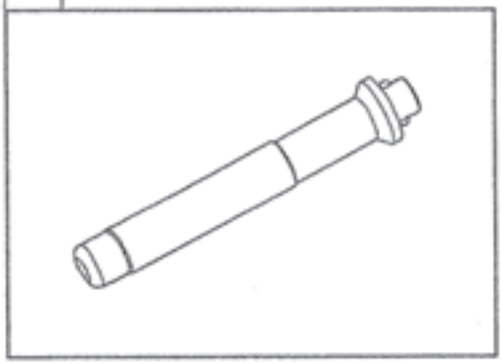
1



Chiave per ghiera
CA119030

Ring nut wrench
CA119030

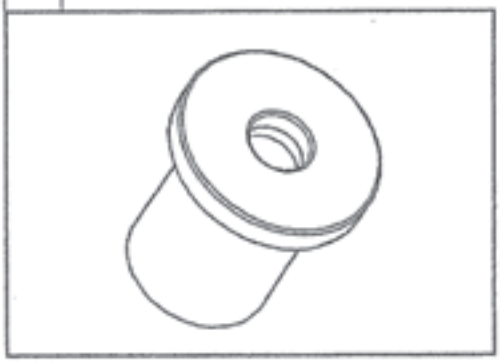
2



Manico intercambiabile
CA119033

Interchangeble handle
CA 119033

3

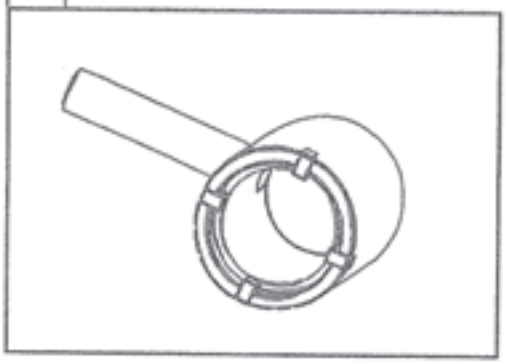


Battitoio bronzina

CA119097

Driver for swivel bush
CA119097

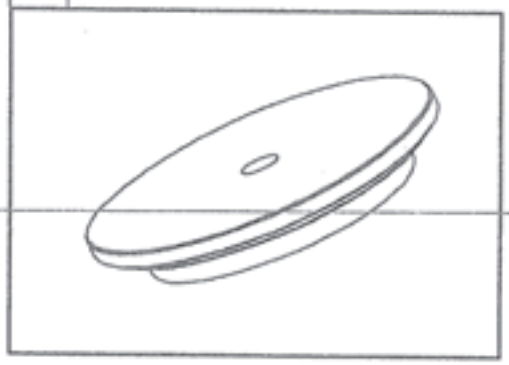
4



Chiave per ghiera pignone
CA119099

Pinion lock nut wrench
CA119099

5



Battitoio anello di tenuta
CA119143

Oil seal driver
CA119143

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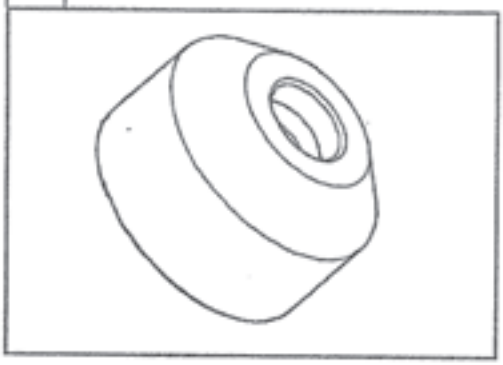

Battitoio anello interno cuscinetto
CA119230

Bearing inner ring driver
CA119230

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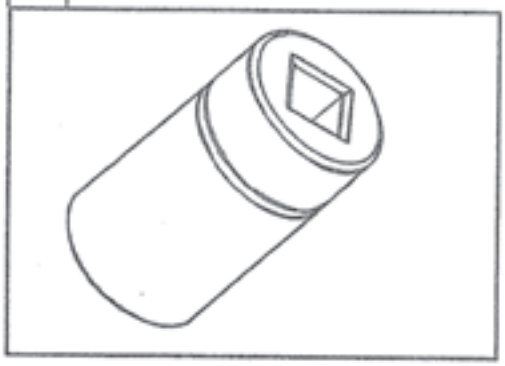

Chiave blocca codolo pignone
CA715022

Pinion shaft lock wrench
CA715022

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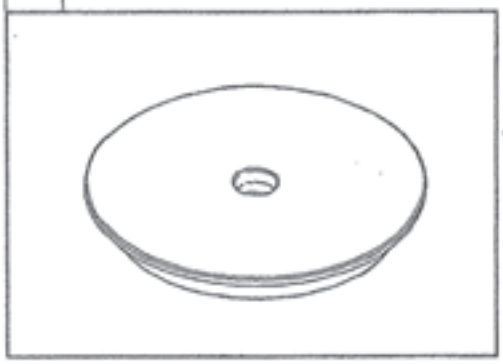
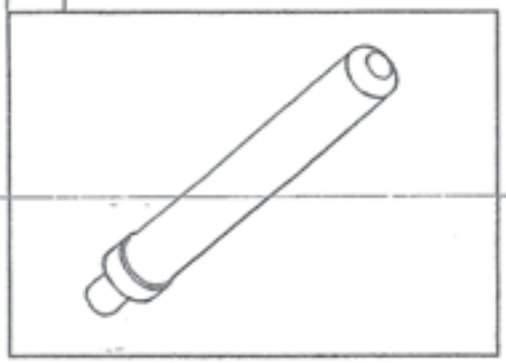


Battitoio cuscinetto anello interno
CA715026

Bearing cone driver
CA715026

9



Battitoio per bussole
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Bush driver
CA715027

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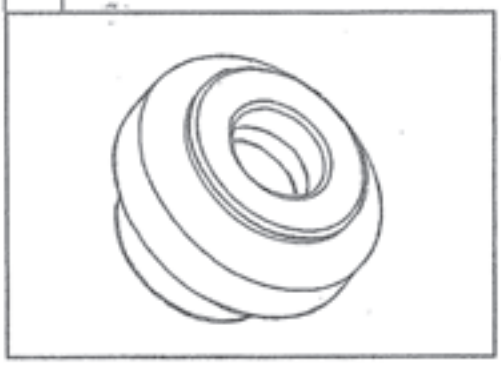
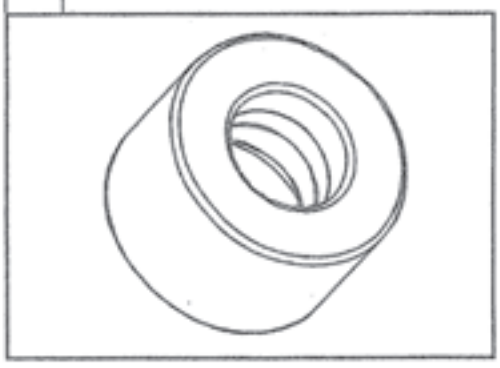


Battitoio per boccola
CA715034

Bush driver
CA715034

11



Battitoio per nodo sferico
CA715035

Driver for ball joint
CA715035

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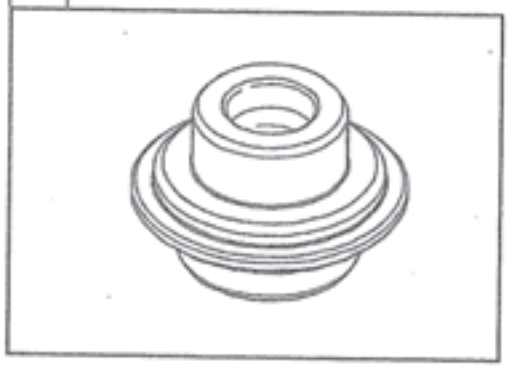

Battitoio anello di tenuta
CA715038

Oil seal driver
CA715038

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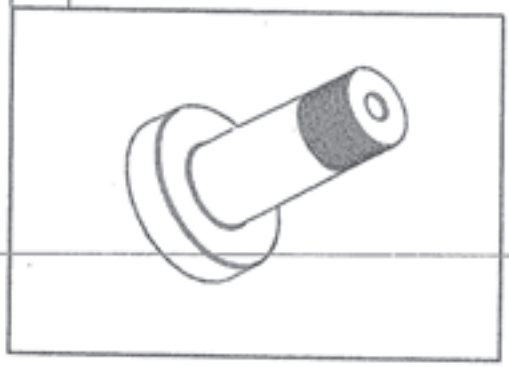

Falso pignone
CA715040

False pinion
CA715040

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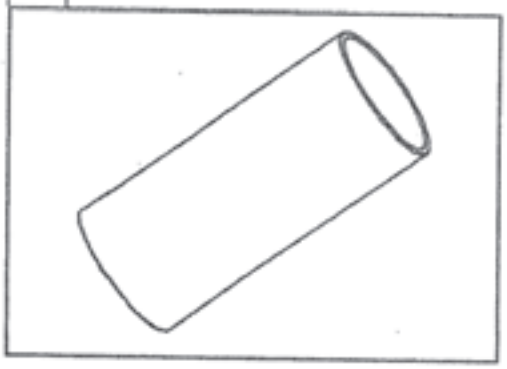

Boccola misurazione dstanziale con falso pignone
CA715041

Bushing for spacer measurement with false pinion
CA715041

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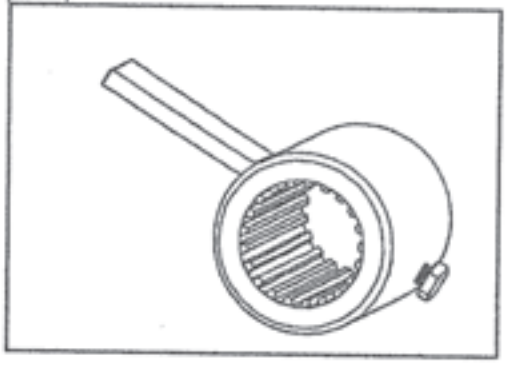

Attrezzatura per rilievo gioco
CA715055

Kit for backlash measurement
CA715055

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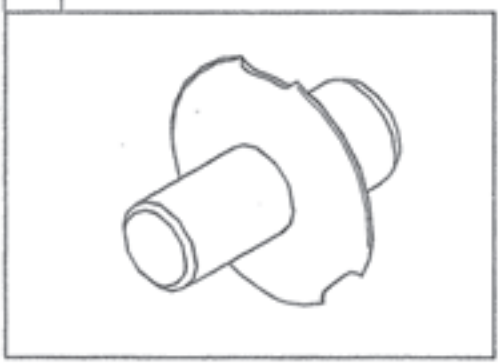
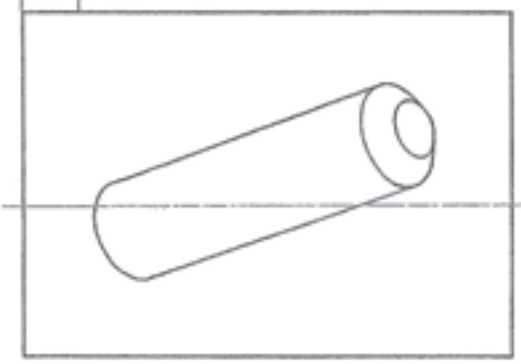


Inserimento pistone su flangia freno
CA715056

Piston introduction on brake flange
CA715056

17



Battitoio cuscinetto su ingranaggio
CA715145

Bearing driver on gear
CA715145

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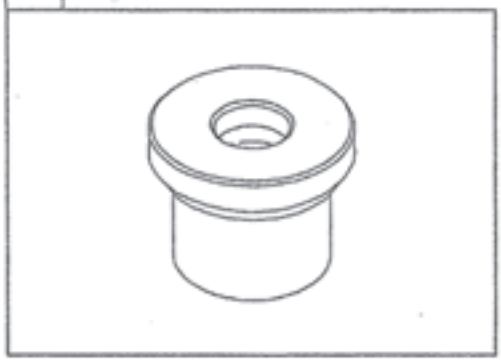

Battitoio per bronzina
CA715157

Driver for bush
CA715157

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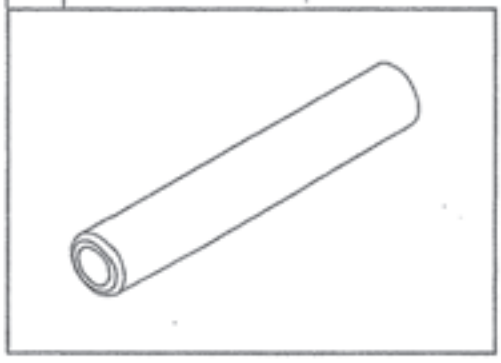

Battitoio anello di tenuta
CA715179

Oil seal driver
CA715179

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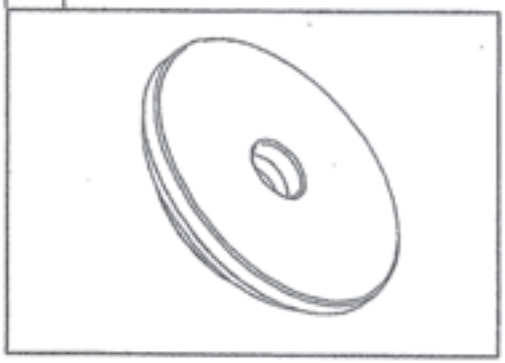
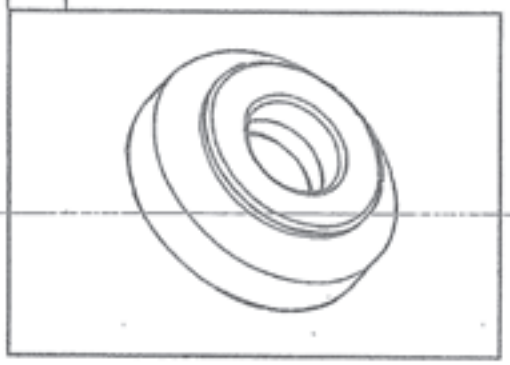


Battitoio cuscinetto su flangia
CA715299

Bearing driver on bearing
CA715299

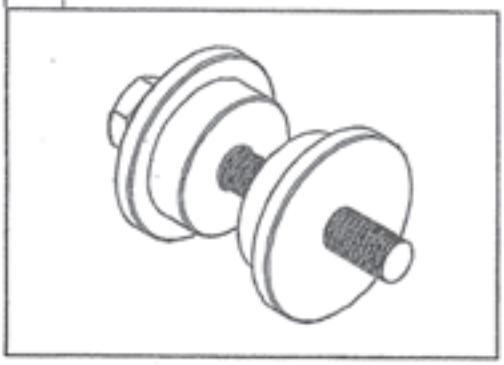
21



Battitoio anello tenuta su calotta
CA715360

Swivel seal ring driver
CA715360

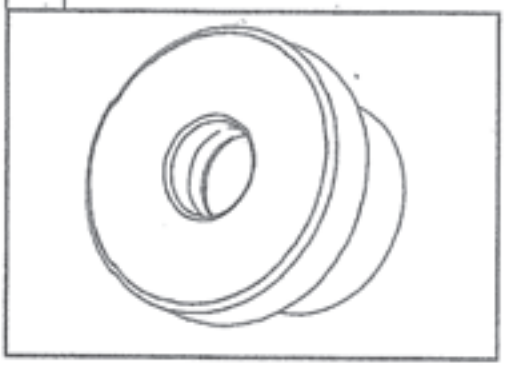
22



Attrezzatura per montaggio piste esterne dei cuscinetti corpo centrale
CA715401

Kit for bearing cups assembly in the central housing
CA715401

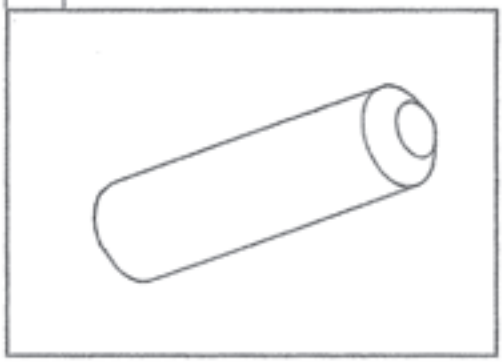
23



Battitoio anello di tenuta su tromba
CA715402

Horn seal ring driver
CA715402

24



Battitoio per cuscinetto su ingranaggio
CA715403

Driver for pinion bearing cone
CA715403

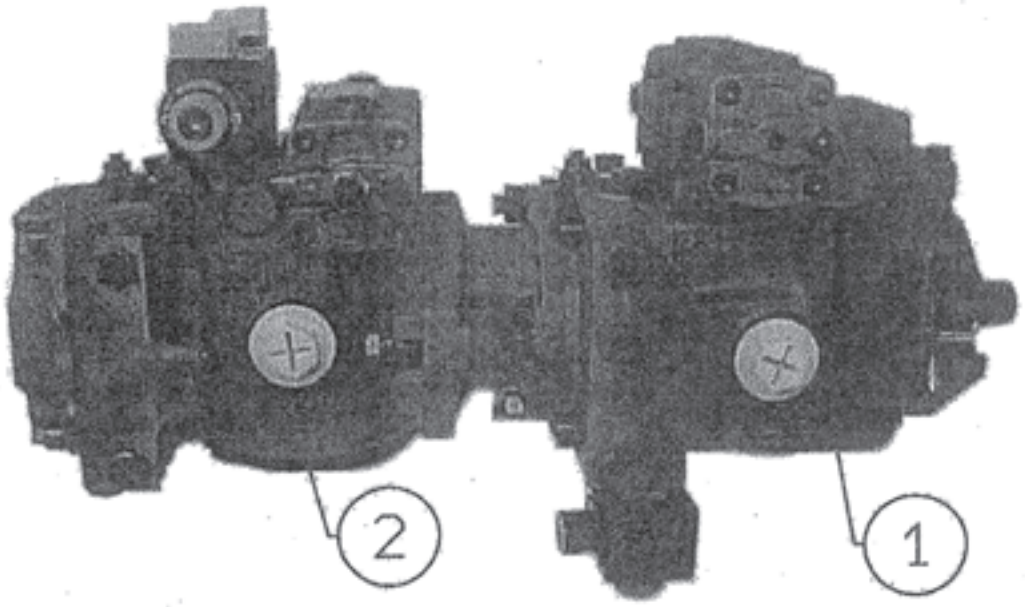
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP3094632000003 **DATE:** December 9, 2005

DESCRIPTION: Double pump M4PV46-46K335AR3BE + M4PV32-32E225BR6BVU-Z3

REF.	QTY.	CODE	DESCRIPTION
1	1	HP39046K3351343	Pump M4PV46-46 K 3 35 A R 3 B E
2	1	HP34932422556l2Z3	Pump M4PV32-32 E 2 25 B R 6 B V U-Z3
3	1	HP490103401	Kit, fasteners for assembling pumps



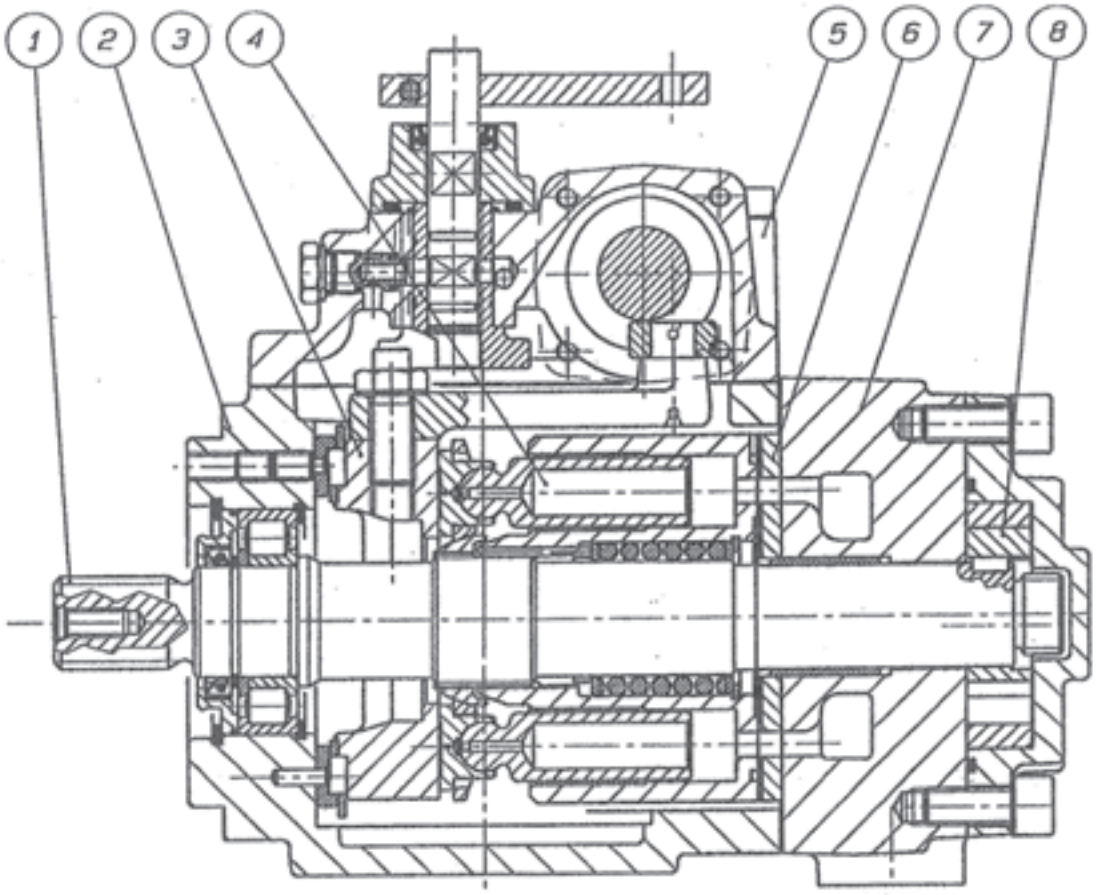
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP39046K3351343 **DATE:** December 9, 2005

DESCRIPTION: Pump M4PV46-46 K 3 35 A R 3 B E

REF.	QTY.	CODE	DESCRIPTION
1	1	HP404345501R	Kit, shaft and bearing, male spline, 15T, 16/32" DP
2	1	HP424560101R	Kit, housing, standard, SAE ports
3	1	HP438560201R	Kit, swash plate with needle bearings
4	1	HP466440902R	Kit, rotating group, M4PV46
5	1	HP471560405R	Kit, servo control, 'K' hydraulic remote
6	1	HP264113401R	Valve plate, M4PV34-46, right hand rotation
7	1	HP434340233R	Kit, distributor, M4PV34-46, SAE ports, automotive
7a	2	HP481032350R	Kit, relief valve, 350 bar
7b	1	HP481262801R	Kit, 'E' no-operator safety option
8	1	HP456561408R	Kit, SAE-B pad, 14cc charge pump
		HP486225615R	Seal kit, M4PV34-65



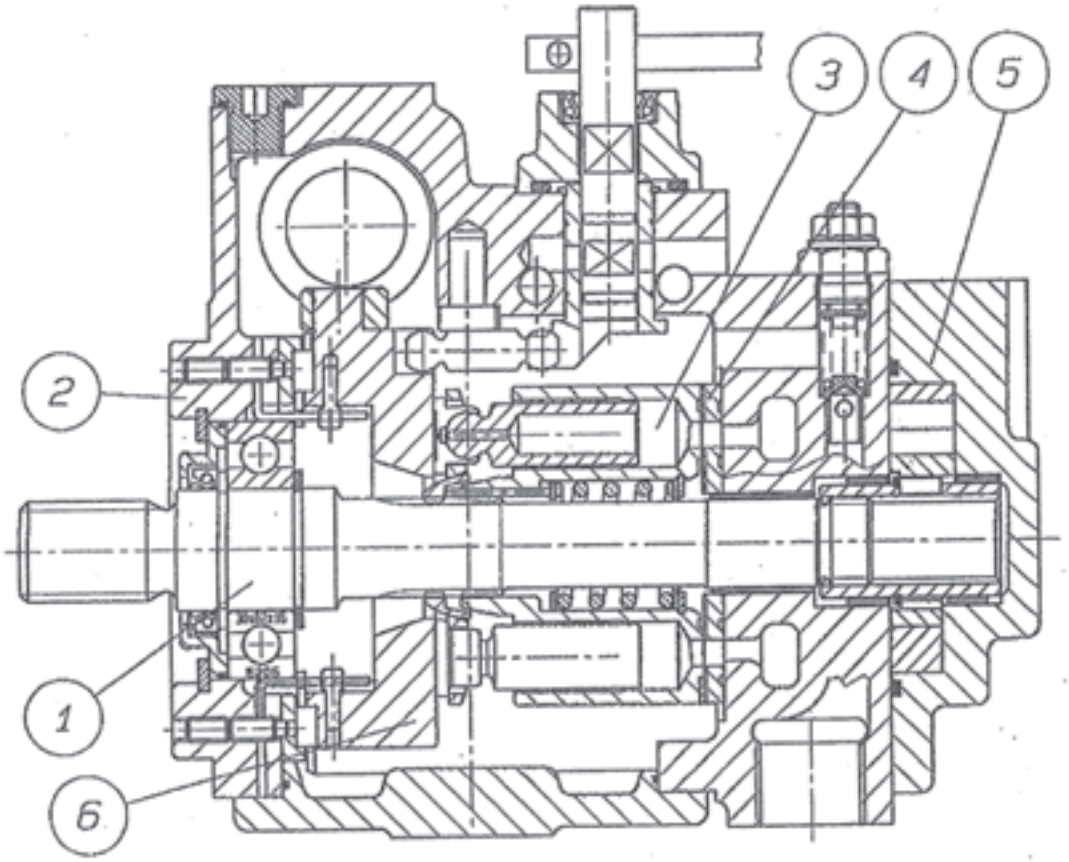
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP349324225561 2Z3 **DATE:** December 9, 2005

DESCRIPTION: Pump M4PV32-32 E 2 25 B R 6 B V U-Z3

REF.	QTY.	CODE	DESCRIPTION
1	1	HP404285302R	Kit, shaft and bearing, 13T 16/32" DP
2	1	HP426280509R	Kit, housing, 'P' servo control, V + M10x55 limit screw
2a	1	HP450260114R	Kit, electric solenoid valve DHI0711P-N 12V, 0.6mm orifice
2b	1	HP481032250R	Kit, relief valve, 250 bar
2c	1	HP482581001R	Kit, plug without relief valve
2d	1	HP481042101R	Kit, 'V' exchange valve option
3	1	HP466320901R	Kit, rotating group, M4PV28
4	1	HP264113201R	Valve plate, M4PV32 right hand rotation
5	1	HP455281006R	Kit, SAE A pad, 10cc charge pump
6	1	HP438280101R	Kit, cam plate and bronze bushings
		HP486222807R	Seal kit, M4PV21-28-32



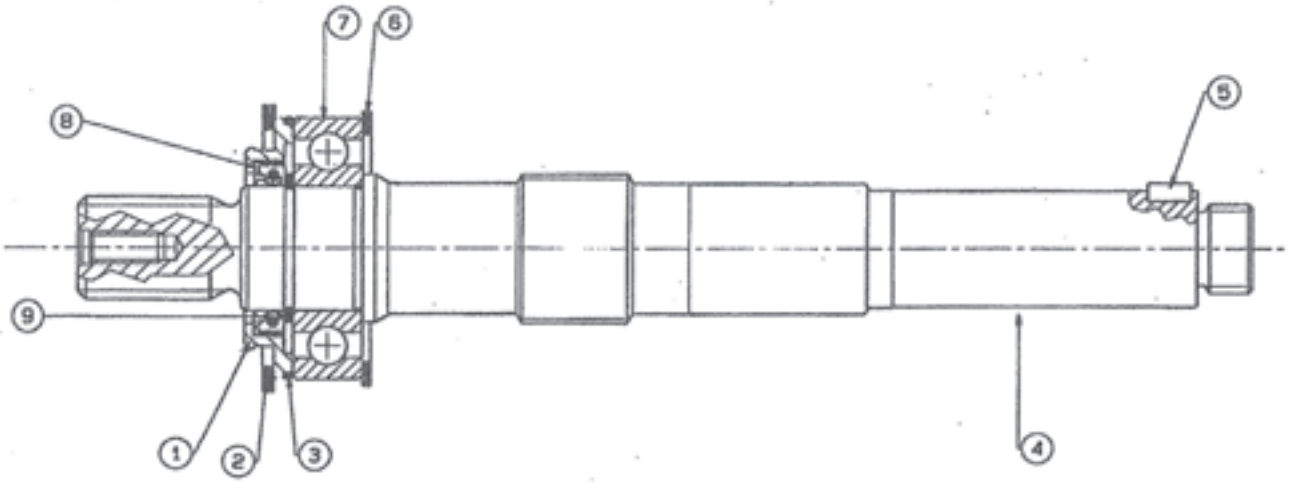
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP404345501R **DATE:** July 11, 2005

DESCRIPTION: Kit, shaft and bearing, spline, 15T, 16/32" DP, M4PV34-46

REF.	QTY.	CODE	DESCRIPTION
1	1	HP292023001R	Support, shaft seal
2	1	HP504106501R	Snap ring, Int. DIA. 65 UNI 7437
3	1	HP512116005R	O-ring, 1.78 x 60.08 70 SH 2-036
4	1	HP210155601R	Shaft, Z15M
5	1	HP257040401R	Key, 4 x 4 x 10 UNI 6604
6	1	HP504106201R	Snap ring, Int. DIA. 62 UNI 7437
7	1	HP524103016R	Bearing, ball, 30 x 62 x 16 6206
8	1	HP512207030R	Shaft seal, BABSL 30 x 42 x 7-7.5
9	1	HP503303001R	Snap ring, Ext. DIA. 30 x 2 UNI 7436
		HP486032102R	Shaft seal kit, M4PV21-65 (items 1,2,3,8)



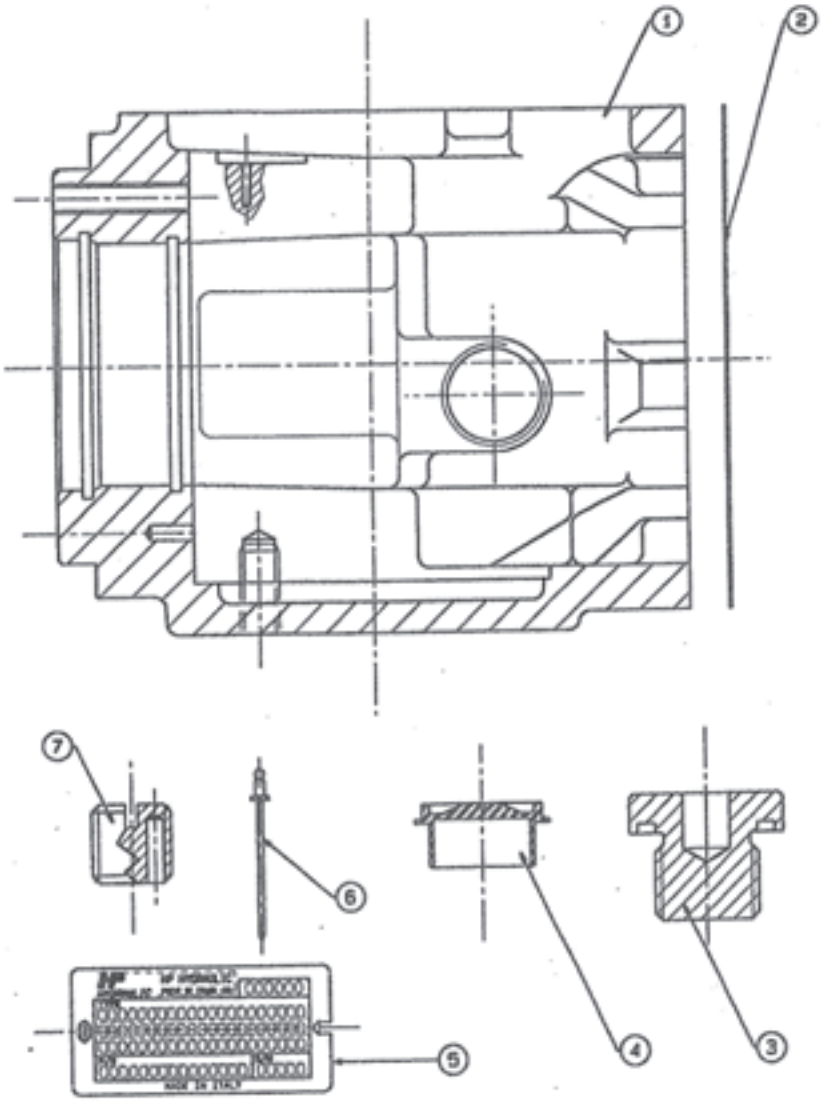
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP424560101R **DATE:** June 6, 2005

DESCRIPTION: Kit, housing for needle bearings, SAE ports, M4PV34-46-50-58-65

REF.	QTY.	CODE	DESCRIPTION
1	1	HP228115601R	Housing, SAE ports
2	1	HP252015601R	Gasket, distributor
3	1	HP580314601R	Plug, 1-1/16"-12 UN -12 SAE
4	1	HP581027002R	Plug, plastic shipping, -12 SAE
5	1	HP299999015R	Nameplate, HP Hydraulic
6	2	HP522012501R	Rivet
7	1	HP293113001R	Plug, M10 x 12, 2.1mm hole



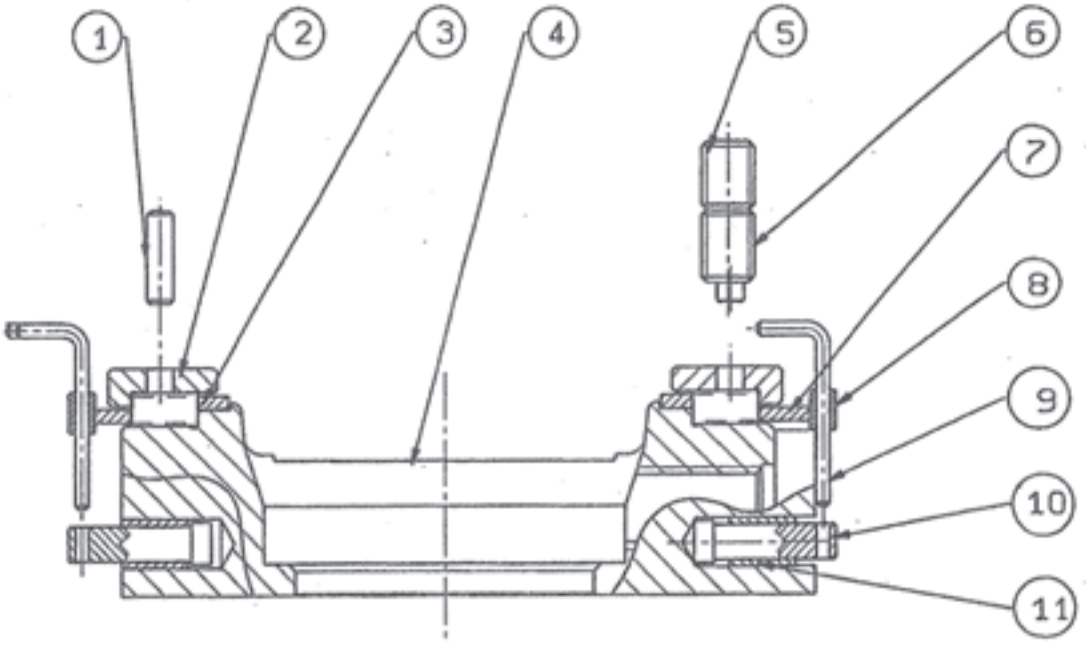
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP438560201R **DATE:** June 6, 2005

DESCRIPTION: Kit, swash plate and needle bearings, M4PV34-46-50-58-65

REF.	QTY.	CODE	DESCRIPTION
1	1	HP574414030R	Pin, 4 x 14 H8 UNI 1707
2	2	HP285003000R	Bearing race, half roller
3	1	HP430013000R	Roller bearing, right plastic
4	1	HP225115602R	Cam plate, needle bearing
5	1	HP593100810R	Set screw, M8 x 10 UNI 5923
6	1	HP298000008R	Screw, bearing adjustment
7	1	HP430023000R	Roller bearing, left plastic
8	2	HP281003000R	Bushing, bearing wire
9	2	HP248003001R	Wire, bearing, elbow
10	2	HP289015801R	Pin, retainer cage stroke
11	2	HP575107010R	Bushing, retainer cage stroke pin, 7 x 10 UNI 6874
		HP409580001R	Needle bearing kit (all parts except item 4)



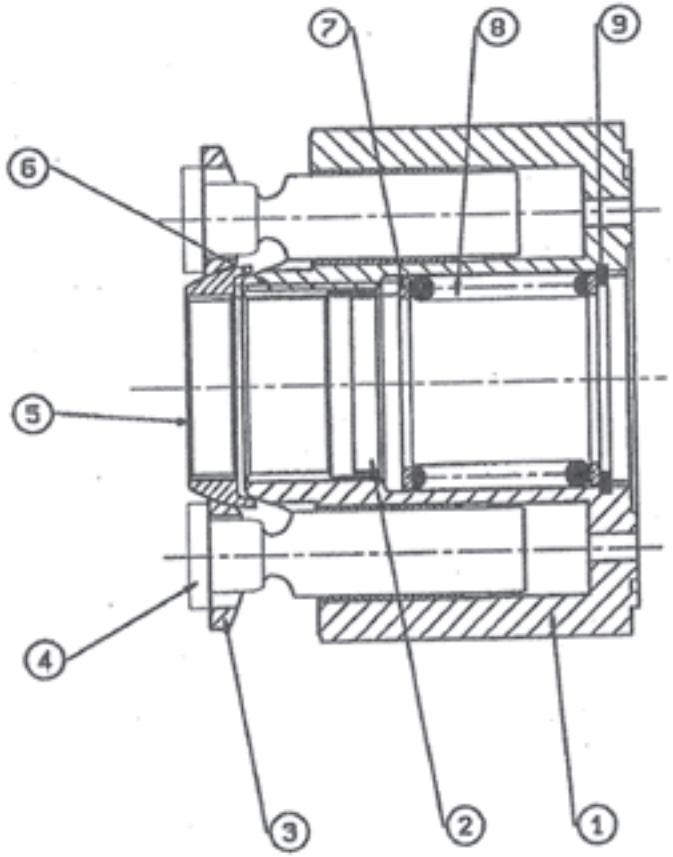
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP466440902R **DATE:** November 4, 2005

DESCRIPTION: Kit, rotating group, M4PV46, M4MF46, M4MV46

REF.	QTY.	CODE	DESCRIPTION
1	1	HP408440903R	Kit, cylinder block with bushings
2	1	HP256370556R	Spring ring, pin retainer
3	1	HP264314401R	Plate, piston retainer
4	9	HP441004401R	Kit, piston with slipper
5	1	HP287005601R	Ball joint
6	3	HP572232556R	Pin, 2.5 x 32.5
7	2	HP278041022R	Washer, cylinder block spring 33 x 41 x 2
8	1	HP254476830R	Spring, cylinder block
9	1	HP504304201R	Snap ring, Int. DIA. 42 UNI 7438



BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP471560405R **DATE:** October 21, 2005

DESCRIPTION: Kit, servo control 'K' hydraulic remote, M4PV34-65

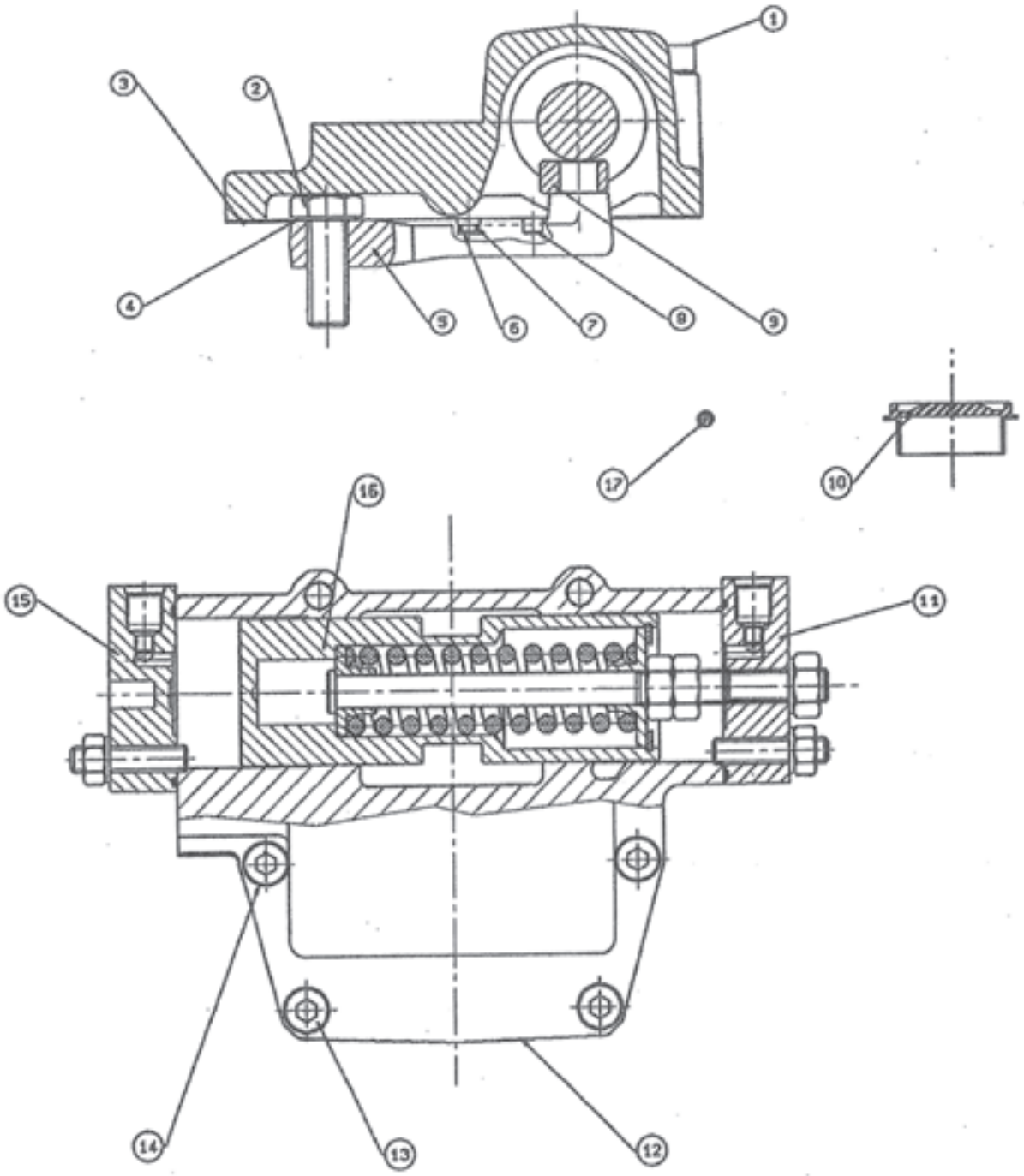
REF.	QTY.	CODE	DESCRIPTION
1	2	ZTF593050860	Cap screw, int. socket head, M8 x 60 UNI 5931
2	1	ZTF593021235	Cap screw, hex head, M12 x 35 UNI 5737
3	1	HP252035601R	Gasket, control
4	1	ZTF562412000	Lock washer, rib-spring, 12mm
5	1	HP253005606R	Lever, oscillating control
6	1	HP261993000R	Pin, hollow w/ 2 o-ring grooves
7	2	HP512110368R	O-ring, 1.78 x 3.68 70 SH 2-007
8	2	HP574610020R	Pin, 6 x 10 H8 UNI 1707
9	1	HP262015601R	Slide plate, servo piston
10	2	HP581010001R	Plug, plastic shipping, 7/16" UNF
11	1	HP414052806R	Kit, servo end cap, M8, M10, 7/16-20 SAE
12	1	HP238155604R	Housing, servo control 'K'
13	4	ZTF593050830	Cap screw, int. socket head, M8 x 30 UNI 5931
14	6	ZTF562408000	Lock washer, rib-spring, 8mm
15	1	HP414052805R	Kit, servo end cap, M8, 7/16-20 SAE
16	1	HP441105801R	Kit, servo piston and centering adjustment
17	1	HP580510305R	Plug, D.5 2901-0506

BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP471560405R **DATE:** October 21, 2005

DESCRIPTION: Kit, servo control 'K' hydraulic remote, M4PV34-65



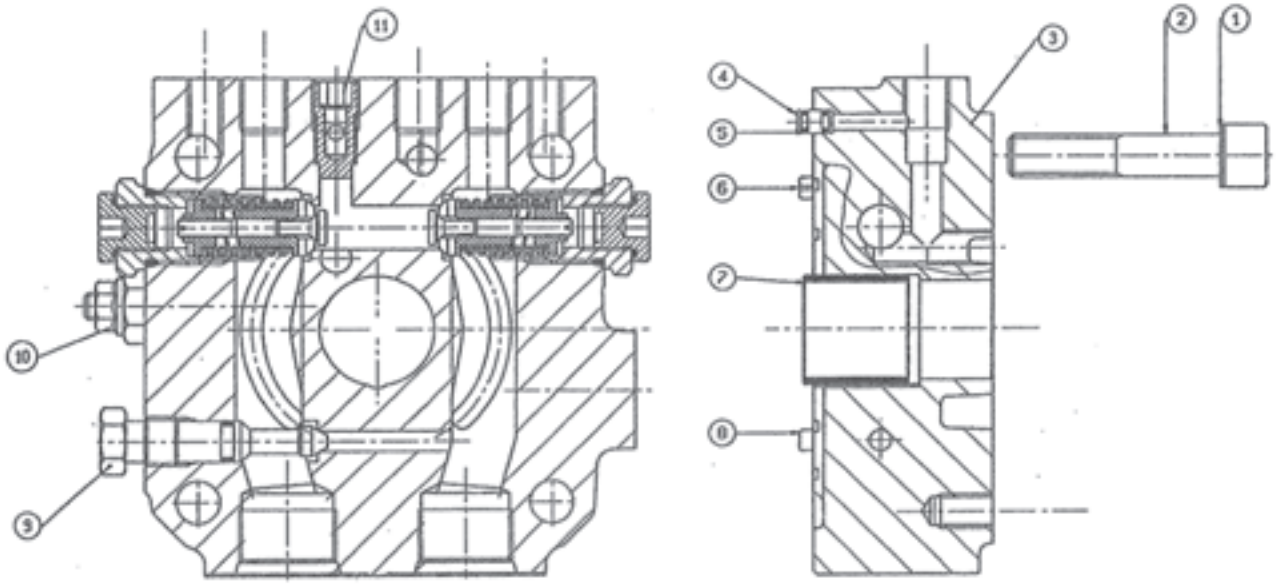
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP434340233R **DATE:** December 9, 2005

DESCRIPTION: Kit, distributor, M4PV34-46, SAE ports, automotive

REF.	QTY.	CODE	DESCRIPTION
1	4	ZTF562412000	Lock washer, rib-spring, 12mm
2	4	ZTF593051260	Cap screw, int. socket head, M12 x 60 UNI 5931
3	1	HP245113420R	Housing, distributor
4	1	HP261993000R	Pin, hollow w/ 2 o-ring grooves
5	2	HP512110368R	O-ring, 1.78 x 3.68 70 SH 2-007
6	1	HP575106010R	Pin, elastic 6 x 10 UNI 6874
7	1	HP516228030R	Bushing, MBI CB85-2830 28 x 30
8	2	HP574610020R	Pin, 6 x 10 H8 UNI 1707
9	1	HP481070028R	Kit, bypass valve
10	1	HP481015801R	Kit, charge relief valve
11	1	HP214025605R	Bushing plug, ¼" BSPP for side option



BONDIOLI & PAVESI

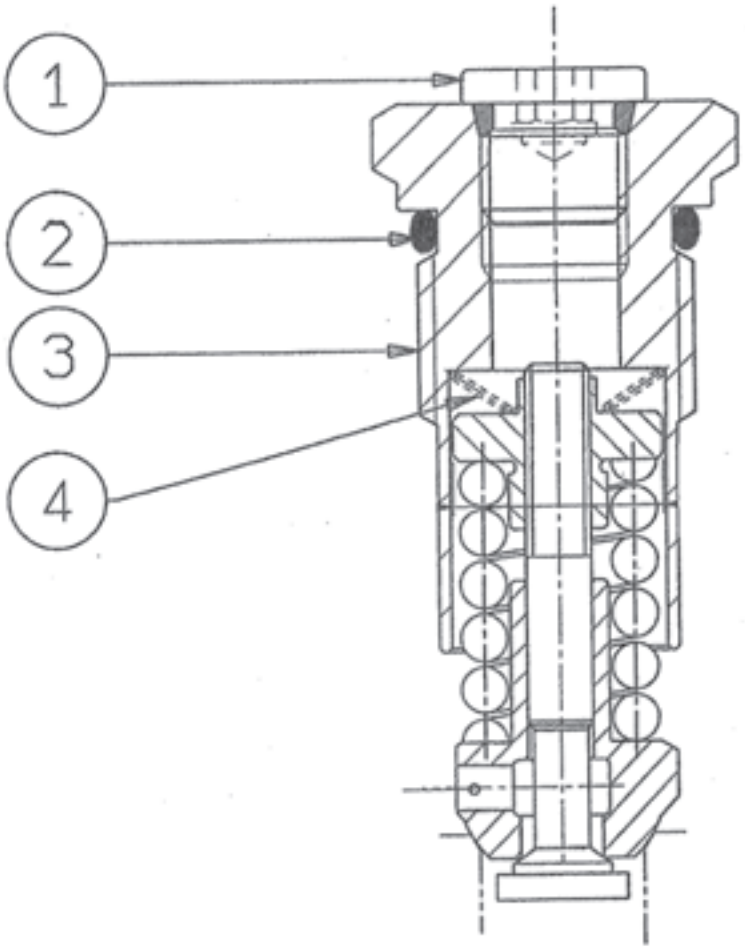
SPARE PARTS LIST

CODE: HP481032---R **DATE:** October 21, 2005

DESCRIPTION: Kit, relief valve, M4PV21-65

REF.	QTY.	CODE	DESCRIPTION
1	1	HP580314201R	Plug, 7/16" – 20 UNF with o-ring
2	1	HP512121712R	O-ring, 2.62 x 17.12 90 SH 2-115
3	1	HP293022003R	Plug, relief valve
4	1	HP254101700R	Spring, tapered
	1	HP586040---R	Relief valve cartridge

Individual parts are not available separately. Complete relief valve kit must be purchased.
--- represents pressure setting in bar.



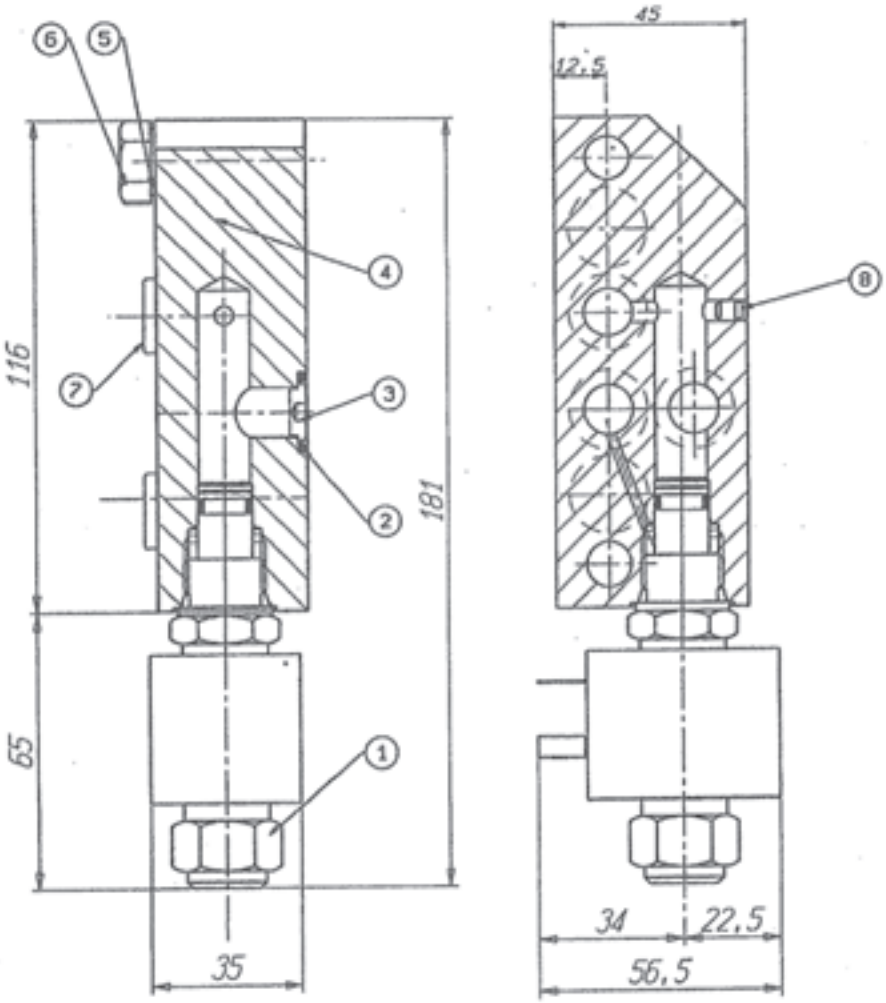
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP481262801R **DATE:** December 9, 2005

DESCRIPTION: Kit, 'E' no-operator safety option

REF.	QTY.	CODE	DESCRIPTION
1	1	HP591202022R	Cartridge, solenoid valve, 12 volt NC, VEI8A2A06.18K0
2	5	HP512121395R	O-ring, 2.62 x 13.94 90 SH 2-113
3	1	HP290040801R	Orifice, 0.8 mm
4	1	HP213012805R	Block, no-operator safety valve
5	2	ZTF562410000	Lock washer, rib-spring, 10 mm
6	2	HP593021050R	Cap screw, hex head, M10 x 50 UNI 5737
7	2	HP580312201R	Plug, countersunk sealed, 1/4" BSPP
8	1	HP580510305R	Plug, SK550-050, M5 x 6.5
		HP550021202R	Coil, replacement



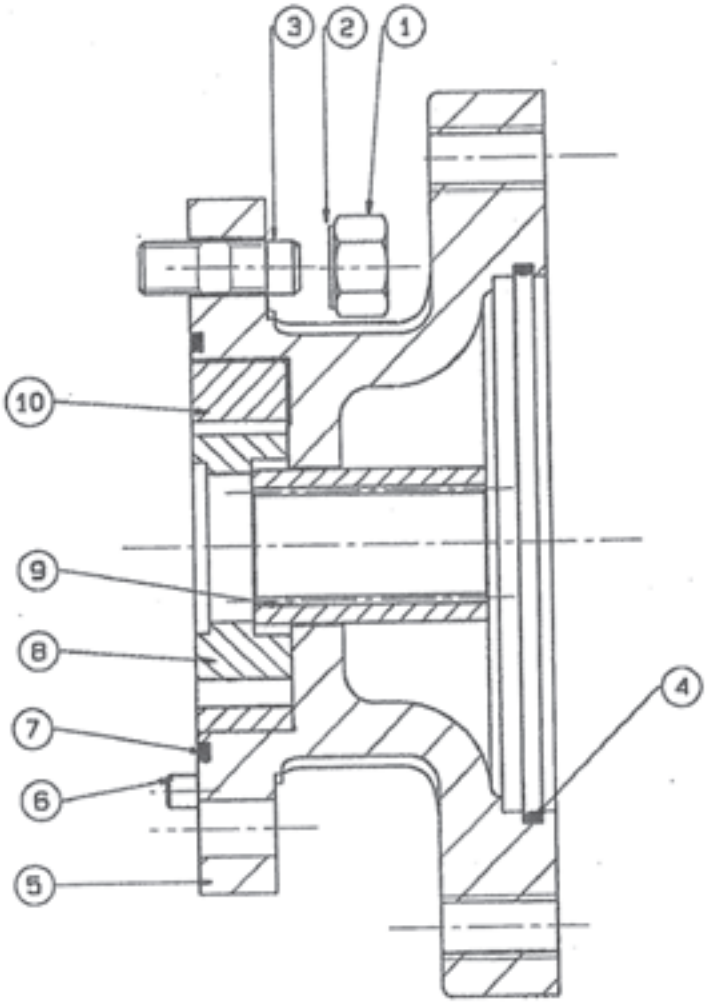
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP456561408R **DATE:** December 9, 2005

DESCRIPTION: Kit, SAE-B pad, 14cc charge pump, M4PV34-65

REF.	QTY.	CODE	DESCRIPTION
1	4	HP529401001R	Nut, M10 UNI 5587
2	4	ZTF562410000	Lock washer, rib-spring, 10mm
3	4	HP593201030R	Stud, M10 x 30 UNI 5911
4	1	HP512120101R	O-ring, 2.62 x 101.27 70 SH 2-155
5	1	HP232111408R	Housing, SAE-B pad, 14cc charge *(Not sold separately)*
6	2	HP574610020R	Pin, 6 x 10 H8 UNI 1707
7	1	HP512127587R	O-ring, 2.62 x 75.87 70 SH 2-151
8	1	HP280151401R	Rotor, internal charge pump *(Not sold separately)*
9	1	HP250113001R	Coupler, 13T female SAE-B
10	1	HP280051401R	Rotor, external charge pump *(Not sold separately)*



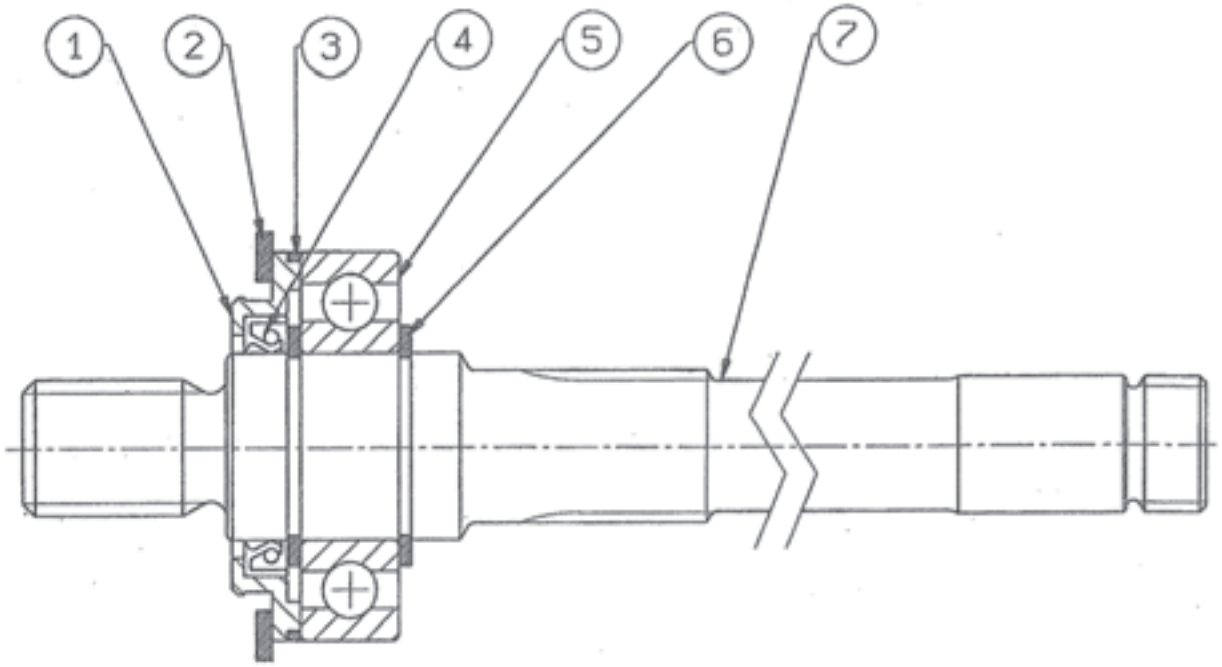
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP404285302R **DATE:** April 19, 2005

DESCRIPTION: Kit, shaft and bearing, male 13T 16/32"DP, M4PV21-28-32

REF.	QTY.	CODE	DESCRIPTION
1	1	HP292023001R	Support, oil seal
2	1	HP504106501R	Snap ring, int. DIA. 65 UNI 7437
3	1	HP512116005R	O-ring, 1.78 x 60.08 70 SH (2-036)
4	1	HP512207030R	Shaft seal, BABSL 30 x 42 x 7-7.5
5	1	HP524103016R	Ball bearing, 6206, 30 x 62 x 16
6	2	HP503303001R	Snap ring, ext. DIA. 30 x 2 UNI 7436
7	1	HP210132802R	Shaft, male 13T 16/32" DP
		HP486032102R	Shaft seal kit, M4PV21-65 (items 1 – 4 above)

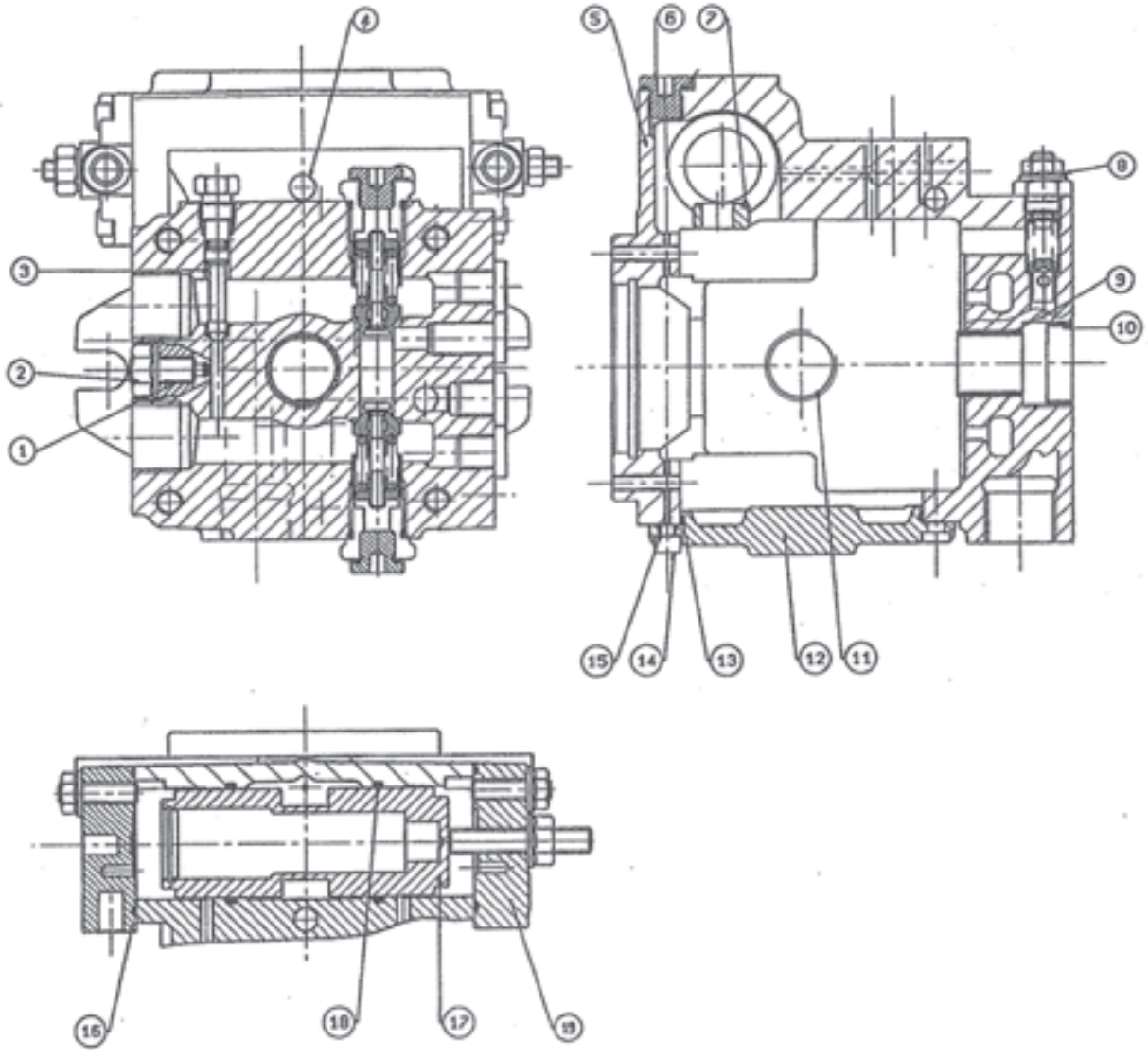


BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP426280509R **DATE:** December 9, 2005

DESCRIPTION: Kit, housing, 'P' servo control, V + M10x55 limit screw, M4PV21-28-32



BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP426280509R **DATE:** December 9, 2005

DESCRIPTION: Kit, housing, 'P' servo control, V + M10x55 limit screw, M4PV21-28-32

REF.	QTY.	CODE	DESCRIPTION
1	1	HP298000053R	Screw, valve plate adjustment, M10 x 30
2	1	HP529101001R	Nut, retainer, M10
3	1	HP481070028R	Kit, bypass valve
4	7	HP580510609R	Plug, D.9
5	1	HP228052860R	Housing, M4PV21-32 P,R
6	10	HP580312201R	Plug, countersunk sealed, 1/4" BSPP
7	1	HP262015601R	Slide plate, servo piston
8	1	HP481015801R	Kit, charge relief valve
9	1	HP516222025R	Bushing, CB85-2225, DIA. 22 x 25
10	1	HP516228010R	Bushing, CB85-2810, DIA. 28 x 10
11	1	HP580314601R	Plug, 1-1/16"-12 SAE o-ring
12	1	HP220002805R	Plate, housing cover
13	1	HP512118862R	O-ring, 1.78 x 88.62 70 SH 2-043
14	4	ZTF593050616	Cap screw, int. socket head, M6 x 16 UNI 5931
15	4	ZTF562406000	Lock washer, rib-spring, M6
16	1	HP414052820R	Kit, servo end plate, M8 thread
17	1	HP272412803R	Piston, servo control
18	2	HP512124095R	O-ring, 2.62 x 40.94 70 SH 2-130
19	1	HP414052826R	Kit, servo end plate, M8 thread & M10x55 limit screw

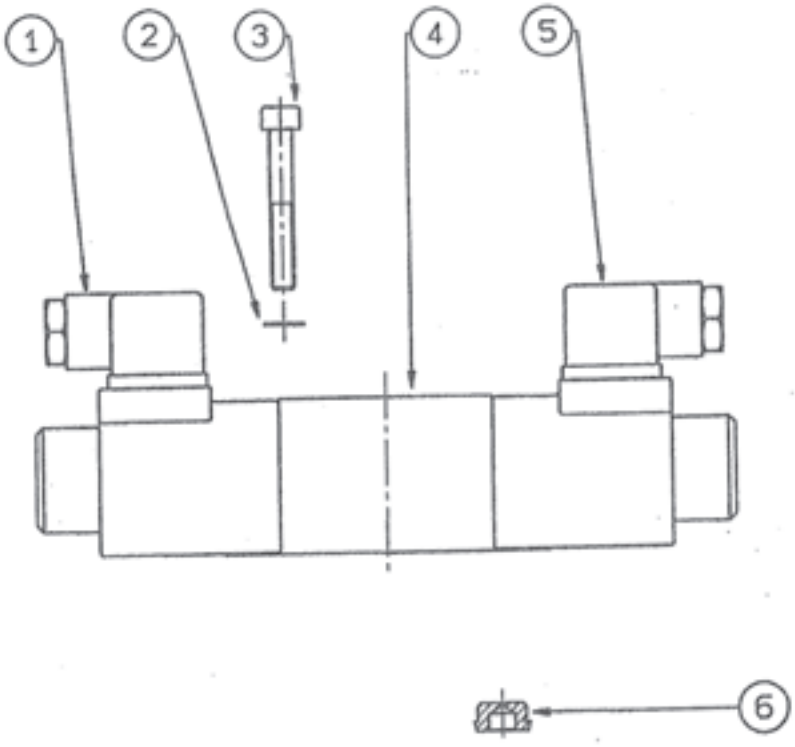
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP450260114R **DATE:** December 9, 2005

DESCRIPTION: Kit, electric solenoid valve, DHI0711P-N 12V, 0.6mm orifices

REF.	QTY.	CODE	DESCRIPTION
1	1	HP5540100003R	Kit, electrical connector, black
2	4	ZTF562405000	Lock washer, rib-spring, 5mm
3	4	HP593050555R	Cap screw, int. socket head, M5 x 55 UNI 5931
4	1	HP590010031R	Valve, Atos, DHI 0711P-N 12V
5	1	HP5540100001R	Kit, electrical connector, white
6	2	HP214020001R	Orifice, 0.6mm



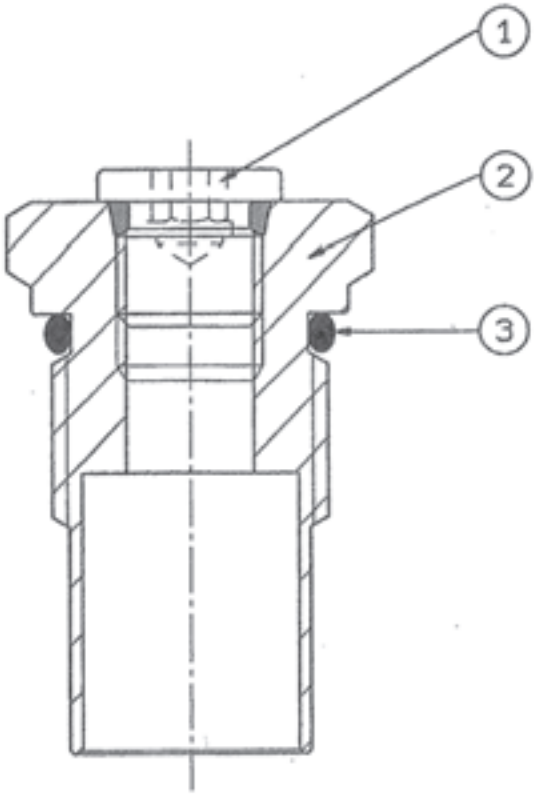
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP482581001R **DATE:** December 12, 2005

DESCRIPTION: Kit, plug without relief valve, M4PV21-65

REF.	QTY.	CODE	DESCRIPTION
1	1	HP580314201R	Plug, 7/16"-20 UNF
2	1	HP293022003R	Plug, relief valve cap
3	1	HP512121712R	O-ring, 2.62 x 17.12 90 SH 2-115



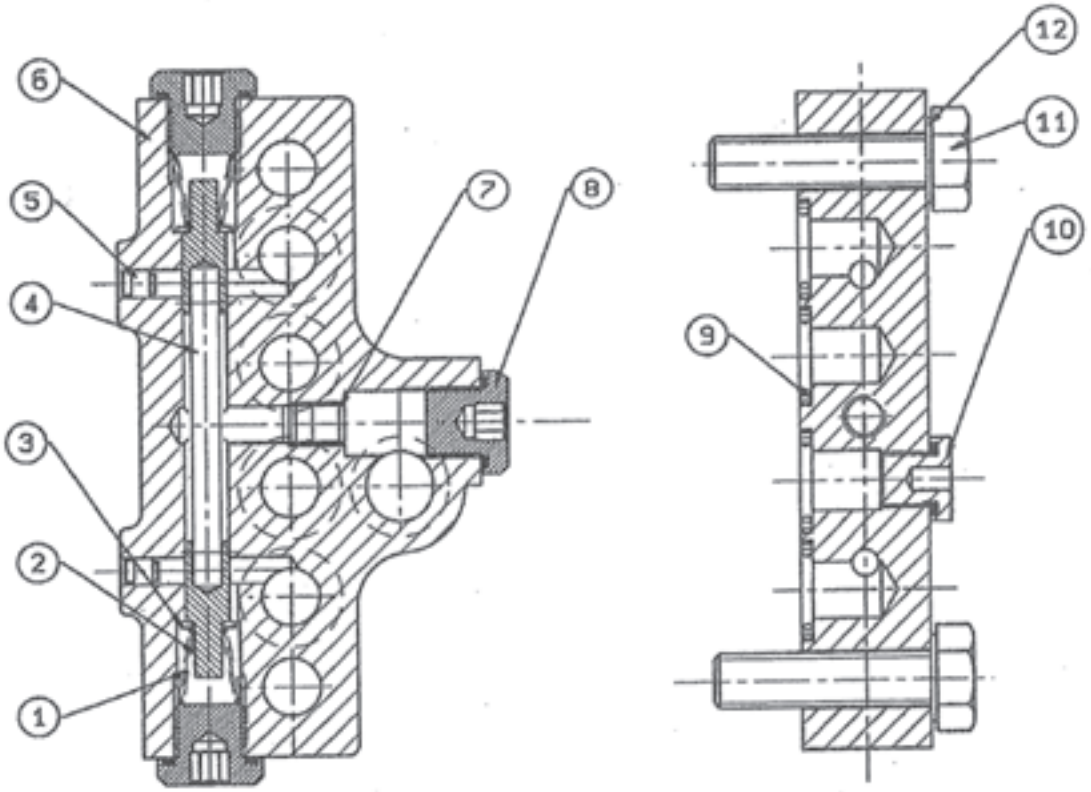
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP481042101R **DATE:** December 9, 2005

DESCRIPTION: Kit, 'V' exchange valve option, M4PV21-65

REF.	QTY.	CODE	DESCRIPTION
1	2	HP254101621R	Spring, exchange valve shuttle
2	2	HP272712101R	Piston, exchange valve shuttle
3	1	HP562105501R	Washer, flat, 5.3 x 10 UNI 6592-69
4	1	HP261992802R	Rod, exchange valve shuttle, 5 x 60
5	2	HP580510305R	Plug, set screw, 5 x 6.5
6	1	HP240032102R	Body, exchange valve
7	1	HP290010812R	Orifice, 1.7mm, M8 x 10
8	3	HP580312201R	Plug, countersunk sealed, 1/4" BSPP
9	5	HP512121395R	O-ring, 2.62 x 13.94 90 SH 2-113
10	1	HP580312101R	Plug, countersunk sealed, 1/8" BSPP
11	2	HP593021040R	Cap screw, hex head, M10 x 40 UNI 5737
12	2	ZTF562410000	Lock washer, rib-spring, 10mm



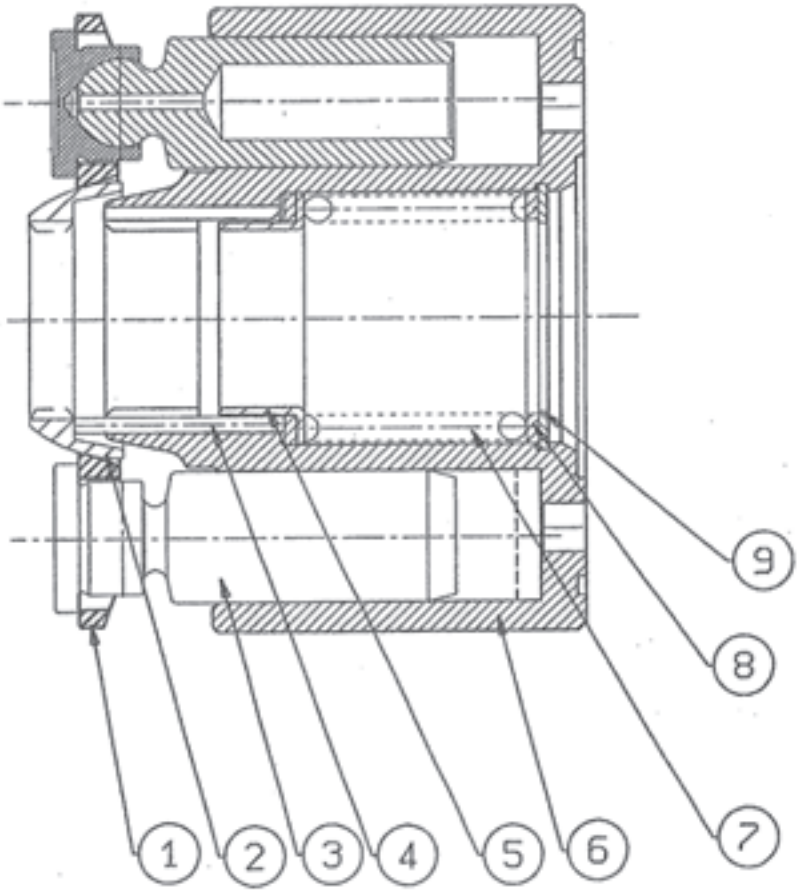
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP466320901R **DATE:** December 12, 2005

DESCRIPTION: Kit, rotating group, M4PV32

REF.	QTY.	CODE	DESCRIPTION
1	1	HP264313201R	Plate, 9 piston retainer M4PV32
2	1	HP287002801R	Ball joint, M4PV21-32
3	9	HP441003201R	Kit, piston with slipper, M4PV32
4	3	HP572270020R	Pin, 2 x 27
5	1	HP214022804R	Ring, pin retainer, M4PV21-32
6	1	HP212113201R	Cylinder block, M4PV32
7	1	HP254354220R	Spring, cylinder block M4PV21-32
8	2	HP278032153R	Washer, cylinder block spring 24.5 x 32 x 1.5
9	1	HP504303201R	Snap ring, Int. DIA. 32 UNI 7438
Items 1 – 9 are not sold separately, purchase complete kit HP466320901R			



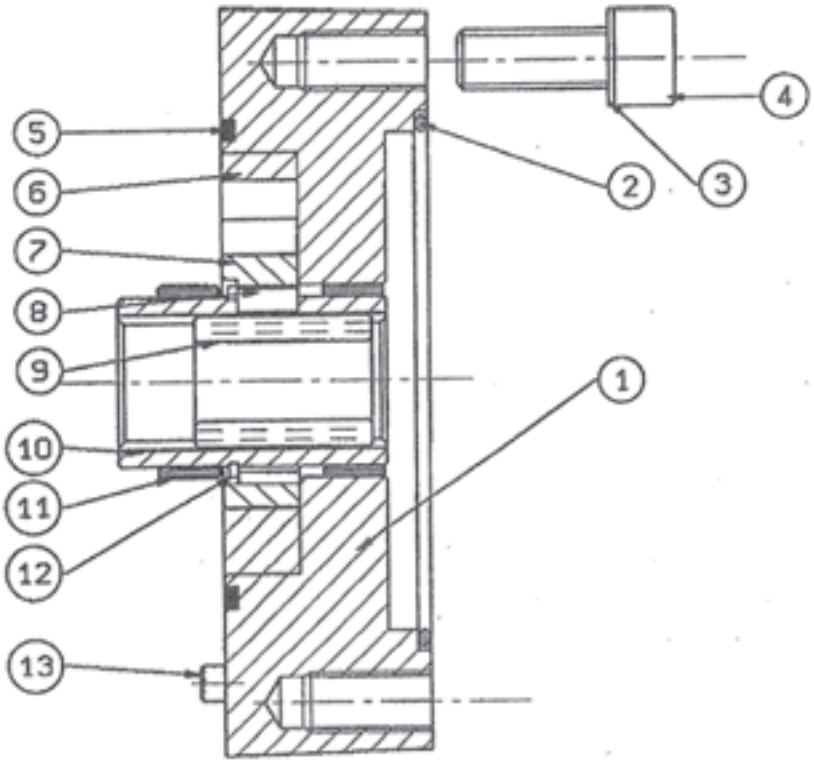
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP455281006R **DATE:** November 4, 2005

DESCRIPTION: Kit, SAE A auxiliary pad, 10cc charge pump, M4PV21-28-32

REF.	QTY.	CODE	DESCRIPTION
1	1	HP232010920R	Housing, SAE A pad, 10cc charge pump (Not sold separately)
2	1	HP512128222R	O-ring, 2.62 x 82.22 70 SH 2-152
3	4	ZTF562410000	Lock washer, rib-spring, 10 mm
4	4	ZTF593051025	Cap screw, int. socket head, M10 x 25 UNI 5931
5	1	HP512127587R	O-ring, 2.62 x 75.87 70 SH 2-151
6	1	HP280051001R	Gear, outer charge pump (Not sold separately)
7	1	HP280151001R	Gear, inner charge pump (Not sold separately)
8	1	HP257040401R	Key, 4 x 4 x 10
9	1	HP250012801R	Coupler, 13T male to 9T female
10	1	HP250002802R	Coupler, Z13F
11	1	HP516228010R	Bushing, 28 x 10
12	1	HP503202801R	Ring, external, WR28
13	2	HP574610020R	Pin, 6 x 10 H8 UNI 1707



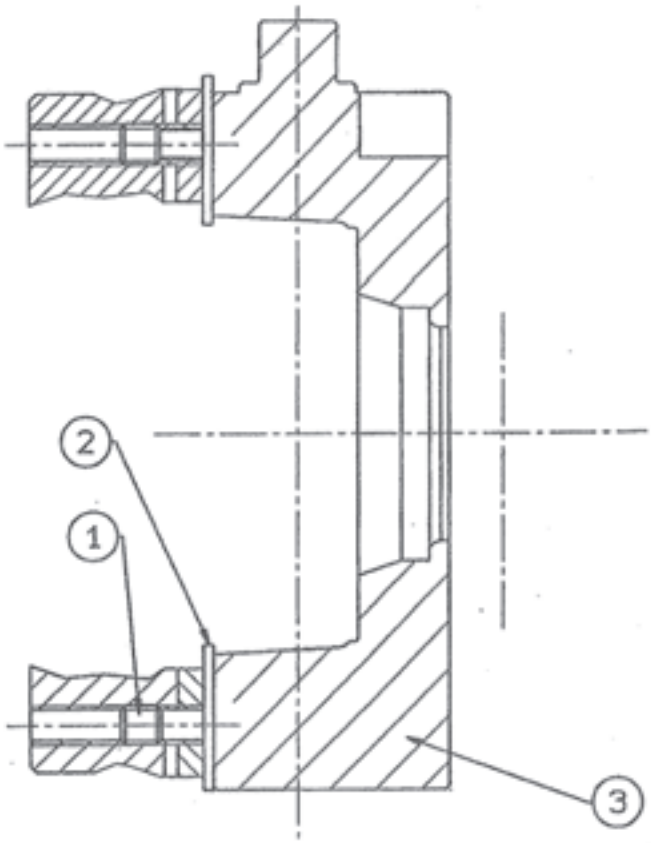
BONDIOLI & PAVESI

SPARE PARTS LIST

CODE: HP438280101R **DATE:** December 9, 2005

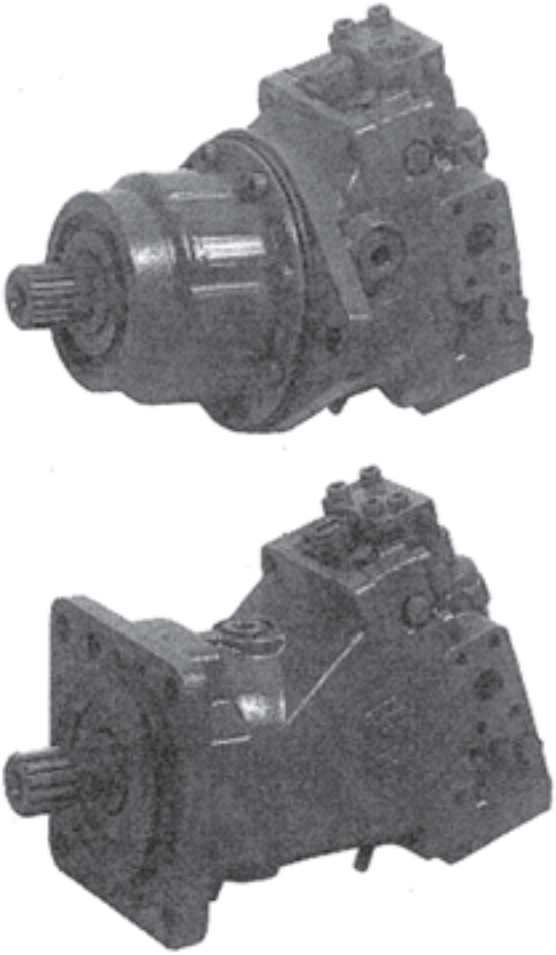
DESCRIPTION: Kit, swash plate and bronze bushings, M4PV21-28-32

REF.	QTY.	CODE	DESCRIPTION
1	2	HP593100606R	Set screw, M6 x 6 UNI 5923
2	2	HP216892802R	Bushing, bronze, swash plate
3	1	HP225112802R	Swash plate, bronze bushing style



SAUER DANFOSS

Series 51



Bent Axis

Variable Motors

Service Manual

General Description

Series 51 Variable Displacement Motors are bent axis design units, incorporating spherical pistons.

These motors are designed primarily to be combined with other products in closed circuit systems to transfer and control hydraulic power.

Series 51 Motors have a large maximum / minimum displacement ratio (5 to 1) and high output speed capabilities. SAE flange and cartridge motor configurations are available.

A complete family of controls and regulators is available to fulfill the requirements of a wide range of applications.

Motors equipped with controls normally start at maximum displacement. This provides maximum starting torque (high acceleration).

The controls may utilize externally or internally supplied servo pressure. They may be overridden by a pressure compensator which functions when the motor is operating in motor and pump modes. A defeat option is available to disable the pressure compensator override when the motor is running in pump mode.

The pressure compensator option features a low pressure rise (short ramp) to provide optimal power utilization throughout the entire displacement range of the motor. The pressure compensator is also available as a stand-alone regulator.

- **The Series 51 - Advanced Technology Today**
- **The Most Technically Advanced Hydraulic Units in the Industry**
- **SAE Flange and Cartridge Motors**
- **Cartridge Motors designed for Direct Installation in Compact Planetary Drives**
- **Large Displacement Ratio (5:1)**
- **Complete Family of Control Systems**
- **Proven Reliability and Performance**
- **Optimum Product Configurations**
- **Compact, Lightweight**

Front page: Option - hydraulic two-position control

Contents

Introduction

The purpose of this manual is to provide information necessary for the normal servicing of the Series 51 family of variable displacement hydrostatic motors.

This manual includes unit and component description, troubleshooting, adjustments, and minor repair procedures. By following the procedures in this manual, inspections and minor repairs may be performed without affecting the unit warranty.

A Series 51 motor does occasionally require servicing, and these units are designed to meet this requirement.

Many repairs or adjustments can be completed without removing the unit from the vehicle or machine, provided the unit is accessible and can be thoroughly cleaned before beginning any procedures.

Dirt or contamination is the greatest enemy of any type of hydraulic equipment. The greatest possible cleanliness is necessary when starting up the system, changing filters, or performing any other service procedure.

For Technical Information on Series 51 motors, refer to publication BLN-10042 or 368753.

For Fluid Quality Requirements, refer to publication BLN-9987 or 697581.

Sauer-Sundstrand provides a complete repair service for its products. Contact any Sauer-Sundstrand Authorized Service Center for details. Sauer-Sundstrand Authorized Service Center locations are listed in publication BLN-2-40527 or 698266.

Basic Hydraulic Circuits

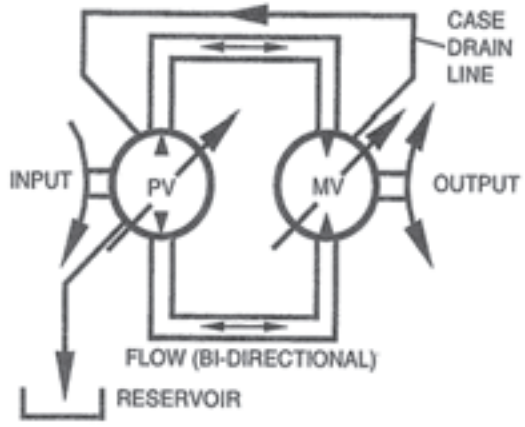


Fig. 0-1 - Basic Closed Circuit

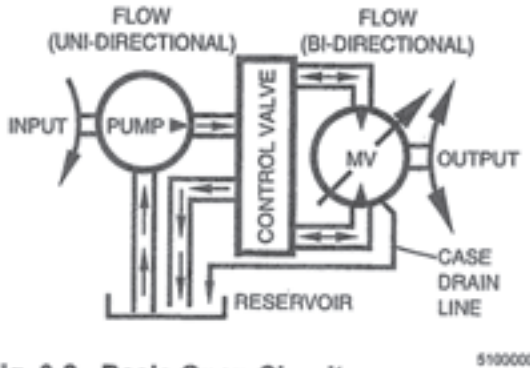


Fig. 0-2 - Basic Open Circuit

Closed Circuit

The main ports of the pump are connected by hydraulic lines to the main ports of the motor. Fluid flows in either direction from the pump to the motor then back to the pump in this closed circuit. Either of the hydraulic lines can be under high pressure. The direction and speed of fluid flow (and the motor output shaft rotation) depends on the position of the pump swashplate. The system pressure is determined by the machine load.

Open Circuit

The outlet port of the pump is connected by a hydraulic line to a directional control valve. The working ports of this valve are connected to the main ports of the motor. When the valve is actuated, fluid flows first from the pump to the valve. The valve then directs the fluid to the motor in either direction. The direction of fluid flow (and motor output shaft rotation) depends on the direction the control valve is shifted. The speed of fluid flow (and motor output shaft speed) depends on pump output volume and the distance the control valve is shifted. The system pressure is determined by the machine load.

Fluid returning from the motor is routed through the control valve to the reservoir. Additional components may be necessary to provide dynamic braking and to deal with over-running loads.

General Description of the Series 51 Variable Displacement Motors

The Series 51 variable displacement hydraulic motors use spherical pistons and piston rings. The angle between the cylinder block and the output shaft can be set between 32° and 6°, providing a 5 to 1 maximum to minimum displacement ratio.

At maximum displacement, the motor will provide a certain maximum output shaft torque and minimum speed corresponding to the pressure and flow supplied to the motor. Under the same input conditions but at minimum displacement, the shaft speed will be approximately five (5) times faster while the available output torque will decrease to approximately one-fifth (1/5) the full displacement value. The displacement is changed by a servo piston which is connected to the valve segment.

Various hydraulic and electrohydraulic controls may be mounted on the motor end cap to control the servo piston and the motor displacement. Servo pressure oil may either be supplied internally from the motor, or externally.

For all controls except the N2 and PC, servo pressure oil is supplied to a four (4) way spool valve in the motor end cap. When a combination of pilot pressure (or force) from an external control assembly and internal spring force shifts this valve, servo pressure is routed to move the servo piston and change the motor's displacement.

A synchronizing shaft, with spherical rollers, synchronizes the rotation of the output shaft and the cylinder block. The ball end of each piston runs in a socket bushing, pressed into the output shaft. There are no other parts used to connect the pistons to the shaft. Two tapered roller bearings support the output shaft.

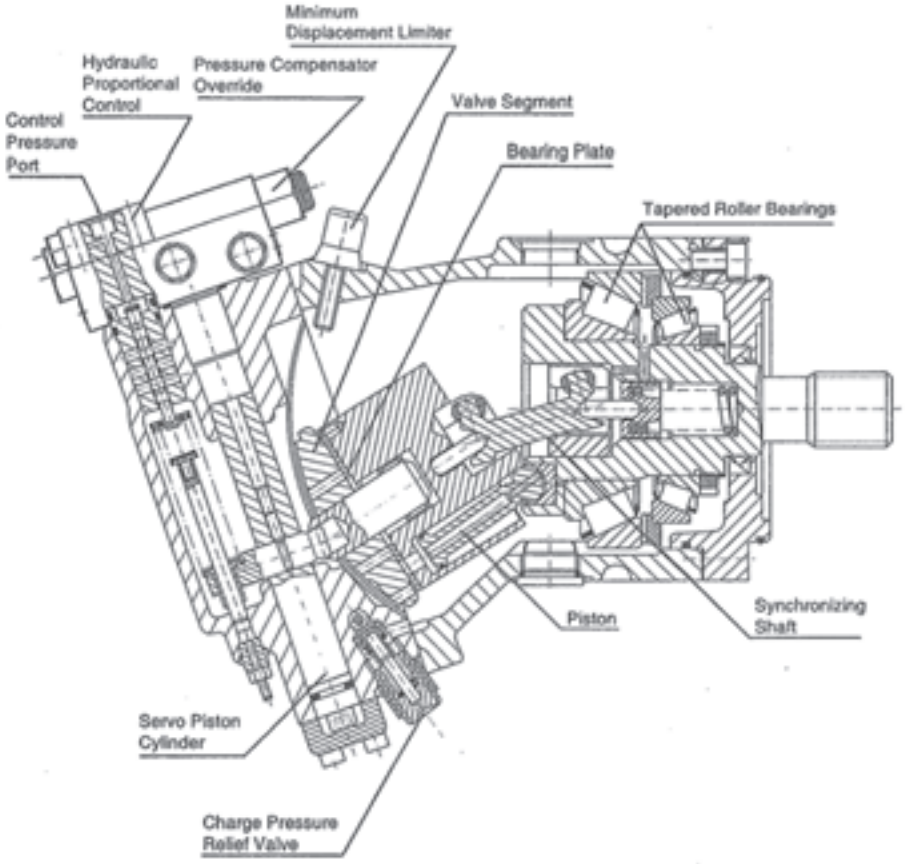


Fig. 10-1 - Sectional view of Series 51 variable displacement motor (SAE Flange Configuration) with Hydraulic Proportional Control

Functional Description

Fig. 10-2 - Loop Flushing Components

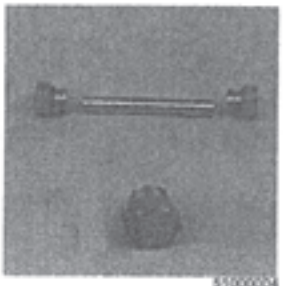


Fig. 10-3 - Loop Flushing Defeat Components

Loop Flushing

Series 51 motors used in closed circuit applications incorporate an integral loop flushing valve as standard equipment. Installations that require additional fluid to be removed from the main hydraulic circuit because of fluid cooling requirements, or circuits requiring the removal of excessive contamination from the high pressure circuit, can benefit from loop flushing. Series 51 motors used in open circuit applications may have the optional loop flushing defeat components installed.

Series 51 motors equipped with an integral loop flushing valve also include a charge pressure relief valve. The setting of the motor charge relief valve affects the function of the flushing circuit. Higher motor charge relief settings reduce the loop flushing flow and increase the flow over the pump charge pressure relief valve when the circuit is operating. Lower motor charge relief settings increase the loop flushing flow and may increase the motor case pressure when the circuit is operating.

An appropriate combination of pump and motor charge pressure settings should be maintained to insure the proper function of the loop flushing circuit. Correct charge pressure must be maintained under all conditions of operation to maintain pump control performance in closed loop systems.

NOTE: An optional orifice may be installed between the motor charge relief and the motor case to limit the maximum flushing oil flow.

Functional Description (Continued)

Displacement Limiters

All Series 51 motors incorporate mechanical displacement limiters. The minimum displacement of the motor can be limited within the standard range by a set screw in the motor housing. The maximum displacement can be limited with spacers installed on the servo piston.

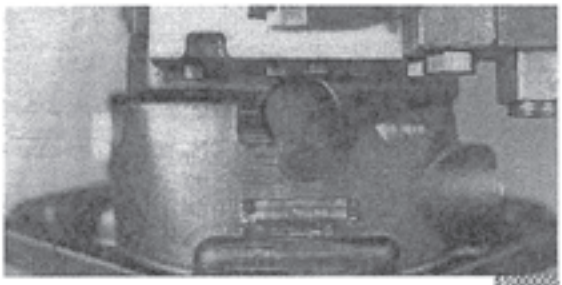


Fig. 10-4 - Minimum Displacement Limiter with Tamper Resistant Cap (Cartridge Motor Configuration Shown)

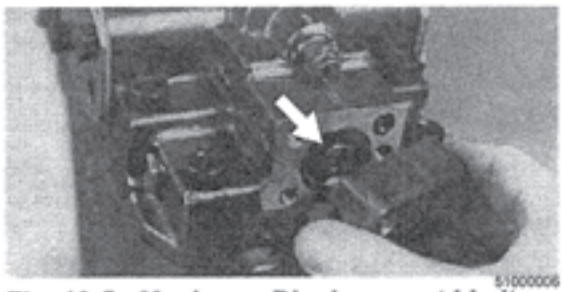


Fig. 10-5 - Maximum Displacement Limiter Screw

Controls - General

A wide range of control options is available for the Series 51 motors. These include pilot operated Electrohydraulic 2-Position Controls, Hydraulic Proportional Controls (single or two [2] connection), and Electrohydraulic Proportional Controls. A directly operated Hydraulic 2-Position Control and a Pressure Compensator regulator are also available.

The Series 51 variable motor servo piston (except when equipped with N2 control or the PC regulator) may be operated either by servo pressure oil supplied internally from the main ports of the motor, or by servo pressure oil supplied from an external source. (The N2 control uses servo pressure supplied by an external control valve. The PC regulator obtains servo pressure from the main ports of the motor.)

Orifice plugs are installed in the control spool sleeve in the end cap to regulate the flow of oil from the servo piston to the motor housing. Orifice plugs may be installed in the end cap to regulate the flow of servo pressure supply oil to the control valve, and to regulate the flow of oil from the control valve to the servo piston.

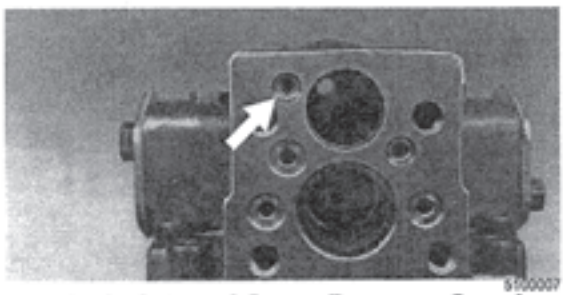


Fig. 10-6 - Internal Servo Pressure Supply Screen with Multi-function Block and/or Control Removed (Plug for External Supply)

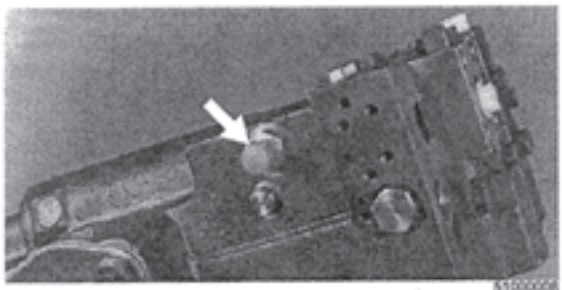


Fig. 10-7 - External Servo Pressure Supply Fitting (Plug for Internal Supply)

Functional Description (Continued)

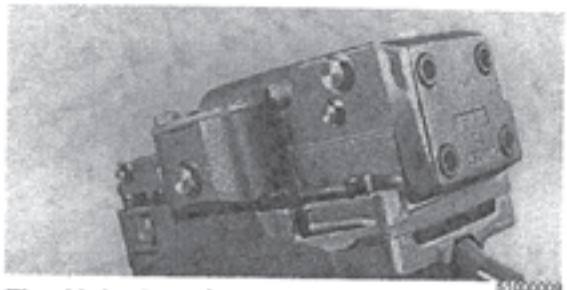


Fig. 10-8 - Series 51 Motor with N2 Control

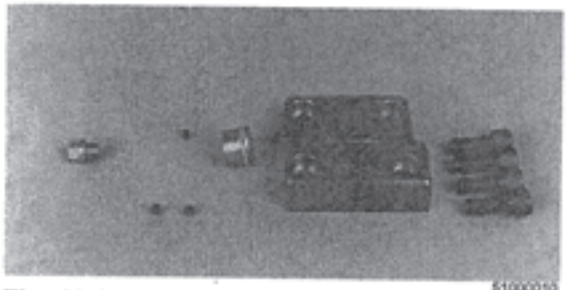


Fig. 10-9 - N2 Control Components

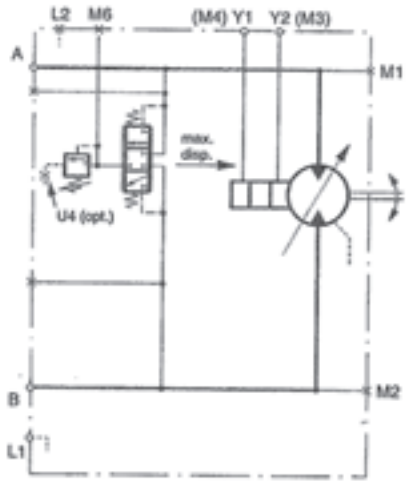


Fig. 10-10 - N2 Control Schematic

Hydraulic 2-Position Control (Type N2)

This is a two (2) position (maximum - minimum displacement) control, consisting of a cover plate mounted on the end cap. An external control valve supplies servo pressure from an external source directly to the servo piston. PCOR is not available with the N2 control.

When servo pressure is supplied to port "Y1," the setting piston moves to the maximum motor displacement position. When servo pressure is supplied to port "Y2," the setting piston moves to the minimum motor displacement position.

Orifices may be installed in the external control valve or its connections to regulate the speed of servo piston movement.

Functional Description (Continued)

Electrohydraulic 2-Position Control (Types E1•E2 and F1•F2)

A 12 or 24 VDC solenoid valve, mounted on the multi-function block, connects the end of the control valve spool in the end cap with pilot pressure (provided by the shuttle spool in the multi-function block) or with the motor case. The control valve in the end cap is biased by a threshold spring, and controls oil flow to the ends of the servo piston. Servo pressure may be supplied from an external source or internally by the shuttle spool in the multi-function block. PCOR is available with these controls.

With the E1 and E2 controls, energizing the solenoid will cause the motor to shift to minimum displacement. When the solenoid is not energized, the motor is held at maximum displacement.

With the F1 and F2 controls, energizing the solenoid causes the motor to shift to maximum displacement. When the solenoid is not energized, the motor is held at minimum displacement.

Fig. 10-11 - Series 51 Motor with E1•E2 or F1•F2 Control

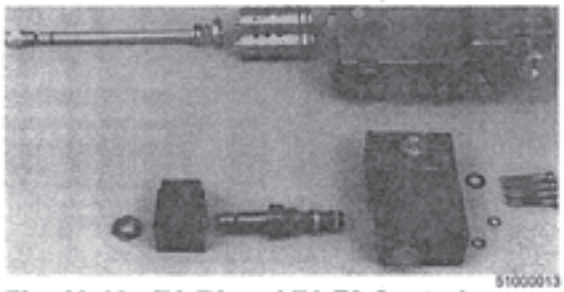


Fig. 10-12 - E1•E2 and F1•F2 Control Components

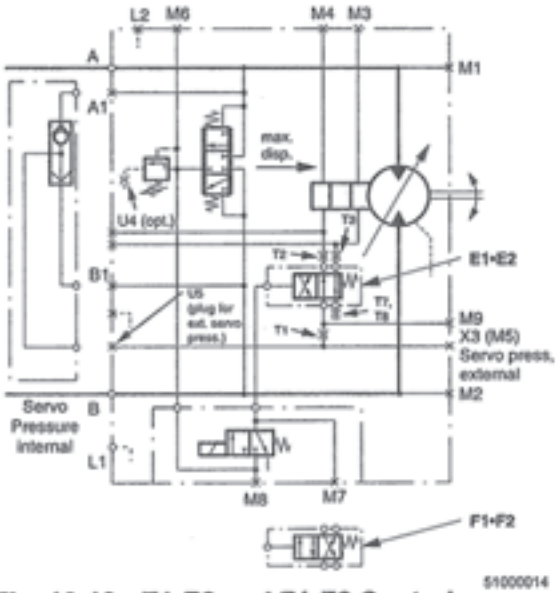


Fig. 10-13 - E1•E2 and F1•F2 Control Schematic

Functional Description (Continued)

Fig. 10-14 - Series 51 Motor with S1 Control

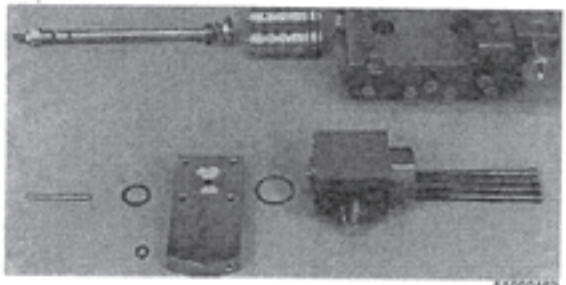


Fig. 10-15 - S1 Control Components

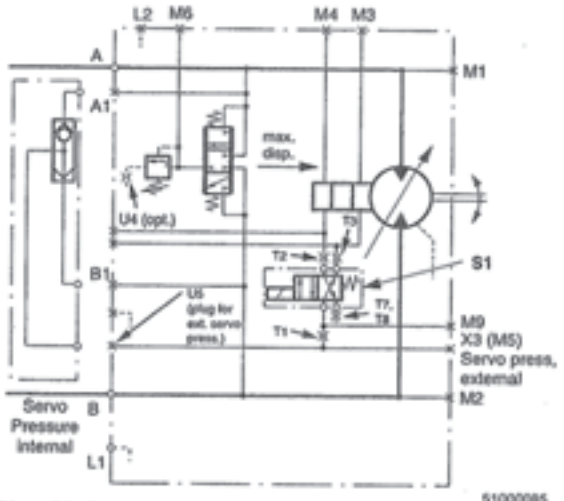


Fig. 10-16 - S1 Control Schematic

Electric 2-Position Control (Type S1)

A 12 VDC solenoid valve, mounted on the multi-function block, directly operates the control valve spool in the end cap. The control valve in the end cap is biased by a threshold spring, and controls oil flow to the ends of the servo piston. Servo pressure may be supplied from an external source or internally by the shuttle spool in the multi-function block. PCOR is available with this control.

With the S1 control, energizing the solenoid causes the motor to shift to maximum displacement. When the solenoid is not energized, the motor is held at minimum displacement.

Functional Description (Continued)

Hydraulic Proportional Control (Type HZ)

The HZ control consists of a cover plate mounted directly on the end cap. A ball type shuttle valve provides internal servo pressure supply to the control valve in the end cap. PCOR is not available with the HZ control.

Feedback springs (single spring for 060, 080 and 110) and a threshold spring are installed in the end cap. The feedback springs and threshold spring provide a force on the end of the control spool. The force of the threshold spring is externally adjustable with an adjusting screw. The feedback spring is positioned between the control spool and a feedback lug attached to the servo piston. The force of the feedback spring increases as the motor's displacement decreases.

Pilot oil pressure from an external source is applied to the end of the control spool opposite the feedback and threshold springs. An increase in pilot pressure (above the threshold pressure and within the modulating pressure range) will result in a decrease in motor displacement, while a decrease in pilot pressure will result in an increase in motor displacement.

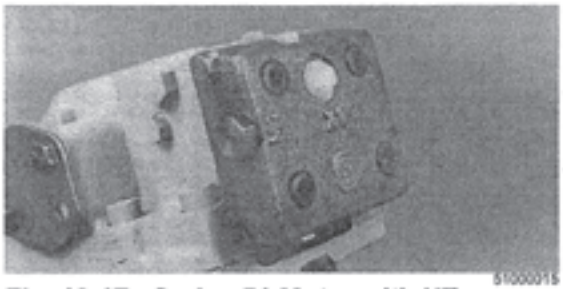


Fig. 10-17 - Series 51 Motor with HZ Control

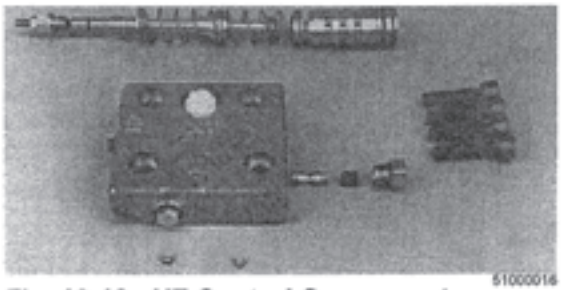


Fig. 10-18 - HZ Control Components

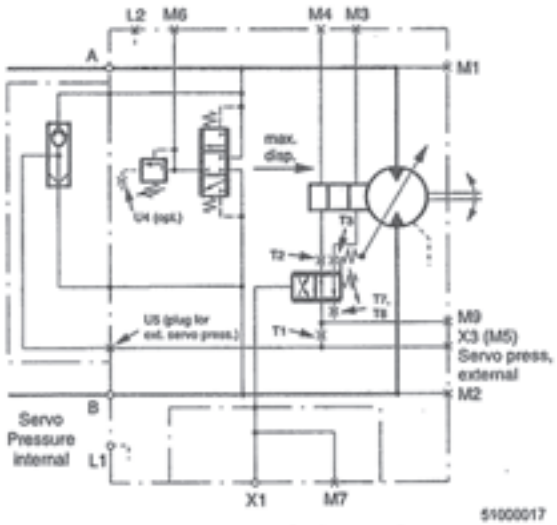


Fig. 10-19 - HZ Control Schematic

Functional Description (Continued)

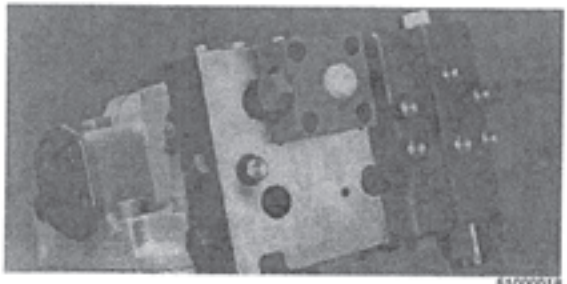


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Fig. 10-20 - Series 51 Motor with HS Control

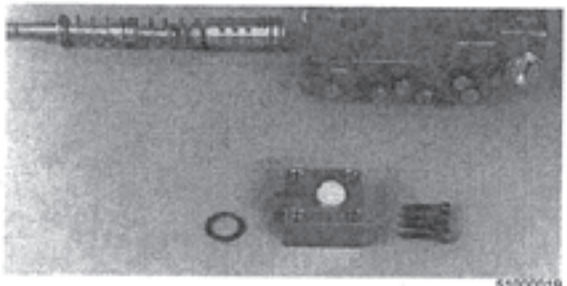

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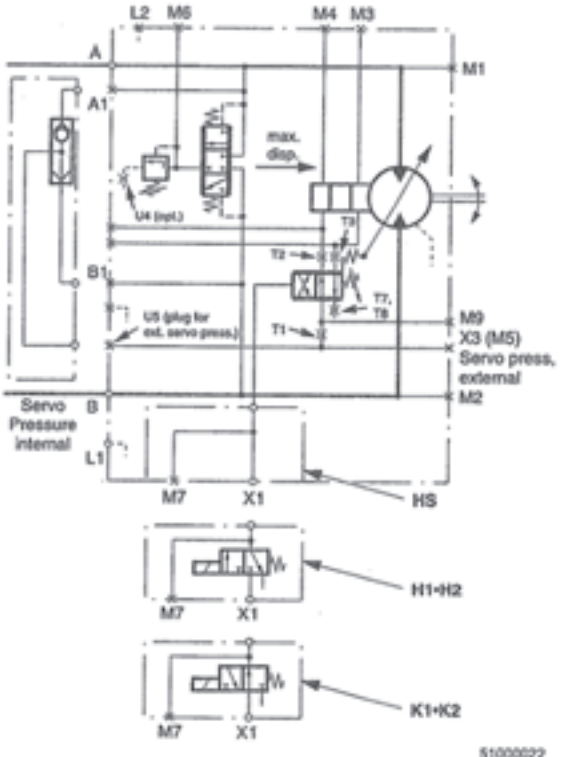
Fig. 10-21 - HS Control Components



51000022

Fig. 10-22 - HS, H1•H2, and K1•K2 Control Schematic

Hydraulic Proportional Control (Type HS)

The HS control consists of a cover plate (with a hydraulic port) mounted on the multi-function block. Servo pressure may be supplied from an external source or internally by the shuttle spool in the multi-function block. PCOR is available with this control.

The function of the HS control is identical to the function of the HZ control.

Functional Description (Continued)

Hydraulic Proportional Control with Electric Override (Types H1•H2 and K1•K2)

The function of the H1•H2 and K1•K2 controls is similar to the function of the HS control. A 12 or 24 VDC solenoid valve is installed between the external pilot pressure source and the control spool.

With the H1•H2 controls, energizing the solenoid allows the control to function as an HS control. When the solenoid is not energized, pilot pressure is blocked and the end of the control spool is drained to the motor case, causing the motor to shift to maximum displacement.

With the K1•K2 controls, energizing the solenoid blocks pilot pressure and drains the end of the control spool to the motor case, causing the motor to shift to maximum displacement. When the solenoid is not energized, the control functions as an HS control.

Fig. 10-23 - Series 51 Motor with H1•H2 Control

Fig. 10-24 - Series 51 Motor with K1•K2 Control

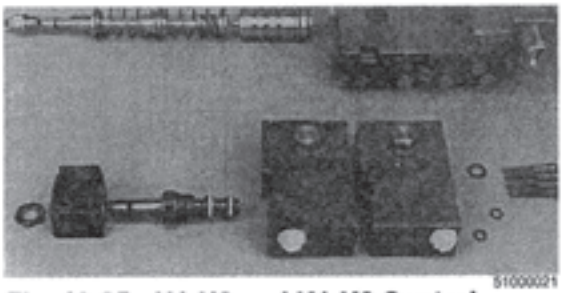


Fig. 10-25 - H1•H2 and K1•K2 Control Components

Functional Description (Continued)

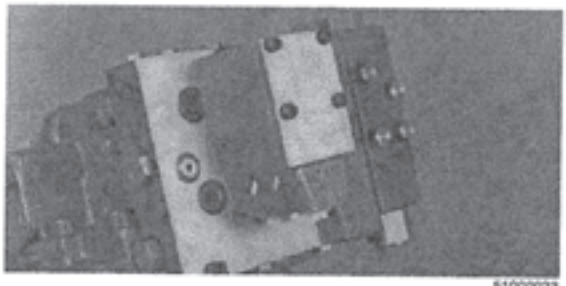


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Fig. 10-26 - Series 51 Motor with HP Control

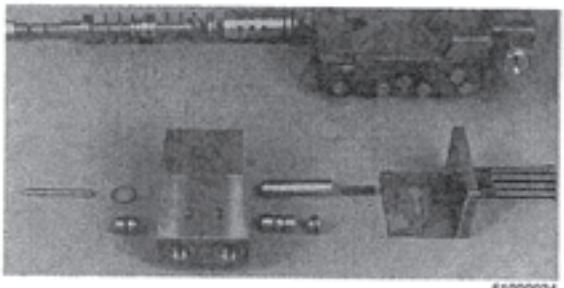

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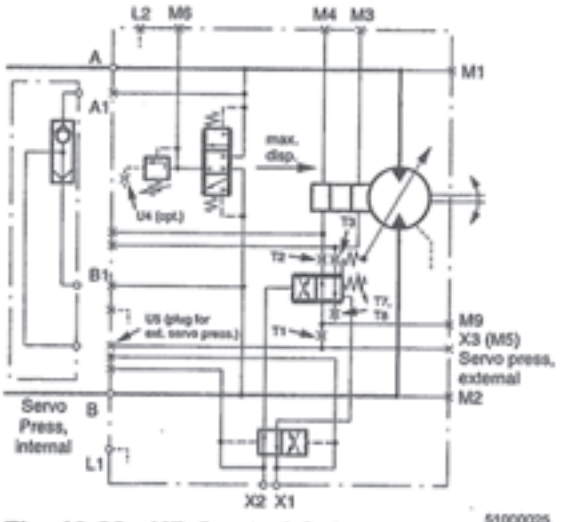
Fig. 10-27 - HP Control Components



51000025

Fig. 10-28 - HP Control Schematic

Two Line Hydraulic Proportional Control (Type HP)

This control consists of a valve block with two (2) hydraulic ports mounted on the multi-function block. The valve block incorporates a shuttle spool and a pilot piston with centering springs. A pin transmits force from the pilot piston to the control spool in the end cap. Feedback springs (single spring for 060, 080, and 110) and a threshold spring are installed in the end cap. These springs function similar to the HS control. Servo pressure may be supplied from an external source or internally by the shuttle spool in the multi-function block. PCOR is available with this control.

Two pilot pressures are provided to the control. The shuttle spool directs the higher pilot pressure to the end of the pilot piston opposite the feedback spring, and the lower pressure to the opposite side of the pilot piston. The rod transmits a force, proportional to the difference of the pilot pressures, to the control spool.

An increase in the difference between the pilot pressures will result in a decrease in motor displacement, while a decrease will result in an increase in displacement.

Functional Description (Continued)

Two Line Hydraulic Proportional Control for "Dual-Path" Vehicles (Type HC)

The HC control operates in a similar manner to the HP control, however the HC control is optimized for use in "dual-path" drive vehicles. This control consists of a valve block with two (2) hydraulic ports mounted on the end cap. The valve block incorporates a shuttle spool and a pilot piston with centering springs. A pin transmits force from the pilot piston to the control spool in the end cap.

A bleed valve is provided to eliminate any air which might become trapped in the pilot piston oil passages.

Feedback springs are installed in the end cap. Servo pressure is supplied internally by a ball type shuttle valve in the control housing. PCOR is not available with this control.

Two pilot pressures are provided to the control. The shuttle spool directs the higher pilot pressure to the end of the pilot piston opposite the feedback springs, and the lower pressure to the opposite side of the pilot piston. The pin transmits a force, proportional to the difference of the pilot pressures, to the control spool.

An increase in the difference between the pilot pressures will result in a decrease in motor displacement, while a decrease will result in an increase in displacement. The feedback springs in the end cap have differing spring rates and operate in parallel (060, 080, and 110) or series (160 or 250) to provide a linear relationship between motor displacement and pilot pressure differential.

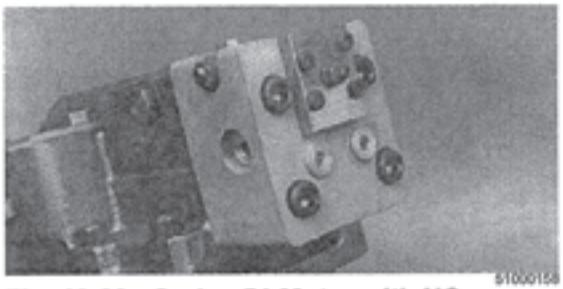


Fig. 10-29 - Series 51 Motor with HC Control

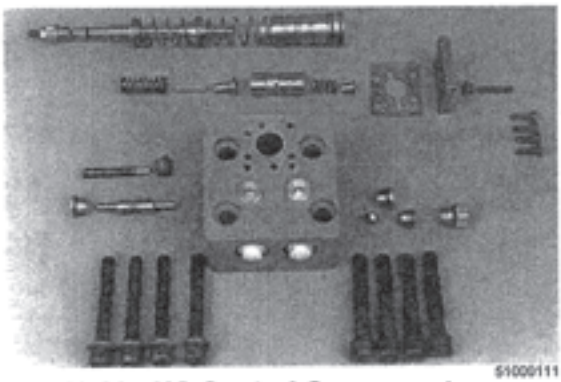


Fig. 10-30 - HC Control Components

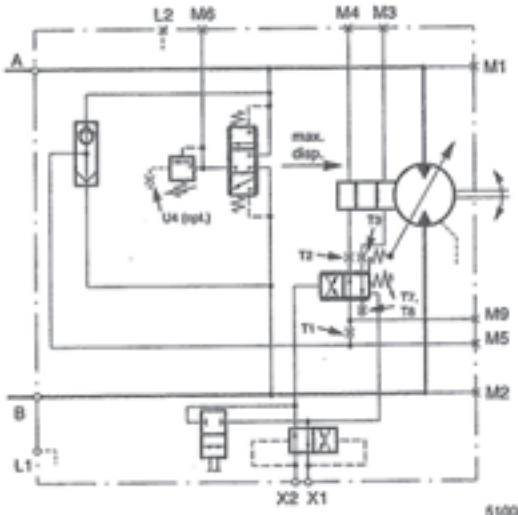


Fig. 10-31 - HC Control Schematic

Functional Description (Continued)

Fig. 10-32 - Series 51 Motor with EP Control (EQ Similar)

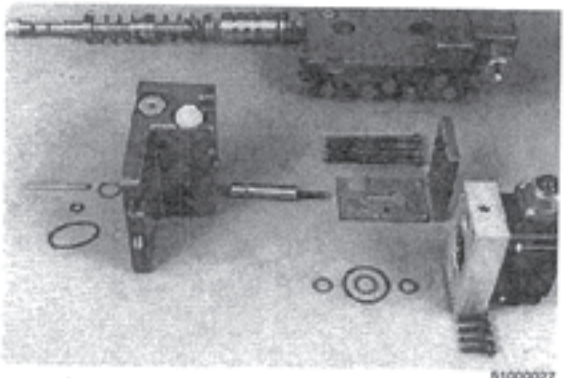


Fig. 10-33- EQ Control Components (EP Similar)

Electrohydraulic Proportional Control (Types EP and EQ)

This control consists of a valve block and PCP (Pressure Control Pilot) valve mounted on the multi-function block. The valve block incorporates a pilot piston with centering springs. A pin transmits force from the pilot piston to the control spool in the end cap. Feedback springs (single spring for 060, 080, and 110) and a threshold spring are installed in the end cap. These springs function similar to the HS control. Servo pressure may be supplied from an external source or internally by the shuttle spool in the multi-function block. PCOR is available with this control.

An external pilot pressure source is connected to the inlet of the PCP valve, which produces differential pilot pressures proportional to the current through it. These pressures are applied to the pilot piston. The operation of this control is similar to that of the HP Control, with the motor displacement being proportional to the current through the PCP valve.

An increase in current (above the threshold current) will result in a decrease in motor displacement, while a decrease will result in an increase in displacement.

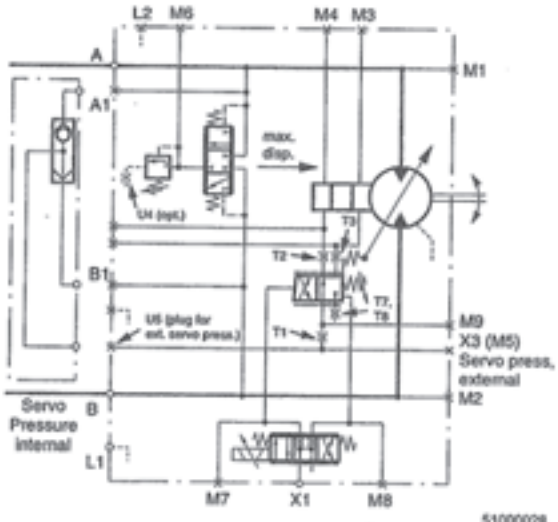


Fig. 10-34 - EP and EQ Control Schematic

Functional Description (Continued)

Multi-function Block Components

The Multi-function Valve Block includes a shuttle valve which provides internally supplied servo pressure, and an optional Pressure Compensator Over-Ride (PCOR) function with optional brake pressure defeat.

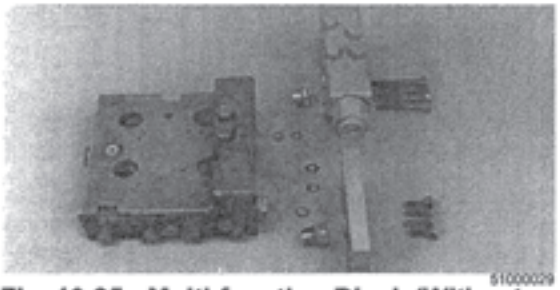


Fig. 10-35 - Multi-function Block (Without Control)

Servo Pressure Supply

For internal supply, the multi-function block incorporates a shuttle spool with internal check ball valve that routes oil from the main circuit ports of the motor to the control valve in the end cap. "High side" pressure is provided to the servo control valve in the end cap.

For external supply, the connection between the shuttle spool and the servo control valve is blocked in the end cap. The external pressure supply to the servo control valve connects to a port ("M5") on the end cap.

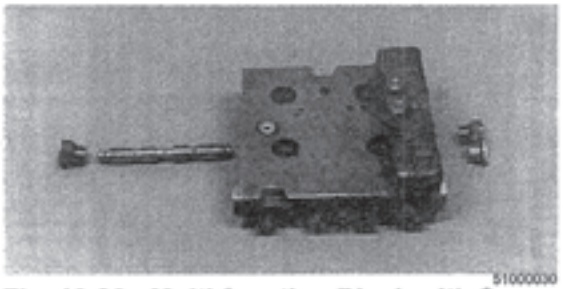


Fig. 10-36 - Multi-function Block with Servo Pressure Supply Shuttle Spool

Pressure Compensator Over-Ride (PCOR)

The Pressure Compensator Over-Ride (PCOR) system includes a spool valve located in the PCOR block which is attached to the multi-function block. This system increases the motor displacement at system pressures above the PCOR valve setting. (Pressure Compensator Over-Ride is not available with the N2 and HZ controls, or the PC regulator.)

For bi-directional PCOR operation, the shuttle valve in the multi-function block routes system high pressure to the PCOR spool valve. For single direction PCOR operation, the PCOR spool valve is connected to one (1) side of the closed loop through passages in the multi-function block

When system pressure exceeds the PCOR setting, the spool valve moves to connect the displacement reducing end of the servo piston to the motor case, and the displacement increasing end of the servo piston to system pressure. This increases the motor displacement, which reduces the motor output speed. When the PCOR valve closes, control of the servo piston returns to the control spool in the motor end cap.

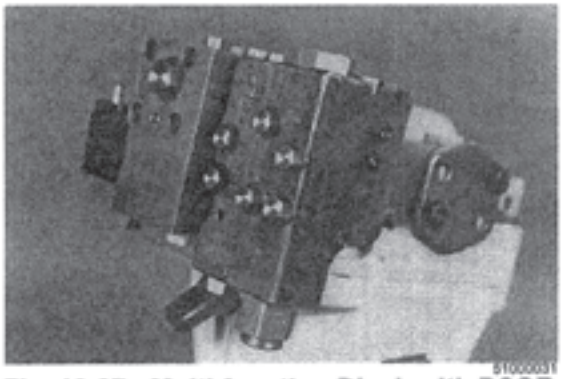
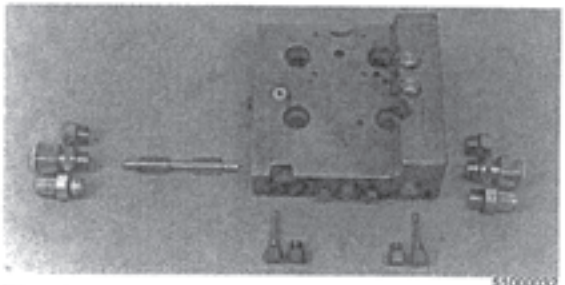


Fig. 10-37 - Multi-function Block with PCOR Block and Spool Valve (K1•K2 Control Shown)

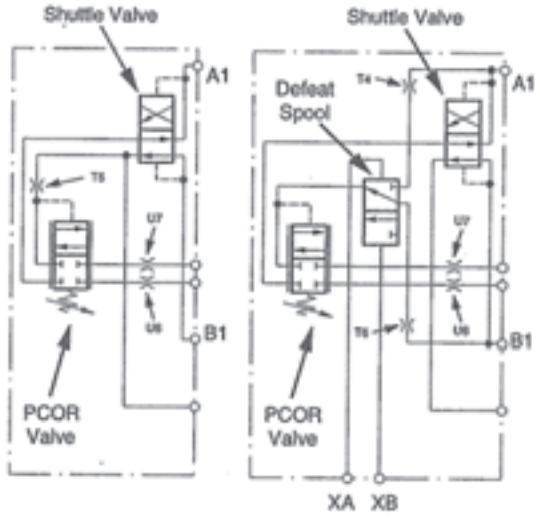
Functional Description (Continued)



S1000032

Fig. 10-38 - Multi-function Block with PCOR Defeat Spool Components

An optional "brake pressure defeat" spool may be installed in the multi-function block. When used with the PCOR, this spool assures that the PCOR does not cause the motor displacement to increase during deceleration (which could cause pump overspeed). Pressure from a source such as the pump servos or an external valve, shifts the defeat spool to block the high pressure supply to the PCOR valve from the "deceleration" side of the closed loop. Either bi-directional or single direction PCOR operation can be specified when PCOR defeat is installed.



S1000033

Fig. 10-39 - PCOR and PCOR with Defeat Schematic

PCOR Brake Pressure Defeat Operation

Rotation	High pressure port	Control pressure on port
CW	A	XB
CCW	B	XA

Functional Description (Continued)

Pressure Compensator Regulator (Type PC)

In this regulator, the Pressure Compensator system in the multi-function block assembly controls the motor displacement. At system pressures below the compensator setting, the servo piston is maintained in the minimum motor displacement position. When system pressure exceeds the POR setting, hydraulic pressure acts on the servo piston to increase the motor displacement.

With the Pressure Compensator regulator, an increase in system pressure (above the setting pressure) will result in an increase in motor displacement and output torque, and a decrease in motor shaft speed.

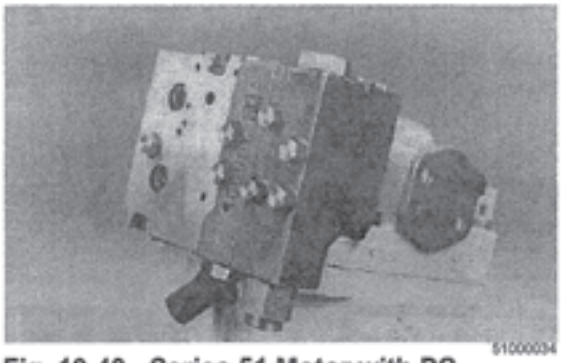


Fig. 10-40 - Series 51 Motor with PC Regulator

Fig. 10-41 - PC Regulator Components

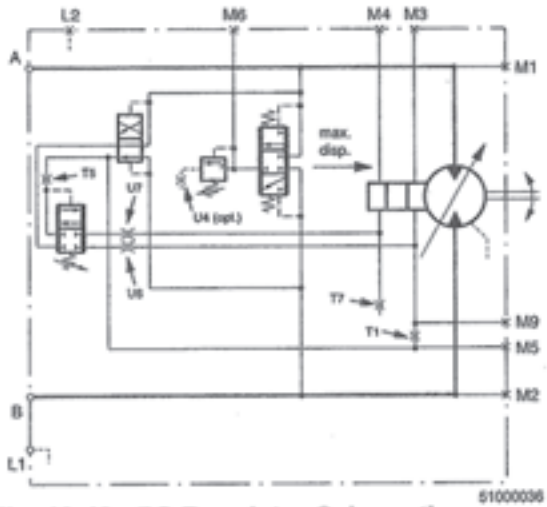


Fig. 10-42 - PC Regulator Schematic

Technical Specifications and Data - Variable Displacement Motors

Design

Piston motor with variable displacement, bent axis construction.

Type of Mounting

SAE four (4) bolt flange – SAE Flange Configuration.
Two (2) bolt flange – Cartridge Motor Configuration.

Pipe Connections

Main pressure ports: SAE flange
Remaining ports: SAE O-ring thread

Direction of Rotation

Clockwise and counter-clockwise.

Installation Position

Installation position discretionary. The housing must always be filled with hydraulic fluid.

System Pressure Range, Input

Max: 480 bar (6960 psi)
Min: 10 bar (145 psi)

Case Pressure

Max. Continuous: 3 bar (44 psi)
Intermittent (Cold start): 5 bar (73 psi)

Hydraulic Fluid

Refer to Sauer-Sundstrand publication BLN-9887 or 697581.

Temperature [1)]

ϑ min = -40°C (-40°F), intermittent, cold start
ϑ nominal = 104°C (220°F), continuous
ϑ max = 115°C (240°F), intermittent

[1)] at the hottest point, normally the case drain line.
Hydraulic fluid viscosity must be as shown below.

Fluid Viscosity Limits

v min =	5 mm²/s (42 SUS)	intermittent
v min =	6.4 mm²/s (47 SUS)	min. continuous
v min =	13 mm²/s (70 SUS)	optimum
v max =	110 mm²/s (510 SUS)	max. continuous
v max =	1600 mm²/s (7400 SUS)	intermittent, cold start

Filtration

Acceptable contamination level: ISO Code 18/13 or better. Refer to Sauer-Sundstrand publication BLN-9887 or 697581.

		Dimension	Frame Size				
			060	080	110	160	250
Displacement	maximum	cm^3 in^3	60.0 3.66	80.7 4.92	109.9 6.71	160.9 9.82	250.0 15.26
	minimum	cm^3 in^3	12.0 0.73	16.1 0.98	22.0 1.34	32.2 1.96	50.0 3.05
Continuous speed	at max disp at min disp	min^{-1} (rpm) min^{-1} (rpm)	3600 5600	3100 5000	2800 4500	2500 4000	2200 3400
Max. speed	at max disp at min disp	min^{-1} (rpm) min^{-1} (rpm)	4400 7000	4000 6250	3600 5600	3200 5000	2700 4250
Theoretical torque	at max disp	Nm / bar lbf•in / 1000 psi	0.95 583	1.28 784	1.75 1067	2.56 1563	3.98 2428
	at min disp	Nm / bar lbf•in / 1000 psi	0.19 117	0.26 156	0.35 214	0.51 313	0.80 486
Max. continuous flow	Q max	L / min gal / min	216 57	250 66	308 81	402 106	550 145
Max. corner power	Pcorner max	kW hp	336 450	403 540	492 660	644 864	850 1140
Mass moment of inertia	J	kg • m^2 lbf • ft^2	0.0046 0.1092	0.0071 0.1685	0.0128 0.3037	0.0234 0.5553	0.0480 1.1580
Weight (with control N2)	m	kg lb	28 62	32 71	44 97	56 123	86 190

Safety Precautions

- When Series 51 units are used in vehicular hydrostatic drive systems, the loss of hydrostatic drive line power in any mode of operation may cause a loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.
- Certain service procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders.
- Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.
- Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Notes

Gauge Installation

Various pressure gauge readings can be a great asset in troubleshooting problems with the Series 51 motor or support system.

Snubbers are recommended to protect pressure gauges. Frequent gauge calibration is necessary to insure accuracy.

Fig. 30-1 - Gauge Ports, Motor with N2 Control

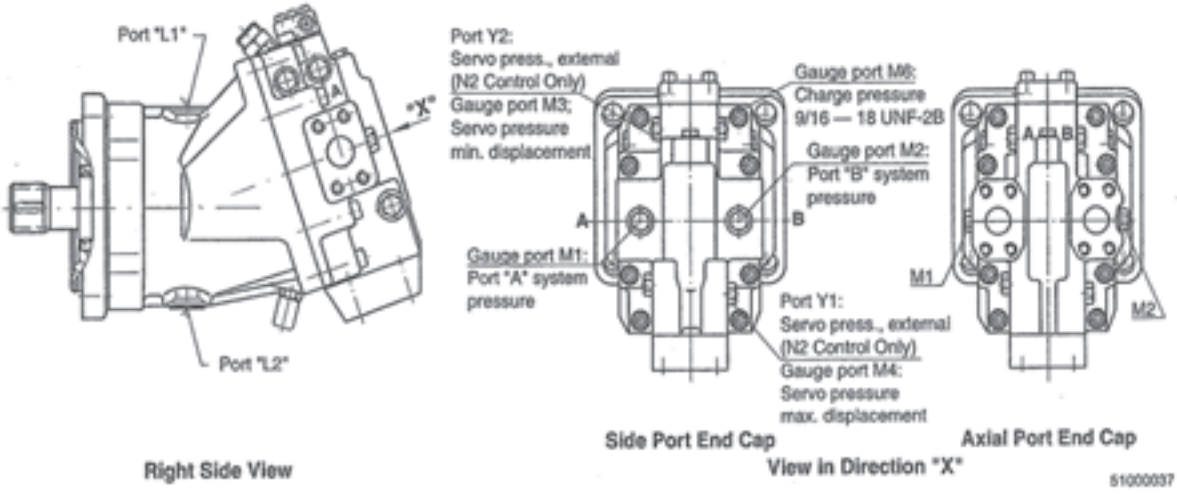


Fig. 30-2- Gauge Ports, Motor with E1•E2, F1•F2, H1•H2, and K1•K2 Controls

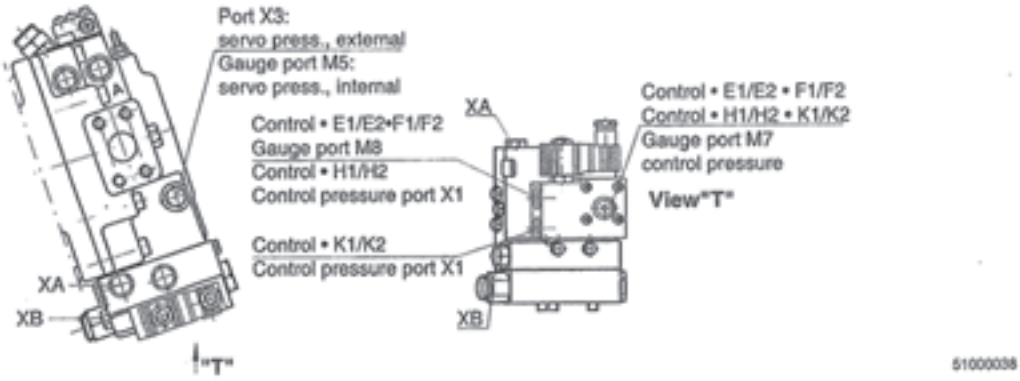
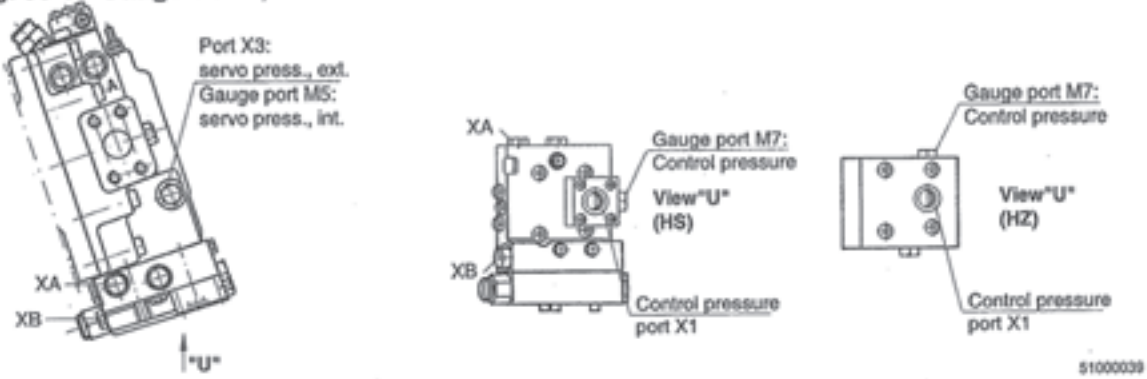


Fig. 30-3 - Gauge Ports, Motor with HS and HZ Controls



Gauge Installation (Continued)

Fig. 30-4 - Gauge Ports, Motor with HP Control

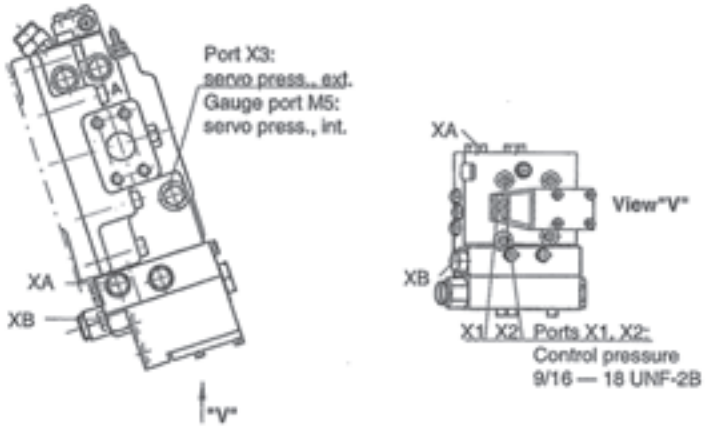
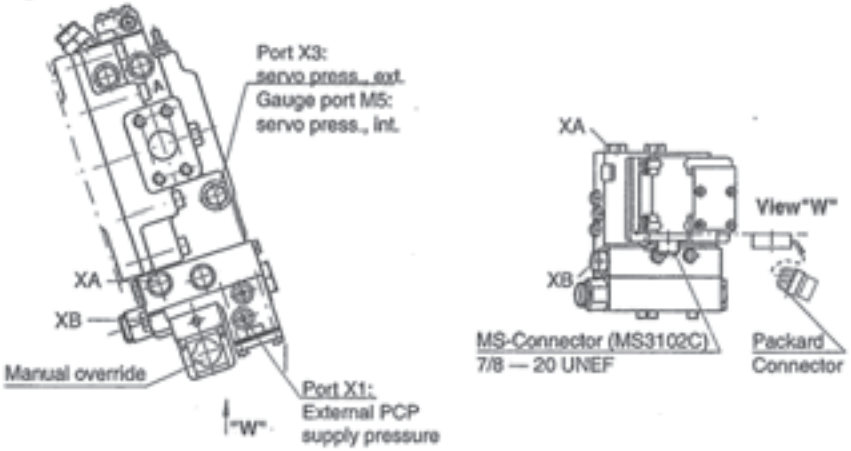


Fig. 30-5 - Gauge Ports, Motor with EP•EQ Control



Gauge Information

M1	System Pressure Port "A"	600 bar or 10,000 psi Gauge 9/16 — 18 O-Ring Fitting
M2	System Pressure Port "B"	600 bar or 10,000 psi Gauge 9/16 — 18 O-Ring Fitting
M3	Servo Pressure (Min. Angle)	600 bar or 10,000 psi Gauge 9/16 — 18 O-Ring Fitting
M4	Servo Pressure (Max. Angle)	600 bar or 10,000 psi Gauge 9/16 — 18 O-Ring Fitting
M5 (M9)	Servo Supply Pressure	600 bar or 10,000 psi Gauge 9/16 — 18 O-Ring Fitting or Tee into Control Pressure Line

M6	Motor Charge Pressure	60 bar or 1000 psi Gauge 9/16 — 18 O-Ring Fitting
M7 M8	Control Test Port	60 bar or 1000 psi Gauge 9/16 — 18 O-Ring Fitting
L1 L2	Case Pressure	60 bar or 1000 psi Gauge **060, 080, 110:** 1-1/16 — 12 O-Ring Fitting **160, 250:** 1-5/16 — 12 O-Ring Fitting
X1 X2 X3	Control Pressure	60 bar or 1000 psi Gauge 9/16 — 18 O-Ring Fitting
XA XB	Defeat Pressure	60 bar or 1000 psi Gauge Tee into Defeat Pressure Line(s)

Start-Up Procedure and Maintenance

Start-Up Precautions

Cleanliness

Ensure that all system components, including fittings, pipes, and hoses, are completely clean. If cloths are used for cleaning components, they must be made of lint-free materials.

Follow the guidelines presented in Sauer-Sundstrand publication BLN-9887 or 697581 for required fluid cleanliness levels at machine start-up.

Reservoir and Fluid Level

The reservoir should be designed to accommodate maximum volume changes during all system operating modes, and to promote de-aeration of the fluid as it passes through the tank. The reservoir outlet (charge pump inlet) and the reservoir inlet (fluid return) must always be below the normal fluid level. A sight glass is the preferred method for checking fluid level.

The reservoir inlet (fluid return) should be positioned so that flow to the reservoir is directed into the interior of the reservoir for maximum dwell and efficient de-aeration. A baffle (or baffles) between the reservoir inlet and outlet ports will promote de-aeration and reduce surging of the fluid.

No funnel-shaped eddying at the reservoir outlet (charge pump inlet) or formation of foam at the reservoir inlet (fluid return) is permitted.

Start-Up Procedure

The following start-up procedure should always be followed when starting-up a new Series 51 installation or when restarting an installation in which either the pump or motor has been removed from the system.

WARNING

The following procedure may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders. Take necessary safety precautions before operating the vehicle/machine.

Prior to installing the motor, inspect the unit for damage incurred during shipping and handling. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

Fill the reservoir with recommended hydraulic fluid, which should be passed through a 10 micron (nominal, no bypass) filter prior to entering the reservoir. The use of contaminated fluid will cause damage to the components, which may result in unexpected vehicle/machine movement.

The inlet line leading from the reservoir to the pump must be filled prior to start up. Check inlet line for properly tightened fittings and make sure it is free of restrictions and air leaks.

Be certain to fill the pump and motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.

Install a 0 to 60 bar or 0 to 1000 psi pressure gauge in the charge pressure gauge port to monitor the charge pressure during start-up.

The external control input signal should be disconnected at the pump control during initial start-up. This will allow the pump to remain in its neutral position.

"Jog" or slowly rotate prime mover until charge pressure starts to rise. Start the prime mover and run at the lowest possible RPM until charge pressure is established. Excess air may be bled from the high pressure lines through the high pressure gauge ports.

Once charge pressure is established, increase speed to normal operating RPM. Note the charge pressure. If charge pressure is incorrect, shut down and determine cause for improper pressure.

Shut down prime mover and connect external control input signal. Start prime mover, checking to be certain pump remains in neutral. With prime mover at normal operating speed, slowly check for forward and reverse machine operation.

Charge pressure should be maintained during forward or reverse operation. Continue to cycle slowly between forward and reverse for at least five (5) minutes.

Shut down prime mover, remove gauges, and plug ports. Check reservoir level and add fluid if necessary.

The transmission is now ready for operation.

Start-Up Procedure and Maintenance (Continued)

Maintenance

Cleanliness

The reservoir breather air filter (if equipped) must be kept clean. Clean the area around the filler cap before opening the reservoir. The hydraulic fluid should be filtered before it enters the reservoir.

Follow the guidelines presented in Sauer-Sundstrand publication BLN-9887 or 697581 for required fluid cleanliness levels during machine operation.

Recommended Fluids

Hydraulic fluids used with Sauer-Sundstrand products should be carefully selected with assistance from a reputable supplier, following the guidelines presented in Sauer-Sundstrand publication BLN-9887 or 697581.

Checking for Leaks

Check the system components for leakage at regular intervals. Tighten any leaking connections while the system is not under pressure. Replace any defective seals and gaskets.

Check hydraulic hoses for damage or aging. When installing replacements, be certain that the hoses are clean and connected properly.

Checking the Fluid Level

Check the reservoir daily for proper fluid level, the presence of water (noted by a cloudy or milky appearance, or free water in bottom of reservoir), and rancid fluid odor (indicating excessive heat).

Changing the Fluid and Filter

To insure optimum service life on Series 51 products, regular maintenance of the fluid and filter must be performed.

The fluid and filter must be changed per the vehicle/machine manufacturer's recommendations. In the absence of such recommendations, the following intervals may be used:

- System with a sealed type reservoir - 2000 hrs.
- System with a breathing type reservoir - 500 hrs.

It may be necessary to change the fluid more frequently if the fluid becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid has been operating at temperature levels greater than the maximum recommended. Never reuse fluid.

The filter should be changed when changing the fluid, or whenever the filter indicator shows that it is necessary to change the filter.

Component Inspection and Adjustment

WARNING

The following procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the adjustments to prevent injury to the technician and bystanders.

Charge Pressure Relief Valve Adjustment

An appropriate combination of pump and motor charge pressure settings should be maintained to insure the proper function of the loop flushing circuit. **Correct charge pressure must be maintained under all conditions of operation to maintain pump control performance in closed loop systems.**

To measure motor charge pressure, install a 0 to 60 bar or 0 to 500 psi pressure gauge in the motor charge pressure gauge port. Install a gauge to measure case pressure. Operate the system with the prime mover at normal operating speed and the pump at half stroke (forward or reverse) when measuring motor charge pressure.

In most applications, the motor charge relief valve is set 2 to 4 bar (29 to 58 psi) below the setting of the pump charge relief valve (measured with the pump in its "neutral" or zero-angle position). This setting assumes a reservoir temperature of 50° C (122° F), and is referenced to case pressure.

Series 51 motors are equipped with an external screw adjustable charge pressure relief valve. To adjust the charge pressure, loosen the lock nut (with a 1-1/16" hex wrench) and turn the adjustment plug with a large screwdriver. Clockwise rotation of the plug increases the setting, and counter-clockwise rotation decreases the setting (at a rate of approximately 3.4 bar [50 psi] per turn). The lock nut should be torqued to 52 Nm (38 ft•lbsf).

Once the desired charge pressure setting is achieved, remove the gauges and reinstall the port plugs.

Fig. 30-6 - Adjusting Charge Pressure Relief Valve

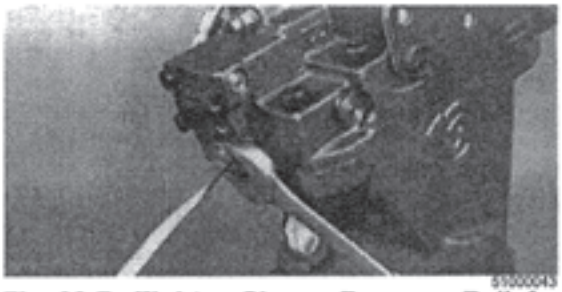


Fig. 30-7 - Tighten Charge Pressure Relief Valve Lock Nut

Component Adjustment (Continued)

Fig. 30-8 - Loosen Minimum Displacement Limiter Lock Nut

Fig. 30-9 - Rotate Minimum Displacement Adjusting Screw

Frame Size	Approximate Change in Minimum Displacement Per Revolution of Adjusting Screw
060	1.5 cc/Rev (.09 in3/Rev)
080	2.1 cc/Rev (.13 in3/Rev)
110	3.1 cc/Rev (.19 in3/Rev)
180	4.0 cc/Rev (.24 in3/Rev)
250	6.2 cc/Rev (.38 in3/Rev)

Frame Size	Min. Displacement Range cc/Rev (in/Rev)	Screw Size and Length mm (in)
060	12 to 29 (.73 to 1.77) 30 to 40 (1.83 to 2.44)	M10x65 (2.56) M10x80 (3.15)
080	16 to 35 (.98 to 2.14) 36 to 54 (2.20 to 3.20)	M10x65 (2.56) M10x80 (3.15)
110	22 to 46 (1.34 to 2.81) 47 to 74 (2.87 to 4.52)	M12x70 (2.76) M12x80 (3.15)
160	32 to 72 (1.95 to 4.39) 73 to 107 (4.45 to 6.53)	M12x75 (2.95) M12x90 (3.54)
250	50 to 90 (3.05 to 5.49) 91 to 130 (5.55 to 7.93) 131 to 167 (7.99 to 10.19)	M12x75 (2.95) M12x90 (3.54) M12x100 (3.94)

Minimum Displacement Limiter Adjustment

The minimum displacement is set at the factory, and the adjustment screw is covered with a tamper-resistant cap

WARNING

Care should be taken in adjusting displacement limiters to avoid undesirable speed conditions. The sealing lock nut must be retorqued after every adjustment to prevent an unexpected change in operating conditions and to prevent external leakage during unit operation.

NOTE: Changes in motor displacement can be detected by providing a constant flow of fluid to the motor, while maintaining the motor at minimum displacement and monitoring the motor output shaft speed. An increase in displacement will result in a decrease in shaft speed, while a decrease in displacement will result in an increase in shaft speed.

To adjust the minimum displacement, first remove and discard the cap covering the adjusting screw. Using a 17 mm hex wrench for 060 and 080 frame size motors or a 19 mm hex wrench for 110 through 250 frame size motors, loosen the lock nut retaining the minimum displacement limiter adjusting screw.

Using a 5 mm internal hex wrench for 060 and 080 frame size motors or a 6 mm internal hex wrench for 110 through 250 frame size motors, rotate the adjusting screw to limit the minimum displacement of the motor.

Rotating the adjusting screw clockwise will increase the minimum displacement of the motor, while rotating the adjusting screw counter-clockwise will decrease the minimum displacement.

For each full revolution, of the adjusting screw, the displacement will change according to the accompanying chart.

Different minimum displacements may require different length adjusting screws. The various lengths are shown in the accompanying chart.

After establishing the desired minimum displacement setting, tighten the lock nut on the adjusting screw to 51 Nm (38 ft•lbsf) for 060 and 080 frame size motors or 86 Nm (63 ft•lbsf) for 110 through 250 frame size motors. Install a new tamper-resistant cap on the adjusting screw.

Component Adjustment (Continued)

Maximum Displacement Limiter Adjustment

The maximum displacement of the Series 51 motors can be limited by limiting the stroke of the setting piston, and the resulting movement of the valve segment. A displacement stop screw is installed on the setting piston (under the minimum angle servo cover) to limit the stroke of the piston.

Spacers may be installed on the displacement stop screw to limit the stroke. A longer or shorter screw must be used to retain a thicker or thinner spacer.

WARNING

Care should be taken in adjusting displacement limiters to avoid undesirable speed conditions. The stop screw must be retorqued after adjustment to prevent an unexpected change in operating conditions.

NOTE: Changes in motor displacement can be detected by providing a constant flow of fluid to the motor, while maintaining the motor at maximum displacement and monitoring the motor output shaft speed. An increase in displacement will result in a decrease in shaft speed, while a decrease in displacement will result in an increase in shaft speed.

To adjust the maximum displacement, first remove the screws retaining the minimum angle servo cover to the end cap with an 8 mm internal hex wrench (060, 080, 110, and 160 units), or a 10 mm internal hex wrench (250 units). Remove the minimum angle servo cover and O-rings. Remove the displacement limiter screw with an 8 mm internal hex wrench.

Installing a thicker spacer on the end of the setting piston will reduce the maximum displacement of the motor. Installing a thinner spacer will increase the maximum displacement. The displacement will change according to the accompanying chart.

Torque the displacement limiter screw to 54 Nm (40 ft•lbsf).

Install the minimum angle servo cover and its O-rings. Install the cover screws and torque to 78 Nm (58 ft•lbsf) for 060, 080, 110, and 160 motors, or 110 Nm (81 ft•lbsf) for 250 motors.

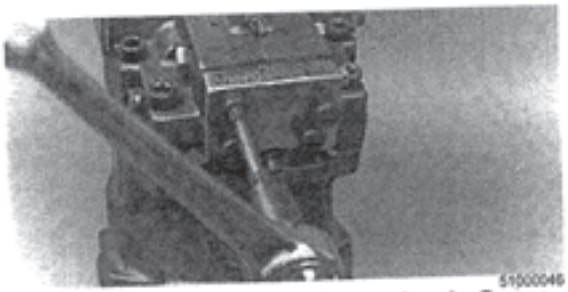


Fig. 30-10 - Remove Minimum Angle Servo Cover Screws

Frame Size	Approximate Change in Maximum Displacement with Change in Spacer Thickness cc/mm (in³/.1 in)
060	0.98 (.15)
080	1.14 (.18)
110	1.48 (.23)
160	1.93 (.30)
250	2.63 (.41)

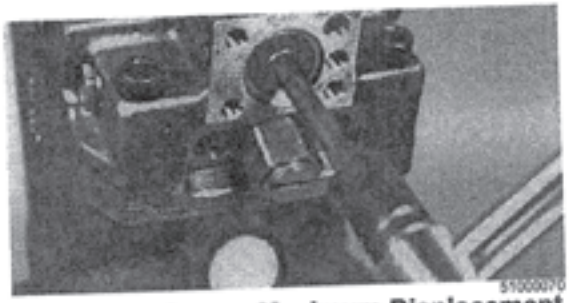


Fig. 30-11 - Torque Maximum Displacement Limiter Screw

Component Adjustment (Continued)

Displacement Control Adjustments

NOTE: A change in motor displacement can be detected by providing a constant flow of fluid to the motor and monitoring the motor output shaft speed while adjusting the control. An increase in displacement will result in a decrease in shaft speed, while a decrease in displacement will result in an increase in shaft speed.

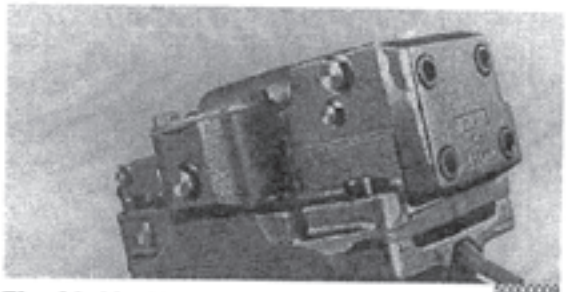


Fig. 30-12 - Hydraulic 2-Position Control, Type N2)

Hydraulic 2-Position Control (Type N2)

No adjustments are provided for the N2 control.

A minimum of 25 bar (360 psi) servo pressure is required to change the motor displacement with the motor shaft turning. A minimum of 70 bar (1015 psi) servo pressure is required to change the motor displacement with the motor shaft locked.

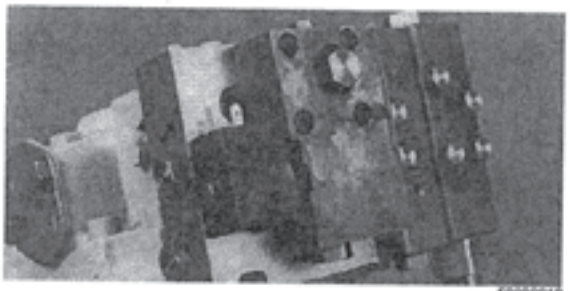


Fig. 30-13 - Electrohydraulic 2-Position Control, Types E1•E2 and F1•F2

Electrohydraulic 2-Position Control (Types E1•E2 and F1•F2) and Electric 2-Position Control (Type S1)

These controls do not require adjustment.

> **CAUTION**
>
> Do not tamper with the adjusting screw in the end cap (opposite the control).

Pilot pressure for the E1•E2 or F1•F2 electric solenoid valve is internally supplied. When the solenoid is energized, motor charge pressure should be present at test ports M7 and M8. When the solenoid is not energized, test port M8 should drop to case pressure.

Fig. 30-14 - Electric 2-Position Control, Type S1

The S1 control utilizes a direct acting solenoid to operate the control valve spool in the end cap.

Servo pressure supply oil is usually provided internally from the main system ports of the motor. If external servo pressure supply is utilized, a minimum of 25 bar (360 psi) is required to change the motor displacement with the motor shaft turning, and a minimum of 70 bar (1015 psi) is required with the motor shaft locked.

Component Adjustment (Continued)

Hydraulic Proportional Control (Types HZ, HS, H1•H2, and K1•K2)

The control start pressure for these controls may be adjusted with the adjusting screw on the end cap (opposite the control block). Control start is that pilot pressure at which the motor displacement starts to decrease.

To check the control start setting, install a gauge to monitor the pilot pressure (connect to port M7 or tee into the pilot line connected to port X1), and the minimum angle servo pressure (port M3). If adjusting an H1 or H2 control, the override solenoid must be energized. If adjusting a K1 or K2 control, the solenoid must not be energized.

NOTE: The pilot signal may be determined by prime mover speed, other shaft speeds, or other control pressures, depending upon the design of the vehicle / machine control circuit.

Increase the pilot signal to the required control start pressure. An increase in minimum angle servo pressure will be noted as the motor displacement starts to decrease.

To adjust the control start pressure, loosen the lock nut using a 10 mm hex wrench and turn the adjusting screw with a 4 mm internal hex wrench. Turning the screw clockwise increases the control start pressure. Torque the lock nut to 9 Nm (6.6 ft•lbsf) after adjusting.

For the H1•H2 controls, the pilot signal pressure supplied to port X1 should also be present at test port M7 when the solenoid is energized. When the solenoid is not energized, test port M7 should drop to case pressure.

For the K1•K2 controls, the pilot signal pressure supplied to port X1 should also be present at test port M7 when the solenoid is not energized. When the solenoid is energized, test port M7 should drop to case pressure.

Shut down the prime mover. Remove the gauges and install the gauge port plugs. Return the pump and motor controls to their normal operation.

Servo pressure supply oil is usually provided internally from the main system ports of the motor. If external servo pressure supply is utilized, a minimum of 25 bar (360 psi) is required to change the motor displacement with the motor shaft turning, and a minimum of 70 bar (1015 psi) is required with the motor shaft locked.

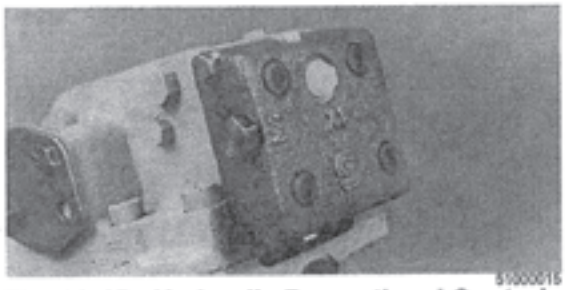


Fig. 30-15 - Hydraulic Proportional Control, Type HZ

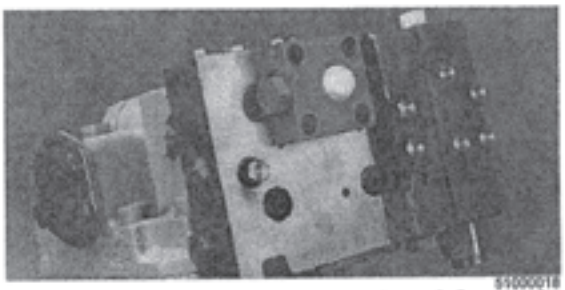


Fig. 30-16 - Hydraulic Proportional Control, Type HS

Fig. 30-17 - Hydraulic Proportional Control with Electric Override, Type H1•H2 (K1•K2 Similar)

Fig. 30-18 - Adjusting Control Threshold, Types HS, HZ, H1•H2, and K1•K2

Component Adjustment (Continued)

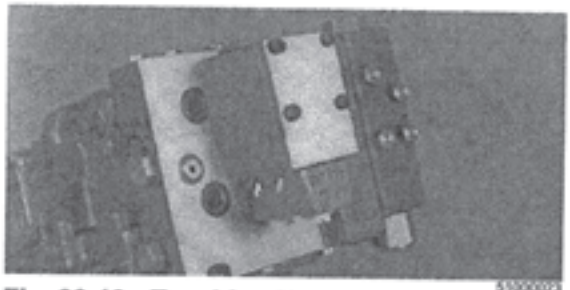


Fig. 30-19 - Two Line Hydraulic Proportional Control, Type HP

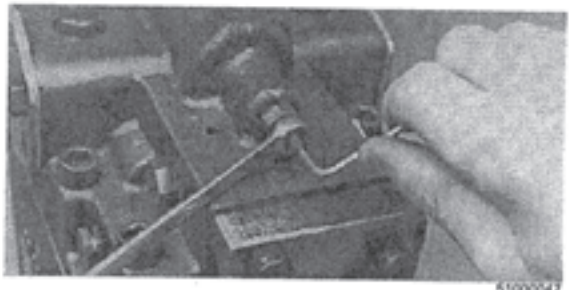


Fig. 30-20 - Adjusting Control Threshold (Type HP)

Two Line Hydraulic Proportional Control (Type HP)

The differential control start pressure for this control may be adjusted with the adjusting screw on the end cap (opposite the control block). Control start is that differential pilot pressure at which the motor displacement starts to decrease.

To check the control start setting, install gauges to monitor the pilot pressures (tee into the pilot lines connected to ports X1 and X2), and the minimum angle servo pressure (port M3).

NOTE: The pilot signals may be determined by prime mover speed, other shaft speeds, or other control pressures, depending upon the design of the vehicle / machine control circuit.

Increase the pilot signal differential to the required control start pressure. An increase in minimum angle servo pressure will be noted as the motor displacement starts to decrease.

The differential control start pressure should be the same no matter which pilot pressure is higher. Differences in control operation when the pilot pressure differential is reversed indicate a problem with the shuttle spool in the control block.

To adjust the control start differential pressure, loosen the lock nut using a 10 mm hex wrench and turn the adjusting screw with a 4 mm internal hex wrench. Turning the screw clockwise increases the control start pressure. Torque the lock nut to 9 Nm (6.6 ft•lbsf) after adjusting.

Shut down the prime mover. Remove the gauges and install the gauge port plugs. Return the pump and motor controls to their normal operation.

Servo pressure supply oil is usually provided internally from the main system ports of the motor. If external servo pressure supply is utilized, a minimum of 25 bar (360 psi) is required to change the motor displacement with the motor shaft turning, and a minimum of 70 bar (1015 psi) is required with the motor shaft locked.

Component Adjustment (Continued)

Two Line Hydraulic Proportional Control for "Dual Path" Vehicles (Type HC)

The differential control start pressure for this control may be adjusted with the adjusting screw on the control housing. Control start is that differential pilot pressure at which the motor displacement starts to decrease.

To check the control start setting, install gauges to monitor the pilot pressures (tee into the pilot lines connected to ports X1 and X2), and the minimum angle servo pressure (port M3).

NOTE: The pilot signals may be determined by prime mover speed, other shaft speeds, or other control pressures, depending upon the design of the vehicle / machine control circuit.

Increase the pilot signal differential to the required control start pressure. An increase in minimum angle servo pressure will be noted as the motor displacement starts to decrease.

The differential control start pressure should be the same no matter which pilot pressure is higher. Differences in control operation when the pilot pressure differential is reversed indicate a problem with the shuttle spool in the control block.

To adjust the control start differential pressure, loosen the lock nut using a 10 mm hex wrench and turn the adjusting screw with a 4 mm internal hex wrench. Turning the screw counter-clockwise (CCW) increases the control start pressure. Torque the lock nut to 9 Nm (6.6 ft•lbsf) after adjusting.

Shut down the prime mover. Remove the gauges and install the gauge port plugs. Return the pump and motor controls to their normal operation.

Servo pressure supply oil is provided internally from the main system ports of the motor.

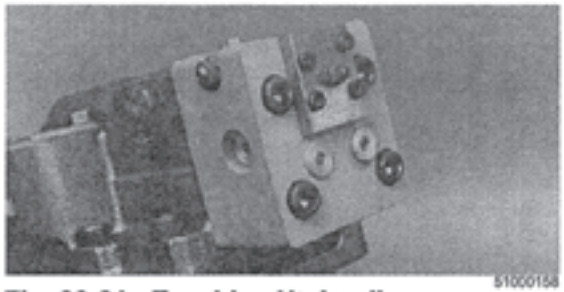


Fig. 30-21 - Two Line Hydraulic Proportional Control, Type HC

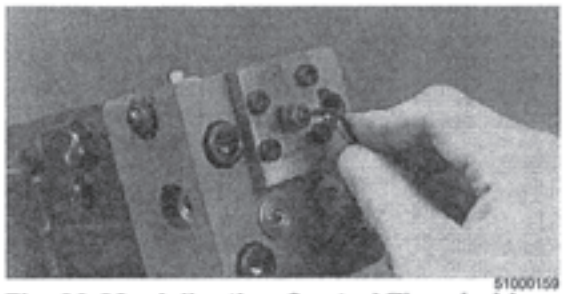


Fig. 30-22 - Adjusting Control Threshold (Type HC)

Component Adjustment (Continued)

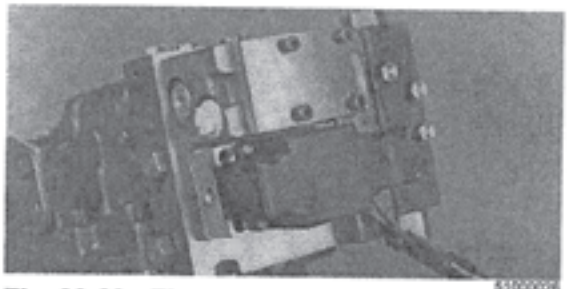


Fig. 30-23 - Electrohydraulic Proportional Control, Type EP (EQ Similar)

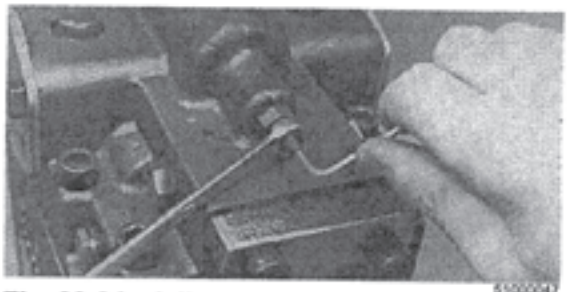


Fig. 30-24 - Adjusting Control Threshold (Type EP•EP)

Electrohydraulic Proportional Control (Types EP and EQ)

The control start current for the EP and EQ controls may be adjusted with the adjusting screw on the end cap (opposite the control block). Control start is that current supplied to the PCP (Pressure Control Pilot) valve at which the motor displacement starts to decrease.

To check the threshold setting, install instruments to monitor the PCP current, and the minimum angle servo pressure (port M3).

NOTE: The current supplied to the PCP may be determined by prime mover speed, other shaft speeds, control pressures, or other electrical signals, depending upon the design of the vehicle / machine control circuit.

Increase the PCP current to the required control start current. An increase in minimum angle servo pressure will be noted as the motor displacement starts to decrease.

To adjust the control start current, loosen the lock nut using a 10 mm hex wrench and turn the adjusting screw with a 4 mm internal hex wrench. Turning the screw clockwise increases the control start current. Torque the lock nut to 9 Nm (6.6 ft•lbsf) after adjusting.

PCP supply pressure oil is provided externally. PCP supply pressure must be a minimum of 20 bar (290 psi) and no more than 70 bar (1015 psi).

Shut down the prime mover. Remove the gauges and install the gauge port plugs. Return the pump and motor controls to their normal operation.

Servo pressure supply oil is usually provided internally from the main system ports of the motor. If external servo pressure supply is utilized, a minimum of 25 bar (360 psi) is required to change the motor displacement with the motor shaft turning, and a minimum of 70 bar (1015 psi) is required with the motor shaft locked.

Component Adjustment (Continued)

Pressure Compensator Over-Ride (PCOR) and Pressure Compensator Regulator (Type PC) Adjustment

The PCOR or PC regulator valve setting may be adjusted with the adjusting screw on the PCOR/PC valve block attached to the multi-function block. The regulator start pressure is that system pressure at which the PCOR or PC regulator starts to increase the motor displacement.

In order to measure the regulator start pressure setting of the PCOR or the PC regulator, the motor output shaft must be loaded to increase the system working pressure. This can accomplished by applying the vehicle's brakes or by loading the work function.

> **WARNING**
>
> The following procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the adjustment to prevent injury to the technician and bystanders.

Install gauges to monitor system pressure (connect to ports M1 and M2), the minimum angle servo pressure (port M3), and the maximum angle servo pressure (port M4).

Start the prime mover and operate at normal speed. Provide a signal to the pump control to provide a constant flow of hydraulic fluid to the motor. Provide a signal to the motor control to maintain the motor at its minimum displacement.

Increase the load on the motor to increase the system pressure to the required regulator start pressure. The maximum angle servo pressure (M4) will increase and the minimum displacement servo pressure (M3) will decrease as the PCOR or PC regulator operates. The servo pressures will equalize, and the maximum angle servo pressure continue to increase, as the motor displacement starts to increase.

During the transition from minimum to maximum displacement, an additional 10 bar (145 psi) increase in system pressure may be noted.

Once the motor is at maximum displacement, further increases in load will result in increasing system pressure until the maximum system pressure (determined by the system relief valve or pump pressure limiter) is reached.

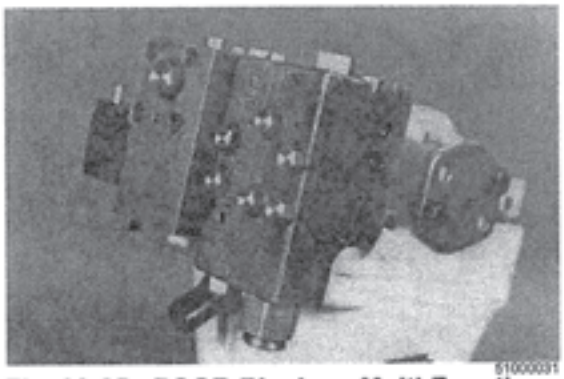


Fig. 30-25 - PCOR Block on Multi-Function Block (K1•K2 Control Shown)

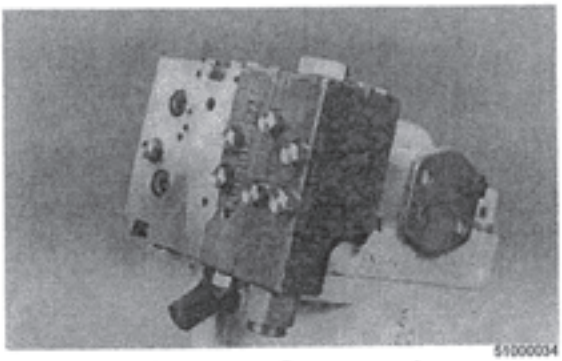


Fig. 30-26 - Pressure Compensator Regulator (Type PC)

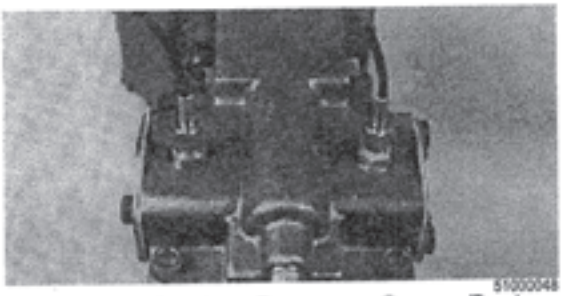


Fig. 30-27 - System Pressure Gauge Ports (Side Port End Cap)

Component Adjustment (Continued)

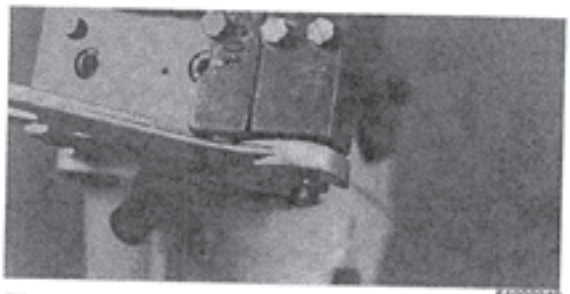


Fig. 30-28 - Loosen PCOR/PC Lock Nut

Fig. 30-29 - Rotate PCOR/PC Adjusting Screw

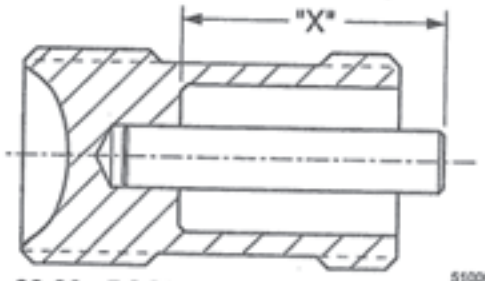


Fig. 30-30 - PCOR/PC Adjusting Screw Stop Pin

Allow the pump to return to its neutral position. Repeat the procedure for the other side of the closed circuit if so configured. The PCOR or PC regulator must operate at the same start pressure as noted previously. Any noticeable difference in operation from side to side may indicate a problem with the pressure supply shuttle spool or brake pressure defeat spool in the multi-function block.

NOTE: Some motors may be configured for the PCOR or PC regulator to function on only one (1) side of the closed loop. Refer to the nomenclature on the motor nameplate.

In order for the PCOR or PC regulator to function properly on motors equipped with a brake pressure defeat spool, the defeat spool must be positioned correctly. The control pressure for the defeat spool should be applied to the appropriate port (XA or XB) as shown in the following table to shift the defeat spool and permit PCOR or PC regulator operation. Maximum pressure across the brake pressure defeat ports XA and XB is 50 bar (725 psi).

Pressure Compensator Override Defeat Operation

Rotation	High system pressure port	Control pressure on port
CW	A	XB
CCW	B	XA

The PCOR or PC regulator valve is screw adjustable. To adjust, loosen the locknut with a 1-1/16" hex wrench. Turn the adjusting screw with a large screwdriver until the desired pressure setting is established. Clockwise rotation of the adjustment screw will increase the pressure setting at a rate of approximately 70 bar (1000 psi) per turn.

CAUTION

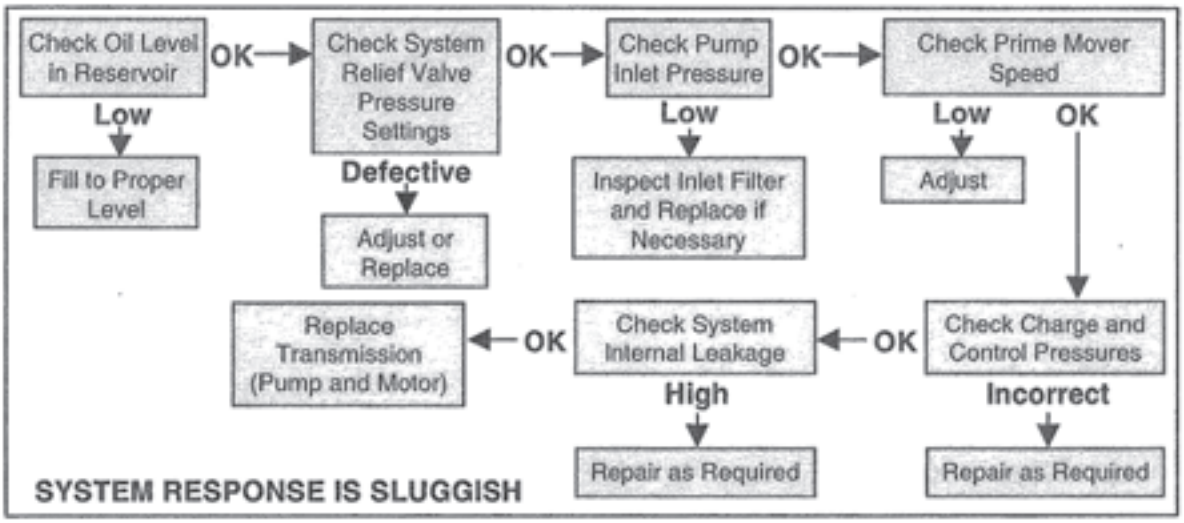
A stop pin is installed in the adjusting screw to prevent "overtravel" of the PCOR/PC valve spool. The stop pin must protrude (distance "X") 19 mm (.75 in.) from the spring seat for settings of 270 to 370 bar (3900 to 5350 psi), or 24 mm (.94 in.) for settings of 110 to 260 bar (1600 to 3750 psi). Refer to the appropriate Service Parts Manual for further information.

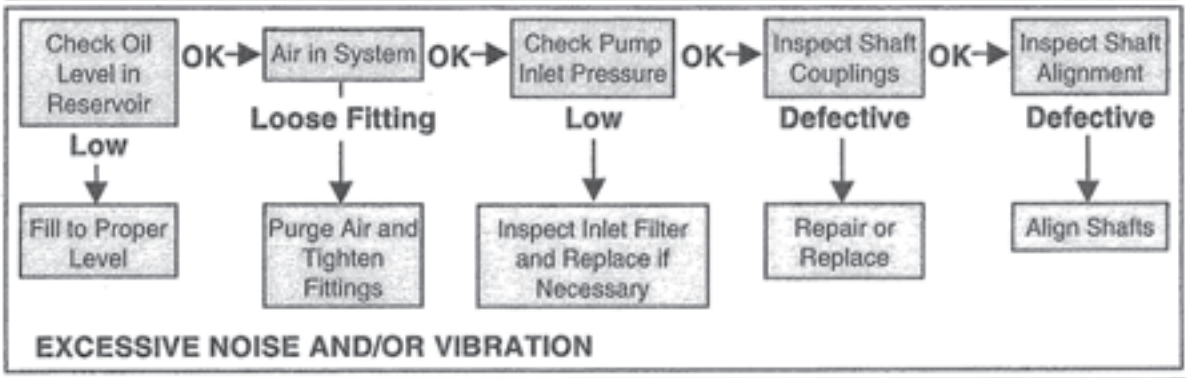
While holding the adjusting screw from turning, torque the lock nut to 52 Nm (38 ft•lbsf). Recheck the PCOR or PC regulator setting.

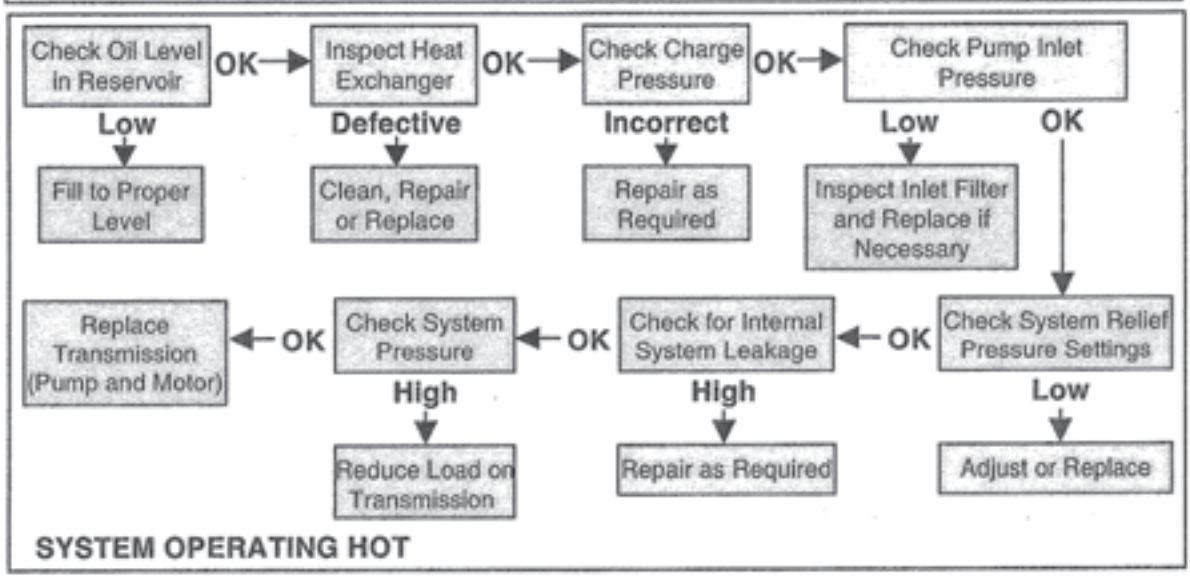
Shut down the prime mover. Remove the gauges and install the gauge port plugs. Return the pump and motor controls to their normal operation.

Troubleshooting

Fault-Logic Diagrams • Closed Circuit

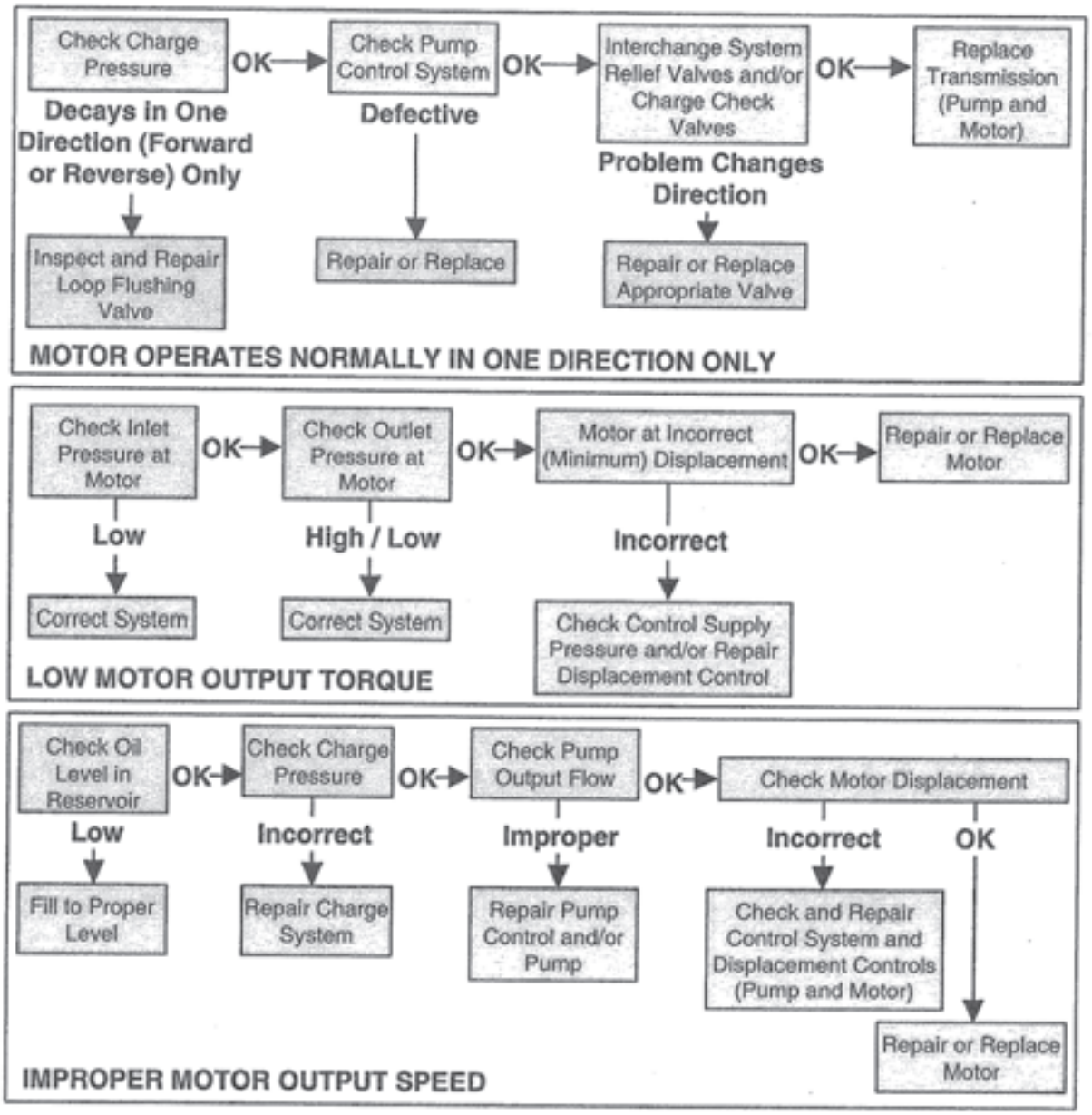






Troubleshooting (Continued)

Fault-Logic Diagrams • Closed Circuit (Continued)



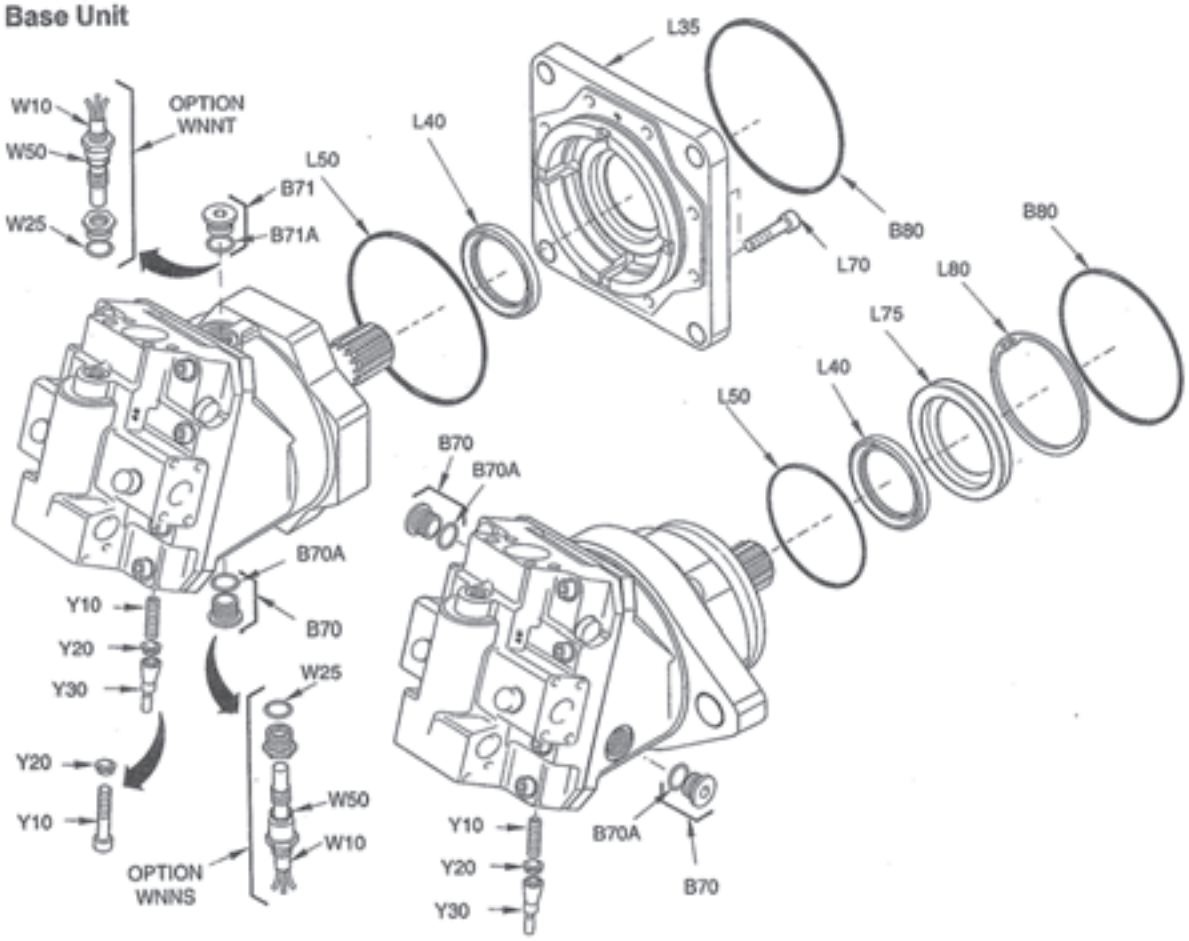
Notes

Notes

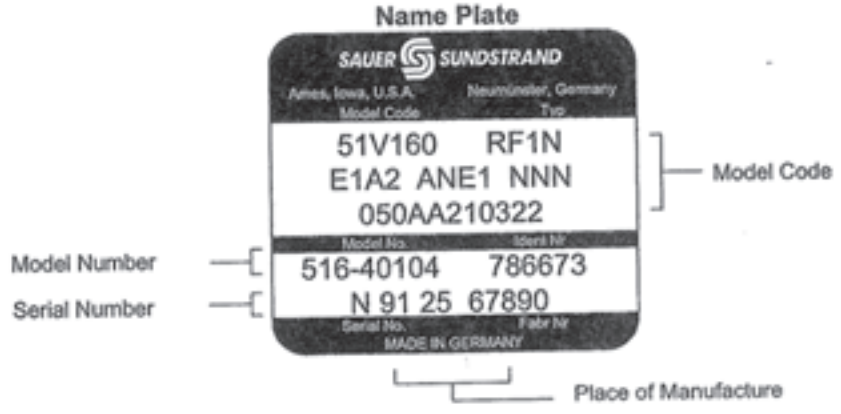
Exploded View of the Series 51 Variable Motor

The following information is for general parts identification ONLY. Refer to the applicable Service Parts List when ordering service parts.

Base Unit



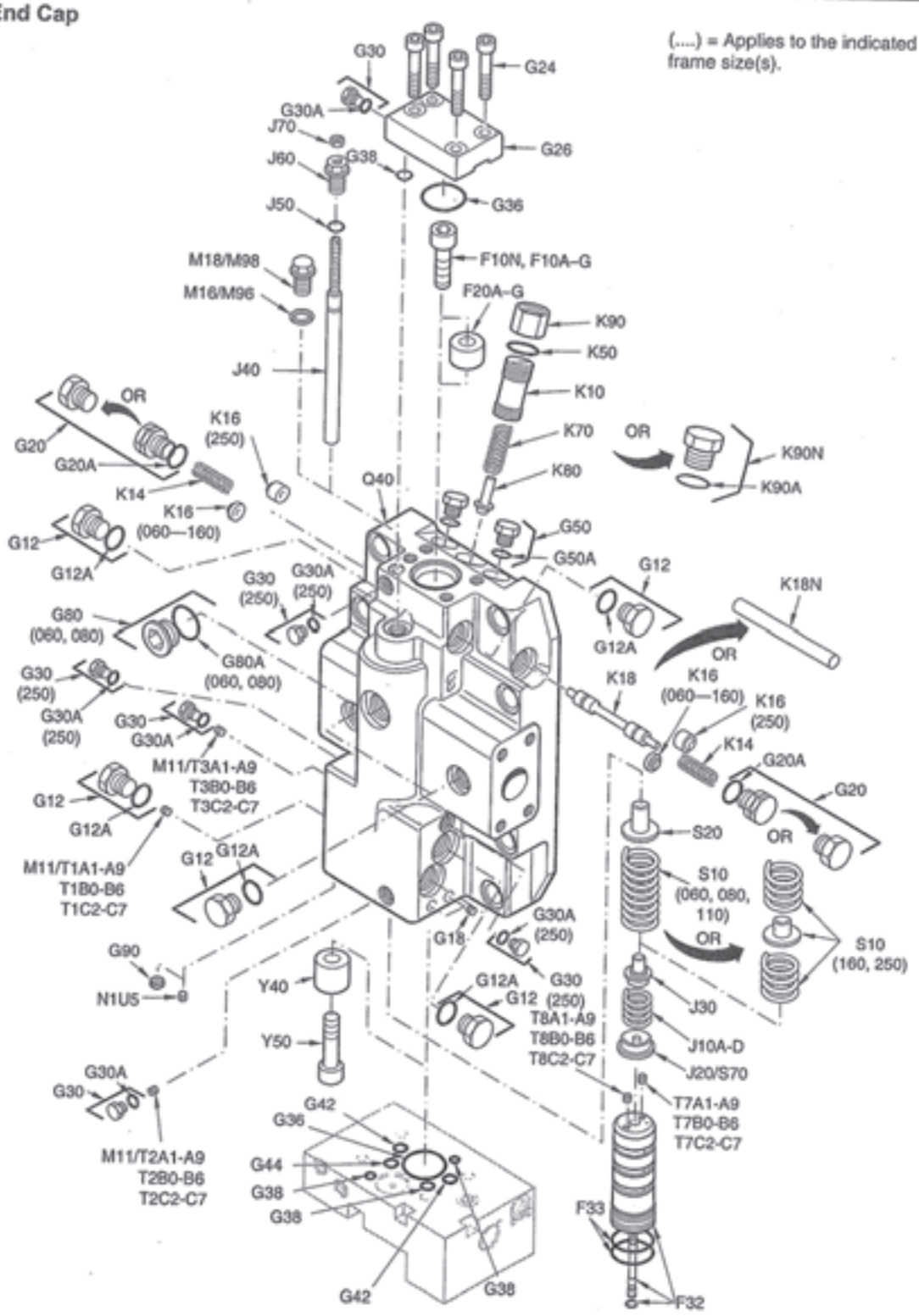
Name Plate



Name Plate (German Production)

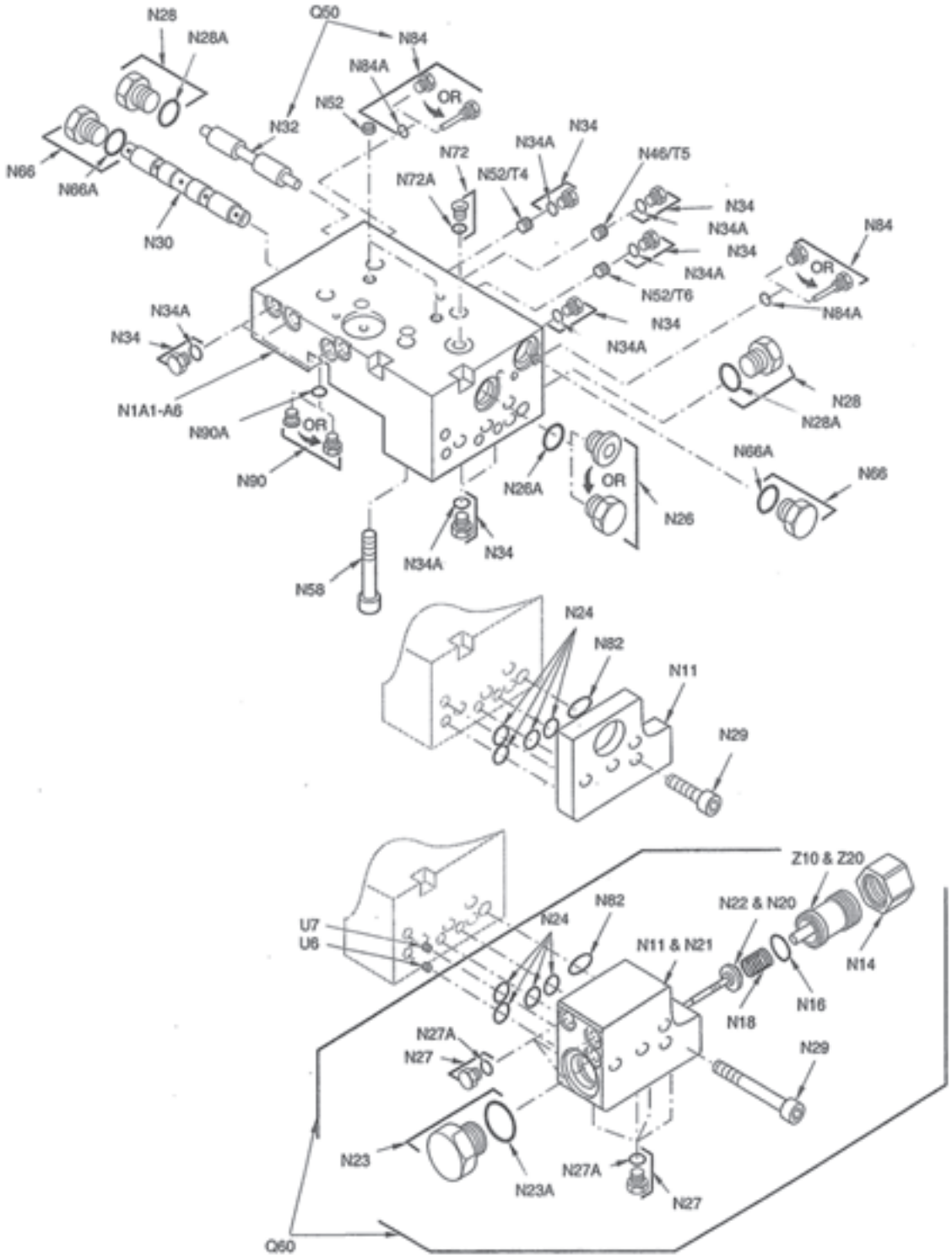
Exploded View of the Series 51 Variable Motor (Continued)

End Cap



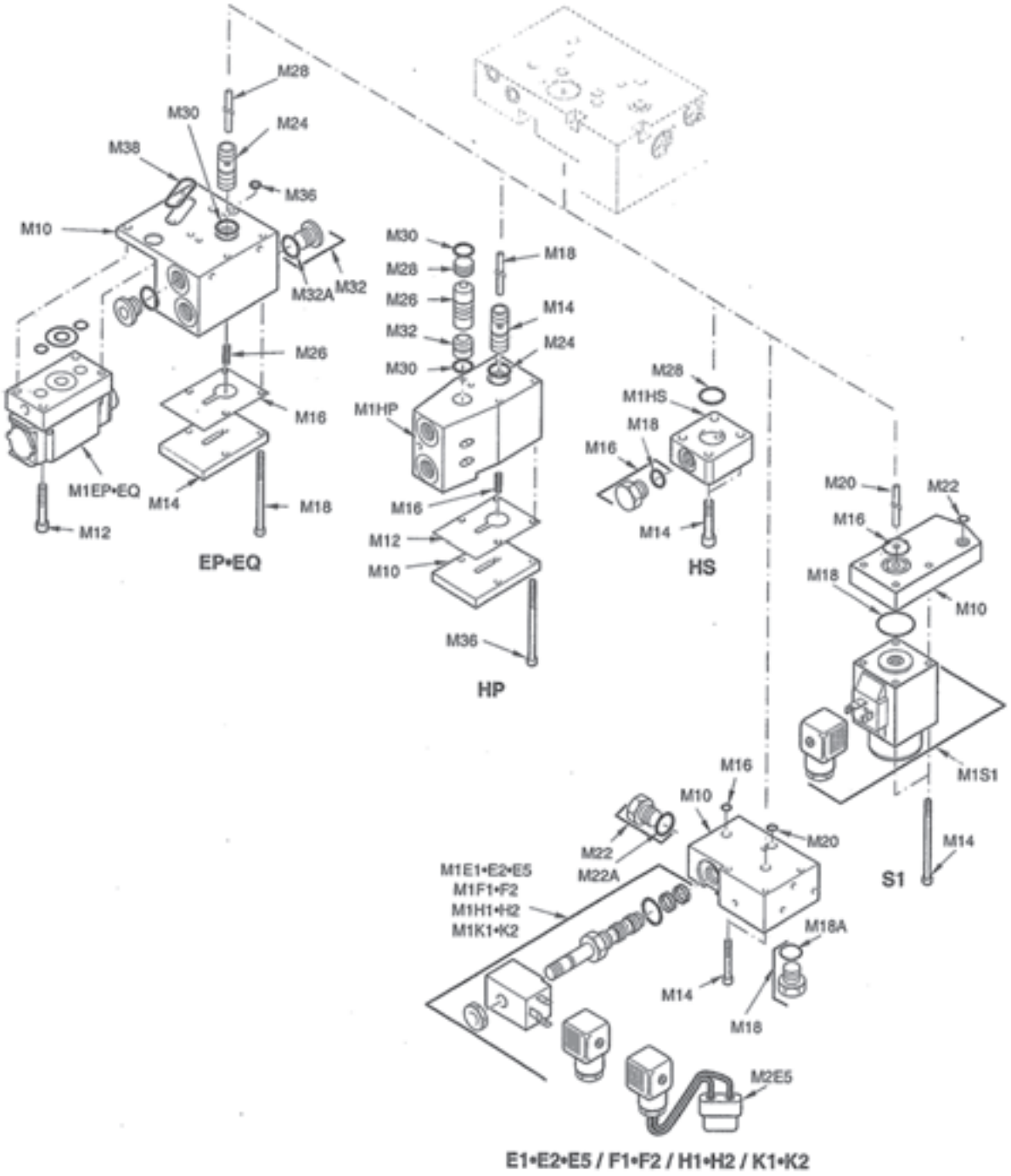
Exploded View of the Series 51 Variable Motor (Continued)

Multi-Function Valve



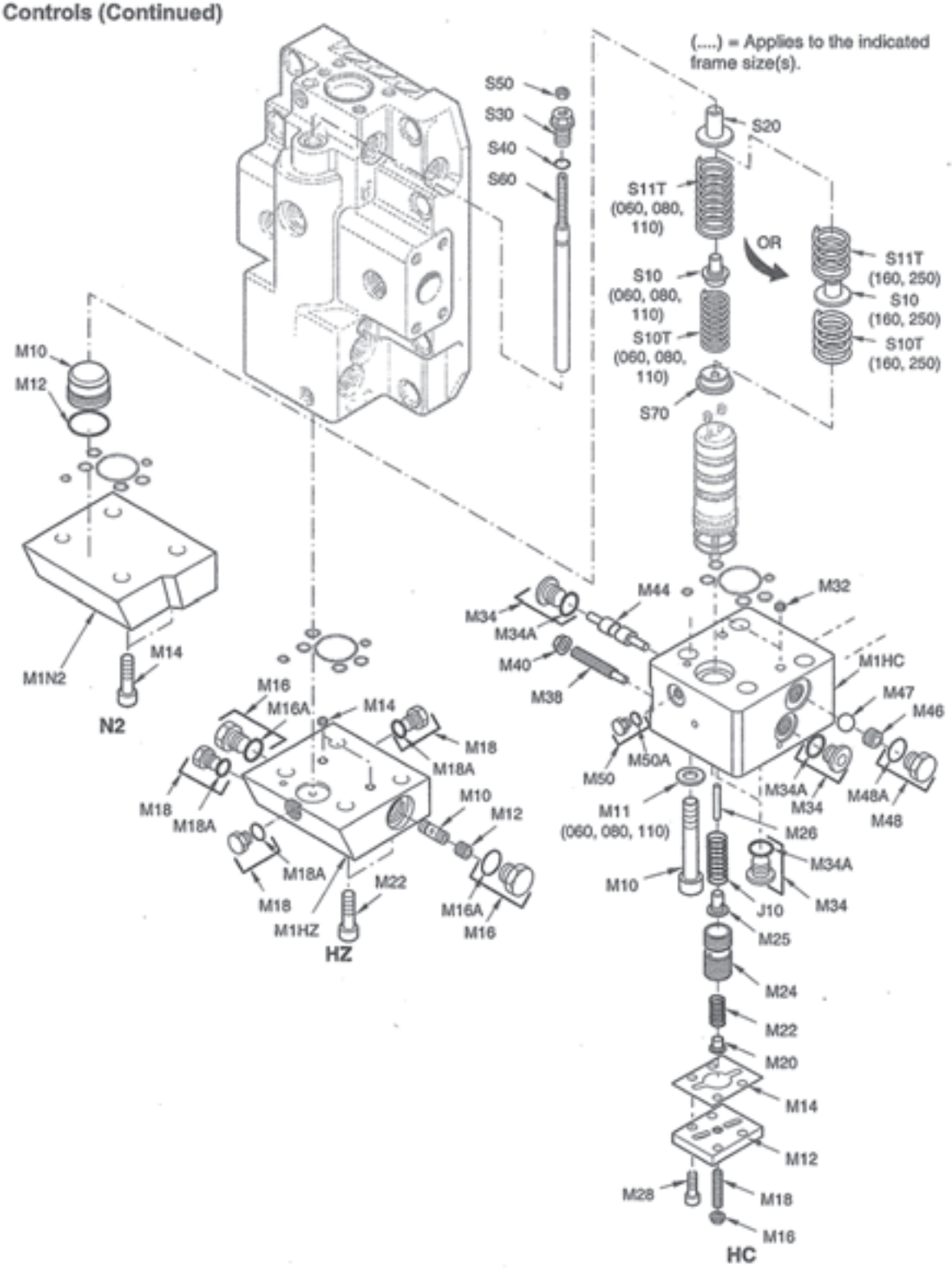
Exploded View of the Series 51 Variable Motor (Continued)

Controls



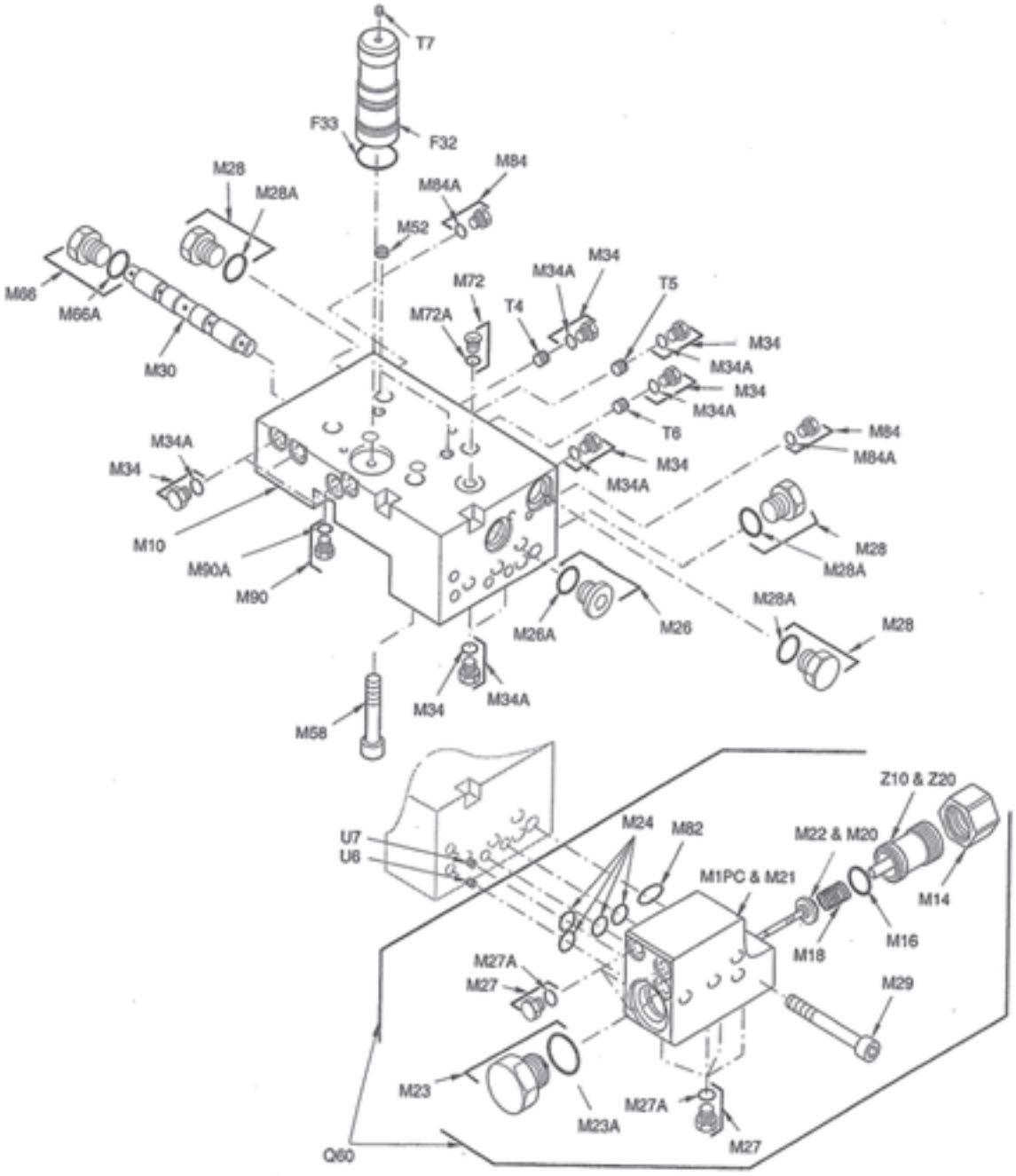
Exploded View of the Series 51 Variable Motor (Continued)

Controls (Continued)



Exploded View of the Series 51 Variable Motor (Continued)

PC Regulator



Exploded View of the Series 51 Variable Motor (Continued)

Item	Description	Quantity
B000	**COMMON PARTS GROUP (SAE FLNG)**	
B80	O-RING	1
L35	FLANGE- SAE	1
L40	SEAL- SHAFT	1
L50	O-RING	1
L70	SCREW- SOC HD	8
C000	**COMMON PARTS GROUP (CARTRIDGE)**	
L40	SEAL- SHAFT	1
L50	O-RING	1
L75	COVER- SEAL	1
L80	RING- RETAINING	1
F•••	**MAXIMUM DISPLACEMENT**	
F10	SPACER- MAX DISPL LMTR	1
F20	SCREW-SOC HD - MAX DISPL LMTR	1
G00A	**END CAP-AXIAL (160-250)**	
G00B	**END CAP-AXIAL, CODE 61 (160-250)**	
G00R	**END CAP-SIDE, LOOP FL**	
G00S	**END CAP-SIDE, LOOP FL, CODE 61**	
G12	PLUG-STR THD HEX	7
G14	PLUG-EXP	1
G16	PLUG-MANDREL	2
G18	SCREW-SET, FLAT PT	2
G20	PLUG- SPECIAL	2
G20N	PLUG- STR THD HEX	2
G24	SCREW-SOC HD	4
G26	COVER-SERVO PISTON	1
G30	PLUG-STR THD HEX	3
G36	O-RING	2
G38	O-RING	4
G42	O-RING	2
G44	O-RING	1
G50	PLUG-ST THD HEX	2
G70	COVER-PORT	2
G90	CONTROL SCREEN FILTER	1
K10	ADJ PLUG ASSY-CHG RLF	1
K14	SPRING-HELICAL COMP	2
K16	GUIDE-SPRING (060 — 160)	2
K16	GUIDE-SPRING (250)	2
K18	SHUTTLE VALVE SPOOL	1
K18N	LOOP FLUSH SPOOL- DEFEAT	1
K50	O-RING	1
K70	SPRING-HELICAL COMPRESSION	1
K80	POPPET-CHG RELIEF	1
K90	NUT-HEX LOCK	1
K90N	PLUG- ST THD HEX	1

Item	Description	Quantity
J00A-K	**CONTROL START SETTING**	
J10A-K	SPRING-HEL COMP- CONT START	1
J20	SEAT-SPRING	1
J30	SEAT-SPRING	1
J40	SCREW-ADJUSTING	1
J50	O-RING	1
J60	NUT-ADJUSTING SCREW	1
J70	NUT-LOCK	1
J00N	**CONT START N/A (FOR 2 POS CONT)**	
M0EP	**CONTROL- ELHYD PRP, PACKARD**	
M0EQ	**CONTROL- ELHYD PRP, MS**	
F32	BUSHING- VALVE ASSY	1
M1EP	PCP VALVE, PACKARD CONN	1
M1EQ	PCP VALVE, MS CONN	1
M10	HOUSING- CONTROL	1
M12	SCREW- SOC HD	4
M14	COVER	1
M16	GASKET	1
M18	SCREW- SOC HD	4
M24	PISTON- SHUTTLE, DELTA P	1
M26	SPRING- HEL COMPRESSION	1
M28	PIN	1
M30	O-RING	1
M32	PLUG-SOC HD	2
M34	PLUG-MANDREL	6
M36	O-RING	1
M38	O-RING	1
M40	CONTROL SCREEN FILTER	1
M42	PLUG-SOC HD	1
M44	PLUG-PLASTIC	1
N90	PLUG-STR THD HEX	1
M0E1/E2	**CONTROL- ELHYD 2 POS**	
M0F1/F2	**CONTROL- ELHYD 2 POS, MAX ANG**	
F32	BUSHING- VALVE ASSY	1
M1E1	VALVE ASSY- SOLENOID,12V	1
M1E2	VALVE ASSY- SOLENOID,24V	1
M10	HOUSING-CONT, ELHYD, 2 POS (E)	1
M10	HOUSING-CONT, ELHYD, 2 POS (F)	1
M12	PLUG-EXP	7
M14	SCREW-SOC HD	4
M16	O-RING	2
M18	PLUG-STR THD HEX	1
M20	O-RING	1
M22	PLUG-STR THD HEX	1
N90	PLUG-STR THD HEX	1

Exploded View of the Series 51 Variable Motor (Continued)

Item	Description	Quantity
M0HC	**CONTROL- HYD PRPNL 2LN, DUAL PATH**	
F32	BUSHING- VALVE ASSY	1
M1HC	HOUSING- HYD PRPNL (2LN),DUAL	1
M10	SCREW-SOC HD	4
M11	WASHER, FLAT (060, 080, 110)	4
M12	COVER	1
M14	GASKET	1
M16	NUT-SEAL LOCK	1
M18	SCREW-SET, FL PT	1
M20	GUIDE- SPRING	1
M22	SPRING-HELICAL COMPRESSION	1
M24	PISTON- DELTA P	1
M25	SEAT- SPRING	1
M26	PIN	1
M28	SCREW-SOC HD	4
M32	CONTROL SCREEN FILTER	2
M34	PLUG-SOC HD	4
M38	VALVE- BLEED	1
M40	NUT- SEAL LOCK	1
M44	VALVE, SHUTTLE- DELTA P	1
M46	SEAT- BALL CHECK	1
M47	BALL- SHUTTLE	1
M48	PLUG-STR THD HEX	1
M50	PLUG-STR THD HEX	1
M0HP	**CONTROL- HYD PRPNL 2LN, W/BLD**	
F32	BUSHING- VALVE ASSY	1
M1HP	HOUSING- HYD PRPNL (2LN),W/BLD	1
M10	COVER	1
M12	GASKET	1
M14	PISTON-SHUTTLE, DELTA P	1
M16	SPRING-HELICAL COMPRESSION	1
M18	PIN	1
M24	O-RING	1
M26	VALVE SHUTTLE,DELTA P	1
M28	PLUG-SEALING	1
M30	O-RING	2
M32	PLUG-SEALING	1
M34	PLUG-EXP	6
M36	SCREW-SOC HD	4
N90	PLUG-STR THD HEX	1

Item	Description	Quantity
M0HS	**CONTROL- HYD PRP, 1 LN**	
F32	BUSHING-VALVE ASSY	1
M1HS	HOUSING- VALVE, HYD PRPRNL 1 LN	1
M10	SCREW-SOC HD	4
M12	O-RING	1
M14	PLUG-STR THD HEX	1
M16	PLUG-PLASTIC	1
N90	PLUG-STR THD HEX	1
M0HZ	**CONTROL- HYD PRP, 1 LN, CMPCT**	
F32	BUSHING- VALVE ASSY	1
M1HZ	HOUSING- VALVE, HYD PRP, 1 LN, CPT	1
M10	VALVE ASSY- DBL CHECK	1
M12	SCREW- SOC- DRILLED	1
M14	CONTROL SCREEN FILTER	2
M16	PLUG-STR THD HEX	2
M18	PLUG-STR THD HEX	3
M0H1/H2	**CONTROL- HYD PRP, 1 LN, MAX ANG**	
M0K1/K2	**CONTROL- HYD PRP, 1 LN, MIN ANG**	
F32	BUSHING-VALVE ASSY	1
M1H1	VALVE ASSY-SOLENOID,12V	1
M1H2	VALVE ASSY-SOLENOID,12V	1
M10	HSG-CONT,ELHYD, 2 POS	1
M12	PLUG-EXP	8
M14	SCREW-SOC HD	4
M16	O-RING	2
M18	PLUG-STR THD HEX	1
M20	O-RING	1
M22	PLUG-PLASTIC	1
N90	PLUG-STR THD,SOC HD	1
M0N2	**CON-HYD, 2 POS, DIRECT**	
M1N2	COVER	1
M10	PLUG	1
M11	SCREW- SET,FLT PT	3
M12	O-RING	1
M14	SCREW-SOC	4
M16	GASKET	1
M18	PLUG	1

Exploded View of the Series 51 Variable Motor (Continued)

Item	Description	Quantity
M0PC	**REGULATOR- PRESS COMP**	
F32	PLUG- VALVE BUSHING BORE	1
F33	O-RING	1
M1PC	HOUSING- VALVE	1
M10	HOUSING- MULTI FUNCTION BLOCK	1
M14	NUT-HEX LOCK	1
M16	O-RING	1
M18	SPRING-HELICAL COMPRESSION	1
M20	SEAT-SPRING, PC	1
M21	BUSHING-VALVE	1
M22	SPOOL-PC VALVE	1
M23	PLUG-STR THD HEX	1
M26	PLUG-SOC HD	1
M27	PLUG-STR THD HEX	10
M28	PLUG-STR THD HEX	4
M29	SCREW-SOC	4
M30	SPOOL, BI-DIRECTIONAL CHECK	1
M34	PLUG-STR THD HEX	10
M36	SCREW-SET,FLT PT	5
M38	PLUG-EXP	11
M50	PLUG-EXP	8
M52	CONTROL SCREEN FILTER	2
M54	PLUG-EXP	1
M58	SCREW-SOC HD	4
M62	PLUG-EXP	1
M66	PLUG-STR THD HEX	2
M72	PLUG-STR THD,SOC HD	1
M82	O-RING	1
M84	PLUG-STR THD HEX	2
M86	SCREW-FL PT	1
M90	PLUG-STR THD HEX	1
M96	GASKET	1
M98	PLUG	1
N24	O-RING	5
M0S1	**CONTROL- ELECTRIC 2 POS, DIRECT**	
F32	BUSHING- VALVE ASSY	1
M1S1	SOLENOID,12V	1
M10	ADAPTER PLATE- SOLENOID	1
M14	SCREW-SOC HD	4
M16	O-RING	1
M18	O-RING	1
M20	PIN	1
M22	O-RING	1
N90	PLUG-STR THD HEX	1

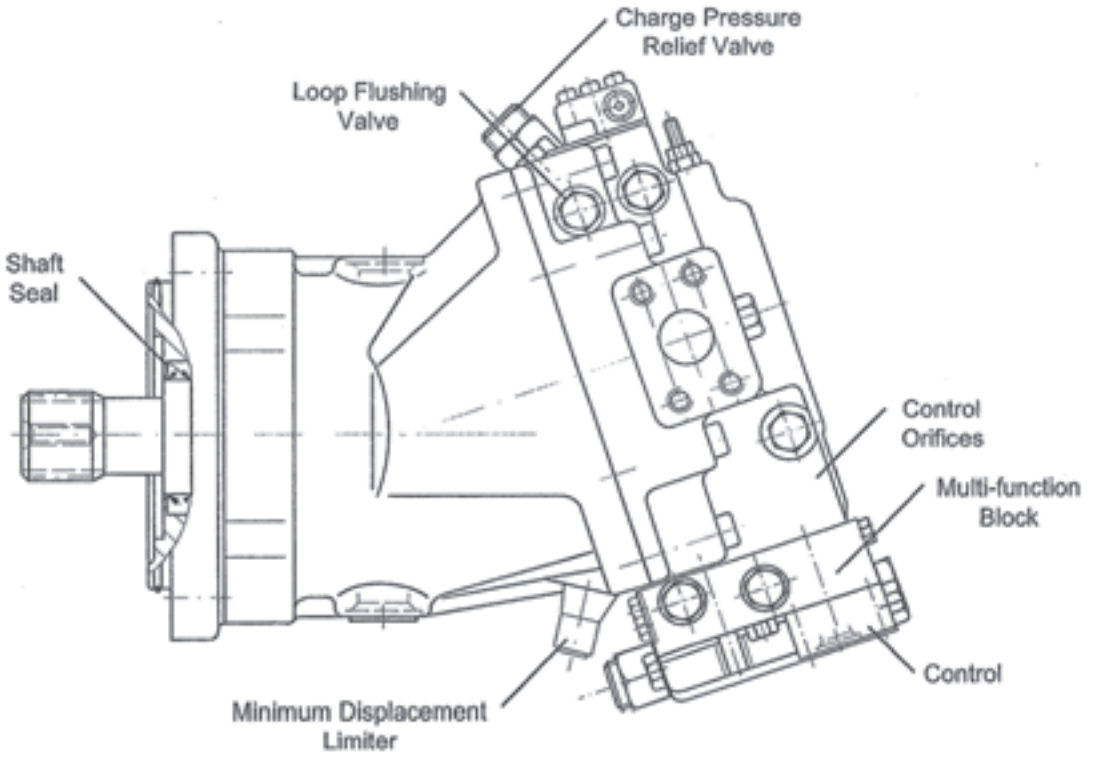
Item	Description	Quantity
N0A1-6	**SVO PRS SPLY, PCOR, DFT**	
N1A1-6	HOUSING-MULTI FUNCTION BLOCK	1
N11	HOUSING-VALVE	1
N14	NUT-HEX LOCK	1
N16	O-RING	1
N18	SPRING-HELICAL COMPRESSION	1
N20	SEAT-SPRING, PCOR	1
N21	BUSHING-VALVE	1
N22	SPOOL-PCOR VALVE	1
N23	PLUG-STR THD HEX	1
N24	O-RING	5
N26	PLUG-SOC HD (W/PCOR)	1
N26	PLUG-STR THD HEX (WO/PCOR)	1
N27	PLUG-STR THD HEX	17
N28	PLUG-PLASTIC (W/DFT)	2
N28	PLUG-STR THD HEX (WO/DFT)	2
N29	SCREW-SOC	4
N30	SPOOL, BI-DIRECTIONAL CHECK	1
N32	PISTON	1
N34	PLUG-STR THD HEX	10
N36	SCREW-SET,FLT PT	5
N38	PLUG-EXP (060 - 110 ONLY)	11
N50	PLUG-EXP (060 - 110 ONLY)	6
N52	CONTROL SCREEN FILTER	2
N54	PLUG-EXP	1
N58	SCREW-SOC HD	4
N62	PLUG-EXP	1
N66	PLUG-STR THD HEX (060-110)	2
N66	PLUG-STR THD HEX (160-250)	1
N72	PLUG-STR THD,SOC HD	1
N74	SCREW-SET, FL PT	3
N82	O-RING	1
N84	PLUG, SPECIAL	2
N84	PLUG-STR THD HEX	2
N86	SCREW-SET	1
U5	PLUG- SOC (EXT SUPPLY)	1
U6	ORIFICE, PCOR DAMPING	1
U7	ORIFICE, PCOR DAMPING	1
N0NN	**SERVO PRESS SPLY- NONE**	
P0AA	**SYS PRESS PROTECT- NONE**	

Exploded View of the Series 51 Variable Motor (Continued)

Item	Description	Quantity
S00D-G	**CONTROL RAMP- HP, HS, H1/H2, K1/K2**	
S10	GUIDE-SPRING (160-250)	1
S10D-G	CONT RAMP SPRING (060-110)	1
S10D-G	CONT RAMP SPRING ASSY (160-250)	2
S20	GUIDE-SPRING	1
S70	SEAT-SPRING	1
S00N	**CONTROL RAMP-NONE**	
S00T	**CONTROL RAMP- HC**	
S10	GUIDE-SPRING	1
S10T	CONT RAMP SPRING	1
S11T	CONT RAMP SPRING	1
S20	GUIDE-SPRING	1
S30	NUT- ADJUSTING SCREW	1
S40	O-RING	1
S50	NUT- LOCK	1
S60	SCREW- ADJUSTING	1
S70	SEAT-SPRING	1
S00U-Z	**CONTROL RAMP- EP/EQ**	
S10	GUIDE-SPRING (160-250)	1
S10U-Z	CONT RAMP SPRING (060-110)	1
S10U-Z	CONT RAMP SPRING ASSY (160-250)	1
T0A0	**CON ORIFICE (A0)- NONE**	
T0A1	**CON ORIFICE (A1)**	
T1	ORIFICE	1
T2	ORIFICE	2
T3	ORIFICE	1
T4	SCREW	2
T5	ORIFICE	1
T6	SCREW	1
T7	ORIFICE	2
T8	ORIFICE	1
U3	SCREW-FL PT	1
T0A2	**CON ORIFICE (A2)**	
T1	ORIFICE	1
T2	ORIFICE	2
T3	ORIFICE	1
T4	ORIFICE	2
T5	SCREW	1
T6	ORIFICE	1
T7	ORIFICE	2
T8	ORIFICE	1
WNNN	**SPCL HDW-NONE**	
A10	SPEED SENSOR 51V	0
B70	PLUG-SOC HD	1
B71	PLUG-PLASTIC	1

Item	Description	Quantity
Y•••	**MINIMUM DISPLACEMENT**	
Y10	SCREW- SET, FLT PT	1
Y20	NUT- HEX, SEAL LOCK	1
Y30	TAMPER RESISTANT CAP	1
Z000	**PRS COMP SET- NONE**	
Z0••	**PCOR / PRESS COMP SETTING**	
Z10	ADJUSTER- THREADED	1
Z20	PIN-STRAIGHT	1

Minor Repair and Replacement - Variable Motor



Variable Displacement Motor (SAE Flange Configuration)

Fig. 50-1 - Minor Repairs

Minor Repairs may be performed, following the procedures in this section, without voiding the unit warranty. Although specific products are illustrated, these procedures apply to all units in the Series 51 family.

General

Cleanliness is a primary means of insuring satisfactory transmission life, on either new or repaired units. Cleaning parts by using a solvent wash and air drying is adequate, providing clean solvent is used. As with any precision equipment, the internal mechanism and related items must be kept free of foreign materials and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material.

It is recommended that all gaskets and O-rings be replaced. All gasket sealing surfaces must be cleaned prior to installing new gasket. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-2 - Remove Screws Holding Flange to Housing (SAE)

Fig. 50-3 - Remove Flange (SAE)

Shaft Seal (SAE Flange Configuration)

Lip type shaft seals are used on the Series 51 motors.

Replacement of the shaft seal usually requires removal of the motor from the machine.

Remove the screws holding the flange to the housing, using a 6 mm internal hex wrench (060 and 080 units), an 8 mm internal hex wrench (110 units), a 10 mm internal hex wrench (160 units), or a 12 mm internal hex wrench (250 units).

Remove the flange from the housing using a suitable puller. Care must be taken so as to not damage the housing bore or shaft.

CAUTION

Do not allow the output shaft to move out of the housing while removing the flange. After the flange is removed, do not attempt to remove the shaft from the housing. If the output shaft moves out of the housing, the synchronizing shaft and rollers could fall out of position, requiring major disassembly of the unit.

Fig. 50-4 - Remove Old Seal from Flange (SAE)

Fig. 50-5 - New Seal Installed in Flange (SAE)

Remove the old seal from the flange. Once removed, the seal is not reusable.

Inspect the flange and the new seal for any damage or nicks.

Using an arbor press, press the new seal into the flange. Be careful not to damage seal.

NOTE: The outside diameter of the seal may be lightly coated with a sealant (such as Loctite High Performance Sealant #59231) prior to installation. This will aid in preventing leaks caused by damage to the seal bore in the flange.

Inspect the sealing area on the shaft for rust, wear, or contamination.

Minor Repair and Replacement - Variable Motor (Continued)

Install a new O-ring on the flange. Prior to assembly, lubricate the flange O-ring and the I.D. of the seal with petroleum jelly.

Protect the seal lip from damage during installation by wrapping the spline or key end of shaft with plastic film, or by using a seal installation tool.

Assemble the flange and seal over the shaft and into the housing bore. Install four (4) of the flange screws, and tighten them evenly to pull the flange into position. Take care to not damage the O-ring or seal lip during installation.

Install the flange screws and torque evenly to 32 Nm (24 ft•lbsf) for 060 and 080 motors, 63 Nm (46 ft•lbsf) for 110 motors, 110 Nm (81 ft•lbsf) for 160 motors, and 174 Nm (128 ft•lbsf) for 250 motors.

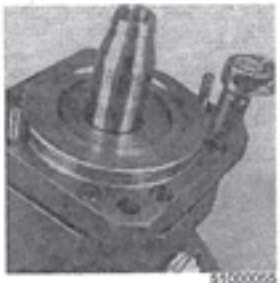


Fig. 50-6 - Install Flange onto Housing (SAE)

Fig. 50-7 - Torque Flange Screws (SAE)

Shaft Seal (Cartridge Configuration)

Lip type shaft seals are used on the Series 51 motors. These seals can be replaced without major disassembly of the unit. However, replacement of the shaft seal requires removal of the motor from the wheel drive or track drive gearbox.

Remove the seal carrier retaining ring from the housing.

Carefully pull the seal cover out of the housing. Care must be taken so as not to damage the housing bore or shaft.

Remove the O-ring from the housing.

Remove the old seal from the carrier. Once removed, the seal is not reusable.

Inspect the carrier and the new seal for any damage or nicks.

Using an arbor press, press the new seal into the carrier. Be careful not to damage seal.

NOTE: The outside diameter of the seal may be lightly coated with a sealant (such as Loctite High Performance Sealant #59231) prior to installation. This will aid in preventing leaks caused by damage to the seal bore in the seal carrier.

Inspect the sealing area on the shaft for rust, wear, or contamination.

Fig. 50-8 - Remove Carrier Retaining Ring (Cartridge)

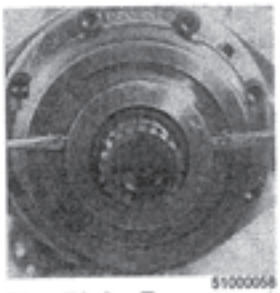


Fig. 50-9 - Remove Seal Carrier (Cartridge)

Fig. 50-10 - Seal Carrier Removed (Cartridge)

Fig. 50-11 - Seal Installed in Carrier (Cartridge)

Minor Repair and Replacement - Variable Motor (Continued)

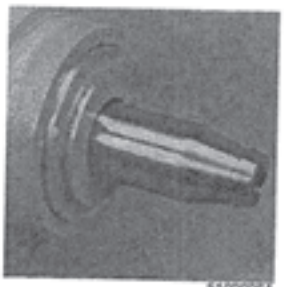


Fig. 50-12 - Install Seal Carrier (Cartridge)

Fig. 50-13 - Install Carrier Retaining Ring (Cartridge)

Install the carrier O-ring into the groove in the housing. Prior to assembly, lubricate the carrier O-ring and the I.D. of the seal with petroleum jelly.

Protect the seal lip from damage during installation by wrapping the spline or key end of shaft with plastic film, or by using a seal installation tool.

Assemble the carrier and seal over the shaft and into the housing bore. Take care to not damage the O-ring or seal lip during installation.

Install the seal carrier retaining ring.

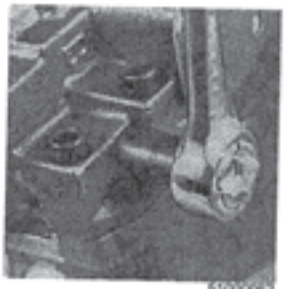


Fig. 50-14 - Remove Shuttle Valve Plugs

Fig. 50-15 - Remove Valve Spool

Loop Flushing Shuttle Valve (Option)

Using an 11/16" wrench, remove the hex plugs from both sides of end cap.

Remove springs and spring seat washers. Note the orientation of the washers.

NOTE The 250 frame size motors use thicker spring seat washers.

Remove flushing valve spool.

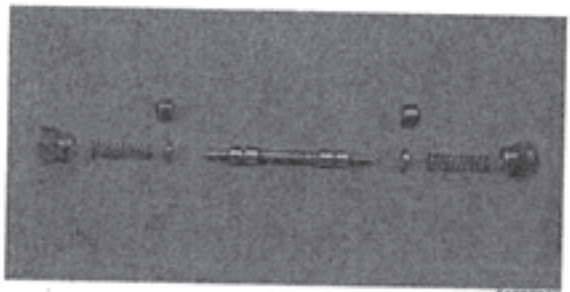


Fig. 50-16 - Loop Flushing Shuttle Valve Components

Inspect parts for damage or foreign material.

Fig. 50-17 - Install Valve Spool and Washers

Fig. 50-18 - Install Plugs and Springs

Install flushing valve spool in end cap, then install the spring seat washers (thick washers on 250 frame size motors) on each end of the spool. The step on the spring seat washers should face out, toward the springs.

Install the spool springs and hex plugs. Torque the plugs to 41 Nm (30 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Charge Pressure Relief Valve

Before removing the screw adjustable relief valve plug, mark the plug, lock nut, and end cap to allow maintaining the original adjustment when assembling. Remove the screw adjustable charge relief valve plug by loosening the lock nut (with a 1-1/16" hex wrench), and unscrewing the plug with a large screwdriver.

Remove the spring and relief valve poppet.

Inspect the poppet and mating seat in the end cap for damage or foreign material.

Install the poppet and spring. Install the plug with its lock nut, aligning the marks made at disassembly, and torque the lock nut to 52 Nm (38 ft•lbsf).

Check and adjust, if necessary, the charge pressure.

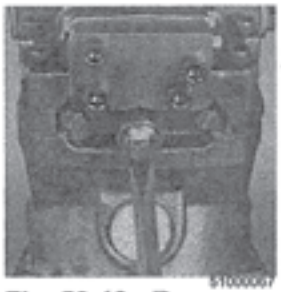


Fig. 50-19 - Remove Charge Relief Valve Plug

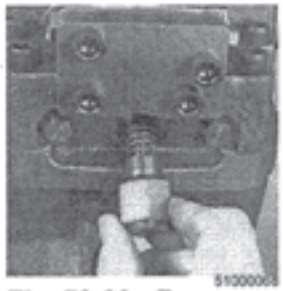


Fig. 50-20 - Remove Charge Relief Valve

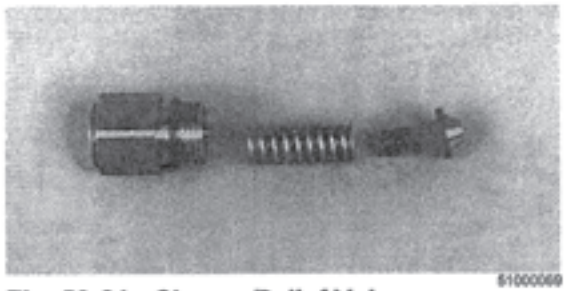


Fig. 50-21 - Charge Relief Valve Components

Minimum Angle Servo Cover

Thoroughly clean external surfaces prior to removal of cover.

Remove the four (4) screws retaining the cover to the end cap with an 8 mm internal hex wrench (060, 080, 110, and 160 units) or a 10 mm internal hex wrench (250 units). Remove the cover. Remove the O-rings between the cover and end cap.

Install new O-rings on the end cap and retain with petroleum jelly. Install the cover onto the end cap and install the screws. Torque the screws to 78 Nm (58 ft•lbsf) for 060, 080, or 110 units, or 110 Nm (81 ft•lbsf) for 160 or 250 units.

The plug in the cover may be removed with a 7/16" hex wrench. Torque this plug to 9 Nm (7 ft•lbsf).

Fig. 50-22 - Remove Servo Cover Screws

Fig. 50-23 - Install Servo Cover

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-24 - Remove Cover Plate Screws

Fig. 50-25 - Remove Cover Plate

Fig. 50-26 - Remove Valve Sleeve Bore Plug

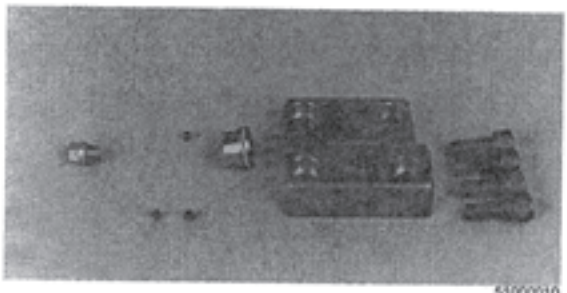


Fig. 50-27 - N2 Control Components

Fig. 50-28 - Torque Cover Plate Screws

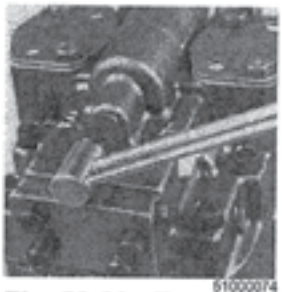


Fig. 50-29 - Torque Plug in End Cap

Hydraulic 2-Position Control (Type N2)

Thoroughly clean external surfaces prior to removal of cover plate.

Remove the four (4) screws retaining the cover plate to the end cap with an 8 mm internal hex wrench (060, 080, and 110 units) or a 10 mm internal hex wrench (160 and 250 units). Remove the cover plate.

Remove the solid plug from the valve sleeve bore in the end cap. (An 8 mm threaded hole is provided in the plug for a puller screw.) Remove the O-ring from the plug.

Remove the O-rings from the end cap.

Install new O-rings on the end cap and retain with petroleum jelly.

Install a new O-ring on the solid plug and install the solid plug into the end cap.

Install the cover plate onto the end cap and install the screws. Torque the screws to 78 Nm (58 ft•lbsf) for 060, 080, or 110 units, or to 110 Nm (81 ft•lbsf) for 160 or 250 units.

Set screws are installed in control orifice holes in the end cap to plug the valve sleeve bore passages. To gain access to the screw plugs, remove the outer plugs from the end cap with a 7/16" or 11/16" hex wrench. Remove the screw plugs with a 3 mm internal hex wrench. When installing, torque the screw plugs to 4 Nm (35 in•lbsf). Torque the 5/16" outer plugs to 9 Nm (7 ft•lbsf), and the 9/16" outer plugs to 37 Nm (27 ft•lbsf). Refer to the "Control Orifices" topic for additional information.

The special plug and seal washer on the end cap opposite the control may be removed with a 13 mm hex wrench. When installing, torque this plug to 20 Nm (15 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Electrohydraulic 2-Position Controls (Types E1•E2 and F1•F2)

Thoroughly clean external surfaces prior to removing the control.

The solenoid may be removed from the valve by removing the nut with a 3/4" hex wrench. The solenoid valve may be removed from the control valve housing with a 7/8" hex wrench.

Fig. 50-30 - Remove E1•E2 or F1•F2 Control Solenoid

Fig. 50-31 - Remove Solenoid Valve

Remove the screws retaining the valve housing to the multi-function block with a 4 mm internal hex wrench. Remove the valve housing.

The plugs on the control housing may be removed with an 11/16" hex wrench. When reinstalling, torque the plugs to 37 Nm (27 ft•lbsf).

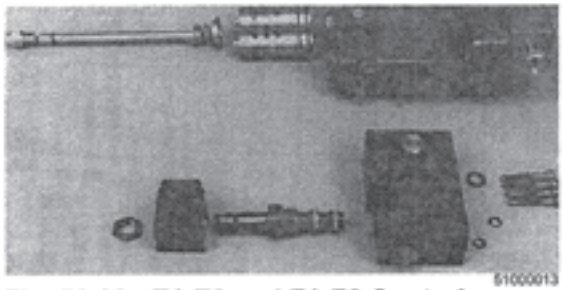


Fig. 50-32 - E1•E2 and F1•F2 Control Components

Install new O-rings onto the valve housing. Install the valve housing onto the multi-function block, and install the screws. Torque the screws to 6.4 Nm (4.7 ft•lbsf).

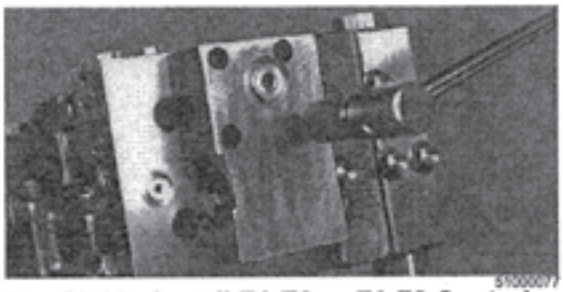


Fig. 50-33 - Install E1•E2 or F1•F2 Control Valve Housing

When installing the solenoid valve into the valve housing, the valve should be torqued to 20 Nm (15 ft•lbsf). When installing the solenoid onto the valve, torque the nut to 15 Nm (11 ft•lbsf.).

Fig. 50-34 - Install Solenoid Valve

Fig. 50-35 - Install Solenoid

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-36 - Remove S1 Control Screws

Fig. 50-37 - Remove Adapter Plate and Solenoid

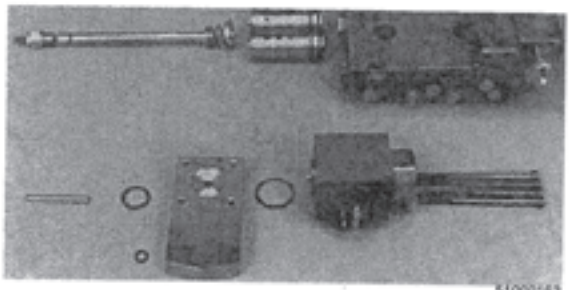


Fig. 50-38 - S1 Control Components

Electric 2-Position Controls (Type S1)

Thoroughly clean external surfaces prior to removing the control.

Remove the screws retaining the solenoid and solenoid adapter plate to the multi-function block with a 4 mm internal hex wrench. Remove the solenoid and the solenoid adapter plate from the multi-function block.

Remove the solenoid pin from the multi-function block.

Install new O-rings onto the adapter plate and the solenoid.

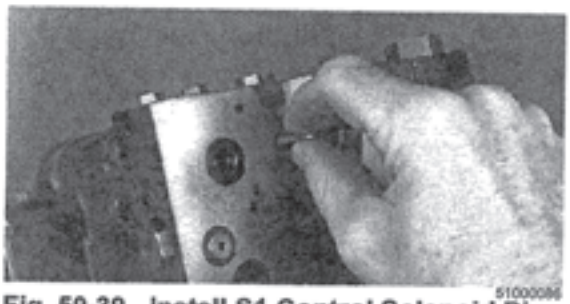


Fig. 50-39 - Install S1 Control Solenoid Pin

Install the solenoid pin into the hole in the multi-function block.

Fig. 50-40 - Install Adapter Plate and Solenoid

Fig. 50-41 - Torque Control Solenoid Screws

Install the adapter plate with O-rings onto the multi-function block.

Install the solenoid with O-ring onto the adapter plate.

Install the screws and torque to 6.4 Nm (4.7 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Hydraulic Proportional Control (Type HZ)

Thoroughly clean external surfaces prior to removal of control.

Remove the four (4) screws retaining the valve housing to the end cap with an 8 mm internal hex wrench (060, 080, and 110 units) or a 10 mm internal hex wrench (160 and 250 units). Remove the valve housing. Remove the O-rings between the valve housing and end cap, and the O-ring on the valve spool sleeve.

The plugs on the control housing may be removed with a 7/16" or 11/16" hex wrench. When reinstalling, torque the 5/16" plugs to 9 Nm (7 ft•lbsf), and the 9/16" plugs to 37 Nm (27 ft•lbsf)

The valve housing is equipped with filter screens in the passages between the housing and the end cap. Units with internal servo pressure supply have a filter screen installed in the end cap passage leading to the valve spool sleeve. These screens should be pressed into position (with the rounded edge of the filter screens facing "out") until they are flush to 2.0 mm (0.08 in.) below the machined surface of the valve housing or end cap.

Units with external servo pressure supply have a plug installed in the end cap passage leading to the valve spool sleeve. This plug may be removed with a 2.5 mm internal hex wrench. When installing this plug, torque to 2 Nm (18 in•lbsf).

Install a new O-ring onto the valve spool sleeve in the end cap. Install new O-rings onto the end cap.

Install the valve housing onto the multi-function block, and install the screws.

Torque the screws to 78 Nm (58 ft•lbsf) for 060, 080, or 110 units, or to 110 Nm (81 ft•lbsf) for 160 or 250 units.

S1000080

Fig. 50-42 - Remove HZ Control Housing Screws


S1000081

Fig. 50-43 - Remove HZ Control Housing

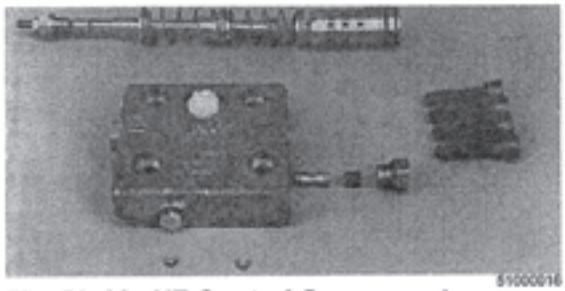

S1000016

Fig. 50-44 - HZ Control Components

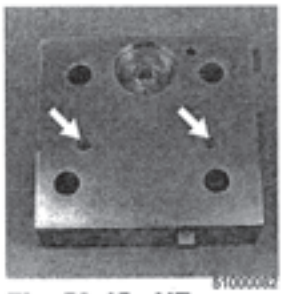

S1000082

Fig. 50-45 - HZ Control Housing Screens


S1000083

Fig. 50-46 - End Cap O-Rings Installed


S1000081

Fig. 50-47 - Install HZ Control Housing


S1000084

Fig. 50-48 - Torque HZ Control Valve Housing Screws

Minor Repair and Replacement - Variable Motor (Continued)

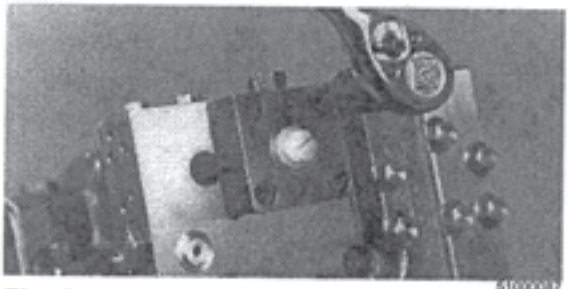


Fig. 50-49 - Remove HS Control Housing Screws

Hydraulic Proportional Control (Type HS)

Thoroughly clean external surfaces prior to removal of control.

Remove the screws retaining the valve housing to the multi-function block with a 4 mm internal hex wrench. Remove the valve housing.

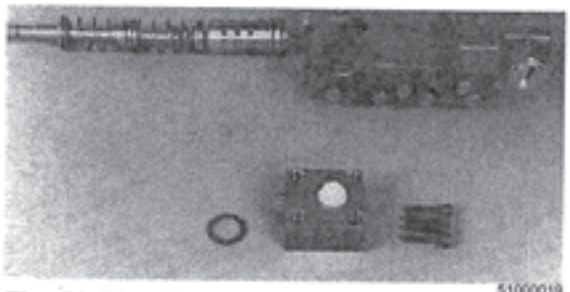


Fig. 50-50 - HS Control Components

The plug on the control housing may be removed with an 11/16" hex wrench. When reinstalling, torque the plug to 37 Nm (27 ft•lbsf).

Install a new O-ring onto the valve housing.

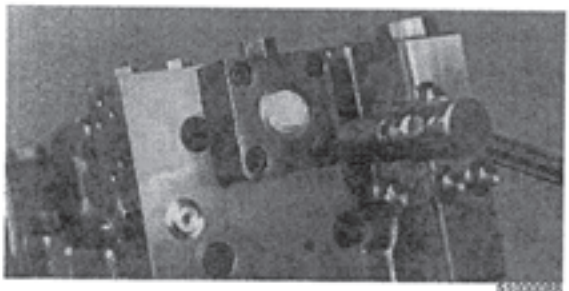


Fig. 50-51 - Torque HS Control Housing Screws

Install the valve housing onto the multi-function block, and install the screws.

Torque the screws to 6.4 Nm (4.7 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Hydraulic Proportional Control with Maximum Angle Over-ride (Types H1•H2 or K1•K2)

Thoroughly clean external surfaces prior to removing the control.

The solenoid may be removed from the valve by removing the nut with a 3/4" hex wrench.

Fig. 50-52 - Remove H1•H2 or K1•K2 Control Solenoid

Fig. 50-53 - Remove Solenoid Valve

The solenoid valve may be removed from the control valve housing with a 7/8" hex wrench.

Remove the screws retaining the valve housing to the multi-function block with a 4 mm internal hex wrench. Remove the valve housing.

The plugs on the control housing may be removed with an 11/16" hex wrench. When reinstalling, torque the plugs to 37 Nm (27 ft•lbsf).

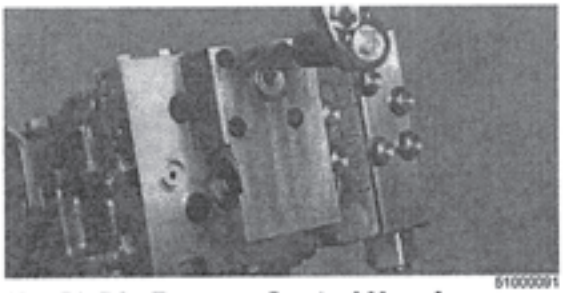


Fig. 50-54 - Remove Control Housing Screws

Install new O-rings onto the valve housing.

Install the valve housing onto the multi-function block, and install the screws. Torque the screws to 6.4 Nm (4.7 ft•lbsf).

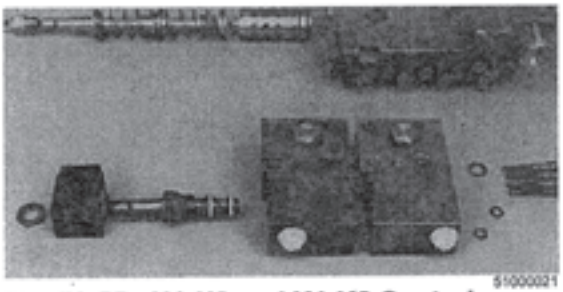


Fig. 50-55 - H1•H2 and K1•K2 Control Components

When installing the solenoid valve into the valve housing, the valve should be torqued to 20 Nm (15 ft•lbsf).

When installing the solenoid onto the valve, torque the nut to 15 Nm (11 ft•lbsf.).

Fig. 50-56 - Install Solenoid Valve

Fig. 50-57 - Install Solenoid

Minor Repair and Replacement - Variable Motor (Continued)

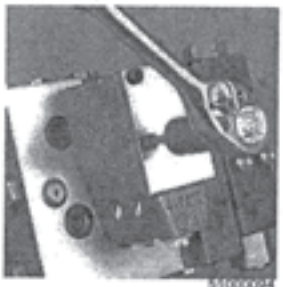


Fig. 50-58 - Remove HP Control Housing Screws

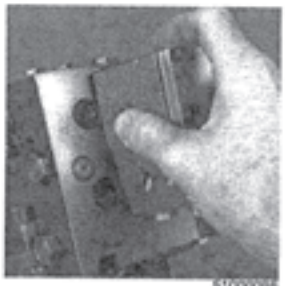


Fig. 50-59 - Remove Control Housing

Fig. 50-60 - Remove Shuttle Spool Plug

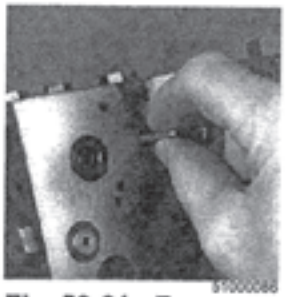


Fig. 50-61 - Remove Pilot Piston Pin

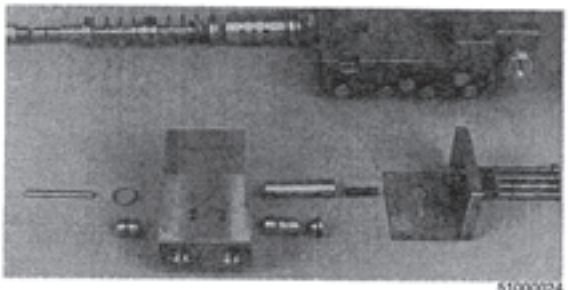


Fig. 50-62 - HP Control Components

Two Connection Hydraulic Proportional Control (Type HP)

Thoroughly clean external surfaces prior to removal of control.

Hold the control housing in position, and remove the screws retaining the cover and control housing to the multi-function block with a 4 mm internal hex wrench. Remove the housing cover and gasket. Remove the valve housing with shuttle valve assembly and pilot piston from the multi-function block.

Remove the O-rings from the valve housing. Remove the pilot piston and spring from the valve housing.

Remove the pilot piston pin from the multi-function block.

Remove the inner shuttle spool plug from the valve housing. (A 5 mm threaded hole is provided in the inner plug for a puller screw.) Remove the shuttle spool from the valve housing. Remove the outer shuttle spool plug. Remove the O-rings from the plugs.

Install new O-rings on the shuttle spool plugs.

Install new O-rings on the valve housing and retain with petroleum jelly.

Minor Repair and Replacement - Variable Motor (Continued)

Install the pilot piston pin in the multi-function block.

Install the outer (thin) shuttle piston plug with the large chamfer toward the shuttle valve bore. Install the shuttle spool into its bore and install the inner (thick) plug with the large chamfer toward the shuttle valve bore.

Fig. 50-63 - Pilot Piston Pin Installed

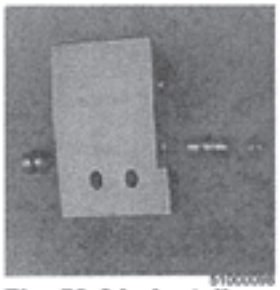


Fig. 50-64 - Install Shuttle Spool and Plugs

Position the valve housing (with O-ring) on the multi-function block.

Install the pilot piston into the housing and over the pin. The end of the piston with the cross drilled hole should engage the pin.

Fig. 50-65 - Install Control Housing

Fig. 50-66 - Install Pilot Piston

Install the small spring in the outer end of the pilot piston.

Install the control cover and gasket. Align the control assembly with the multi-function block and install the four (4) screws.

Torque the control screws to 6.4 Nm (4.7 ft•lbsf).

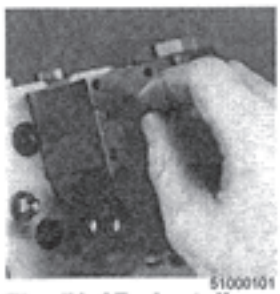


Fig. 50-67 - Install Spring

Fig. 50-68 - Install Cover, Gasket, and Screws

Minor Repair and Replacement - Variable Motor (Continued)

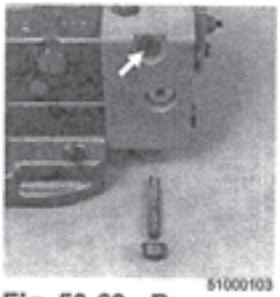

S1000103

Fig. 50-69 - Remove HC Control Bleed Valve


S1000175

Fig. 50-70 - Install HC Control Bleed Valve


S1000176

Fig. 50-71 - Install HC Control Bleed Valve Seal Nut

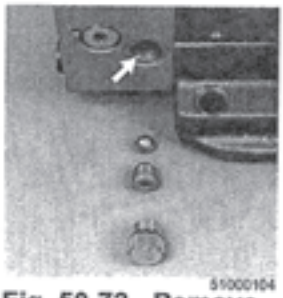

S1000104

Fig. 50-72 - Remove Servo Pressure Ball Shuttle Valve

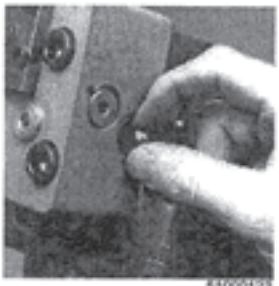

S1000123

Fig. 50-73 - Install Servo Pressure Shuttle Ball Valve


S1000174

Fig. 50-74 - Torque Servo Pressure Shuttle Ball Seat


S1000105

Fig. 50-75 - Install Control Pressure Shuttle Spool

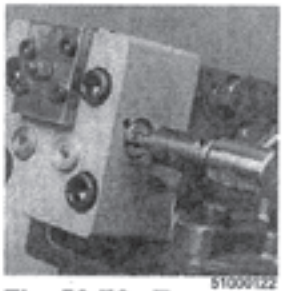

S1000122

Fig. 50-76 - Torque Shuttle Spool Plugs

Two Connection Hydraulic Proportional Control for "Dual Path" Vehicles (Type HC)

Bleed Valve

Loosen the seal lock nut on the bleed valve with a 10 mm hex wrench, and remove the valve with a 4 mm internal hex wrench.

Install the bleed valve and torque to 3 Nm (27 in•lbsf).

Install the seal lock nut and torque to 19 Nm (14 ft•lbsf).

Servo Pressure Shuttle Valve

Remove the servo pressure shuttle plug with an 1 1/16" hex wrench. Remove the shuttle ball seat with a 5 mm internal hex wrench and remove the ball.

Install the servo pressure shuttle ball.

Install the shuttle ball seat and torque to 11 Nm (8 ft•lbsf). Install the shuttle passage plug and torque to 37 Nm (27 ft•lbsf).

Control Pressure Shuttle Valve

Remove the shuttle spool plugs with a 1/4" internal hex wrench. Remove the control pressure shuttle spool.

Install the control pressure shuttle spool.

Install the shuttle spool plugs and torque to 20 Nm (15 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Pilot Piston and Control Housing

Thoroughly clean external surfaces prior to disassembly of control.

Remove the four (4) screws retaining the cover to the control housing with a 4 mm internal hex wrench.

Remove the housing cover and gasket (with the adjusting screw and seal lock nut).

Fig. 50-77 - Remove HC Control Housing Cover Screws

Fig. 50-78 - Remove HC Control Housing Cover

Remove the control start adjustor spring seat and spring from the pilot piston.

Remove the pilot piston from the control housing.

Remove the pilot piston pin seat and pin from the control housing (or pilot piston).

Remove the control start spring from the control housing.

Fig. 50-79 - Remove Adjustment Spring and Pilot Piston

Fig. 50-80 - Remove Pilot Piston Pin and Control Start Spring

Remove the four (4) screws (and washers for 060, 080, and 110 units) retaining the control housing to the end cap with an 8 mm internal hex wrench (060, 080, and 110 units) or a 10 mm internal hex wrench (160 and 250 units).

Remove the control housing from the end cap. Remove the O-rings between the control housing and the end cap, and the O-ring on the valve spool sleeve.

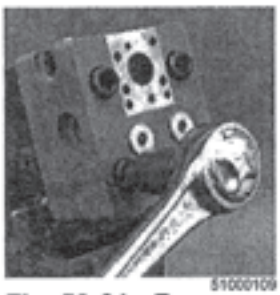


Fig. 50-81 - Remove HC Control Housing Screws

Fig. 50-82 - Remove HC Control Housing

Minor Repair and Replacement - Variable Motor (Continued)

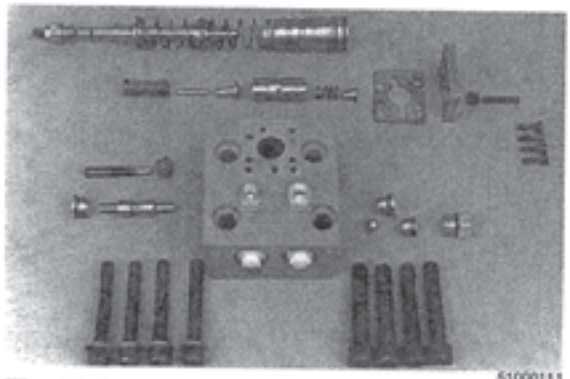

S1000111

Fig. 50-83 - HC Control Components

The plugs on the control housing may be removed with a 7/16" hex wrench or a 1/4" internal hex wrench. When reinstalling, torque the 5/16" plugs to 9 Nm (7 ft•lbsf), and the 9/16" plugs to 20 Nm (15 ft•lbsf).

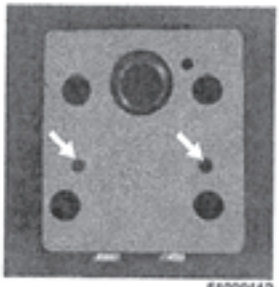

S1000112

Fig. 50-84 - HC Control Housing Screens

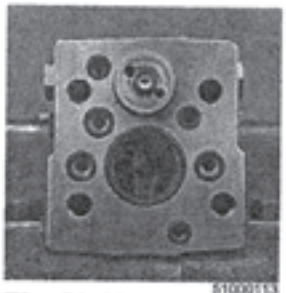

S1000113

Fig. 50-85 - End Cap O-Rings Installed for HC Control

The control housing is equipped with filter screens in the passages between the housing and the end cap. Units with internal servo pressure supply have a filter screen installed in the end cap passage leading to the valve spool sleeve. These screens should be pressed into position (with the rounded edge of the filter screens facing "out") until they are flush to 2.0 mm (0.08 in.) below the machined surface of the valve housing or end cap.

Install a new O-ring onto the valve spool sleeve in the end cap. Install new O-rings onto the end cap.


S1000110

Fig. 50-86 - Install HC Control Housing

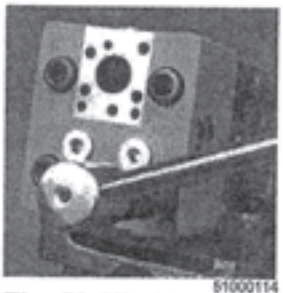

S1000114

Fig. 50-87 - Torque HC Control Housing Screws

Install the valve housing onto the end cap, and install the screws (with flat washers on 060, 080, and 110 units).

Torque the screws to 78 Nm (58 ft•lbsf) for 060, 080, and 110 units, or to 110 Nm (81 ft•lbsf) for 160 and 250 units.

Minor Repair and Replacement - Variable Motor (Continued)

Install the control start spring into the control housing.

Install the pilot piston pin. The end of the pin must engage the recess in the end of the control valve spool.

Fig. 50-88 - Install HC Control Start Spring

Fig. 50-89 - Install Pilot Piston Pin

Install the pilot piston pin seat.

Install the pilot piston into the housing and over the spring and spring seat. The end of the piston with the deeper bore and the cross drilled hole should engage the start spring and pin seat.

Fig. 50-90 - Install Pilot Piston Pin Seat

Fig. 50-91 - Install HC Control Pilot Piston

Install the adjustor spring in the outer end of the pilot piston.

Install the adjustor spring seat.

Fig. 50-92 - Install HC Control Start Adjuster Spring

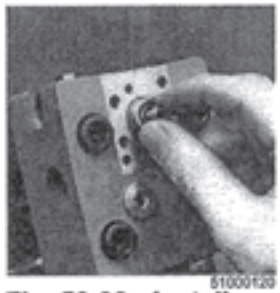


Fig. 50-93 - Install HC Control Start Adjuster Spring Seat

Install the control cover and gasket (with adjusting screw and seal lock nut).

Torque the control cover screws to 6.4 Nm (4.7 ft•lbsf).

Fig. 50-94 - Install HC Control Cover and Gasket

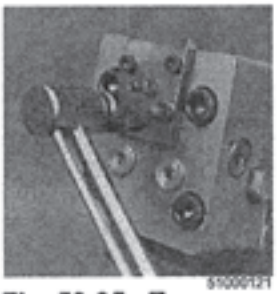


Fig. 50-95 - Torque Control Cover Screws

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-96 - Remove PCP Valve

Fig. 50-97 - Remove EP•EQ Control Housing Screws

Fig. 50-98 - Remove EP•EQ Control Housing

Fig. 50-99 - Remove Pilot Piston Pin

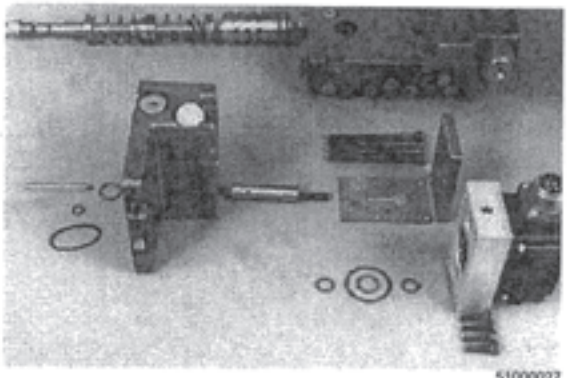


Fig. 50-100 - EQ Control Components (EP Similar)

Electrohydraulic Proportional Control (Types EP and EQ)

Thoroughly clean external surfaces prior to removal of control.

The Pressure Control Pilot (PCP) valve may be removed from the control valve housing, as described under the following heading.

Remove the screws retaining the control housing cover and control valve housing to the multi-function block with a 4 mm internal hex wrench. Remove the housing cover and gasket.

Remove the valve housing with the pilot piston from the multi-function block.

Remove the O-rings from the valve housing. Remove the pilot piston and spring from the valve housing.

Remove the pilot piston pin from the multi-function block.

Install new O-rings on the valve housing and retain with petroleum jelly.

The plugs on the control housing may be removed with a 1/4" internal hex wrench. When reinstalling, torque the 9/16" plugs to 20 Nm (15 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Install the pilot piston pin in the multi-function block.

Position the valve housing (with O-rings) on the multi-function block.

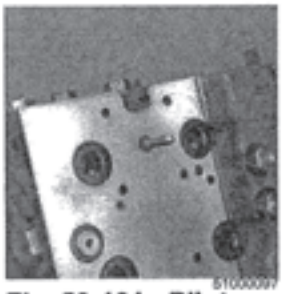


Fig. 50-101 - Pilot Piston Pin Installed

Fig. 50-102 - Install Control Housing

Install the pilot piston into the housing and over the pin. The end of the piston with the cross drilled hole should engage the pin.

Install the small spring in the outer end of the pilot piston.

Fig. 50-103 - Install Pilot Piston

Fig. 50-104 - Install Spring

Install the control cover and gasket. Align the control assembly with the multi-function block and install the four (4) screws.

Torque the control screws to 6.4 Nm (4.7 ft•lbsf).

Reinstall the PCP valve, if removed.

Fig. 50-105 - Torque Cover, Gasket, and Screws

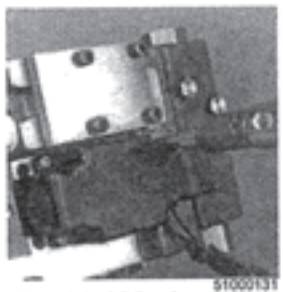


Fig. 50-106 - Install PCP Valve

Minor Repair and Replacement - Variable Motor (Continued)

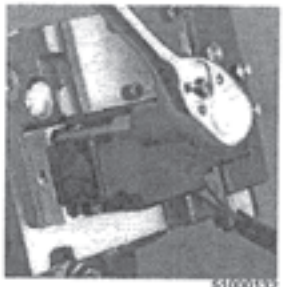


Fig. 50-107 - Remove PCP Valve Screws

Fig. 50-108 - PCP Valve Components

Fig. 50-109 - Install PCP onto Control

Fig. 50-110 - Torque PCP Valve Screws

Pressure Control Pilot (PCP) Valve for Electrohydraulic Proportional Control (Types EP and EQ)

Thoroughly clean external surfaces of control.

Using a 4 mm internal hex wrench, remove the four (4) screws and remove the PCP valve.

Check surfaces for nicks or damage. Clean internal screens.

Install new O-rings on the PCP housing and retain with petroleum jelly. Position the PCP on the control valve housing and install the screws.

Torque the screws to 5.4 Nm (48 in•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Multi-function Block

Removal and Installation

Remove the external control assembly as described in the instructions for the specific control.

Remove the four (4) screws (and washers for 060, 080, and 110 units) retaining the multi-function block to the end cap with an 8 mm internal hex wrench (060, 080, and 110 units) or a 10 mm internal hex wrench (160 and 250 units).

Remove the multi-function block from the end cap. Remove the O-rings between the multi-function block and the end cap, and the O-ring on the valve spool sleeve.

The multi-function block is equipped with filter screens in the passages between the block and the end cap. Units with internal servo pressure supply have a filter screen installed in the end cap passage leading to the valve spool sleeve. These screens should be pressed into position (with the rounded edge of the filter screens facing "out") until they are flush to 2.0 mm (0.08 in.) below the machined surface of the multi-function block or end cap.

Units with external servo pressure supply have a plug installed in the end cap passage leading to the valve spool sleeve. This plug may be removed with a 2.5 mm internal hex wrench. When installing this plug, torque to 2 Nm (18 in•lbsf).

Install a new O-ring onto the valve spool sleeve in the end cap.

Install new O-rings onto the end cap.

Install the multi-function block onto the end cap, and install the screws.

Torque the screws to 78 Nm (58 ft•lbsf) for 060, 080, or 110 units, or to 110 Nm (81 ft•lbsf) for 160 or 250 units.

Reinstall the external control assembly as described in the instructions for the specific control.

Fig. 50-111 - Remove External Control (HS Shown)

Fig. 50-112 - Remove Multi-function Block Screws

Fig. 50-113 - Remove Multi-function Block

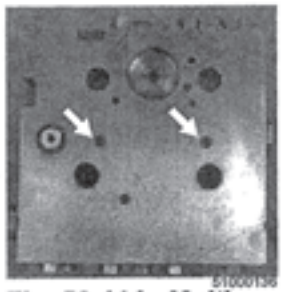


Fig. 50-114 - Multi-function Block Screens

Fig. 50-115 - End Cap O-Rings Installed

Fig. 50-116 - Install Multi-function Block

Fig. 50-117 - Torque Multi-function Block Screws

Fig. 50-118 - Install External Control (HS Shown)

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-119 - Remove Servo Pressure Supply Spool Plug

Fig. 50-120 - Remove Servo Pressure Supply Shuttle Spool

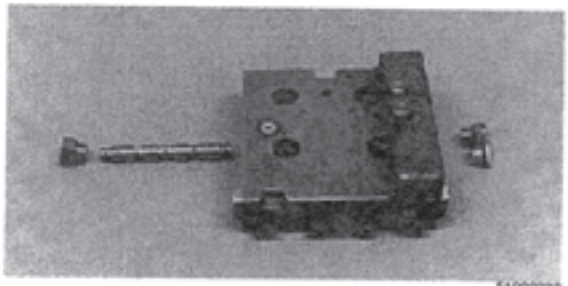


Fig. 50-121 - Multi-function Block with Servo Pressure Supply Shuttle Spool

Servo Pressure Supply Shuttle Spool

Remove the servo pressure supply shuttle spool plug from the multi-function valve with a 9/16" hex wrench.

NOTE: If a pressure compensator valve block is installed, the opposite end of the shuttle spool bore in the multi-function valve is plugged with an internal hex head plug located under the valve block. If a pressure compensator valve block is not installed, the opposite end of the shuttle spool bore is plugged with a hex head plug.

Remove the servo pressure supply shuttle spool from the multi-function valve block.

Inspect the shuttle spool for burrs or scoring. The spool must slide free in its bore. The shuttle ball in the spool must be free to move.

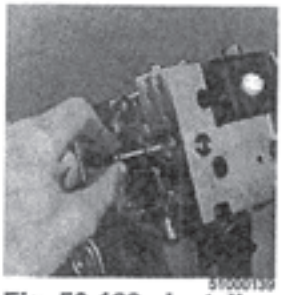


Fig. 50-122 - Install Servo Pressure Supply Shuttle Spool

Fig. 50-123 - Torque Servo Pressure Supply Spool Plug

Install the shuttle spool into the multi-function block.

Install the hex head plug into the multi-function valve and torque to 37 Nm (27 ft•lbsf).

NOTE: If an internal hex head plug was removed from the opposite end of the shuttle spool bore, torque it to 20 Nm (15 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Blocking Plate for Multi-function Block Without PCOR

The blocking plate may be removed by removing the four (4) screws with a 5 mm internal hex wrench. Remove the O-rings from the plate.

Install new O-rings on the blocking plate and retain with petroleum jelly. Install the plate on the multi-function block and install the screws. Torque the screws to 11 Nm (8 ft•lbsf).

Fig. 50-124 - Remove Blocking Plate (Less PCOR)

Fig. 50-125 - Torque Blocking Plate Screws (Less PCOR)

Pressure Compensator Valve for Pressure Compensator Over-Ride (PCOR) and Pressure Compensator Regulator (Type PC)

Loosen the adjusting screw lock nut with a 1-1/16" hex wrench. Remove the adjusting screw from the valve block with a large screwdriver.

Remove the pressure compensator valve spring and the spool assembly from the block.

Fig. 50-126 - Remove PCOR•PC Adjustor

Fig. 50-127 - Remove PCOR•PC Spring and Spool Valve

Remove the valve block plug with a 1" hex wrench.

Remove the four (4) screws retaining the valve block to the multi-function block with a 5 mm internal hex wrench. Remove the valve block and O-rings.

Fig. 50-128 - Remove PCOR•PC Plug

Fig. 50-129 - Remove PCOR•PC Valve Block

Install new O-rings on the pressure compensator valve block and retain with petroleum jelly. Install a new O-ring on the adjusting screw.

The plugs on the valve block may be removed with a 7/16" hex wrench. When reinstalling, torque the 5/16" plugs to 9 Nm (7 ft•lbsf).

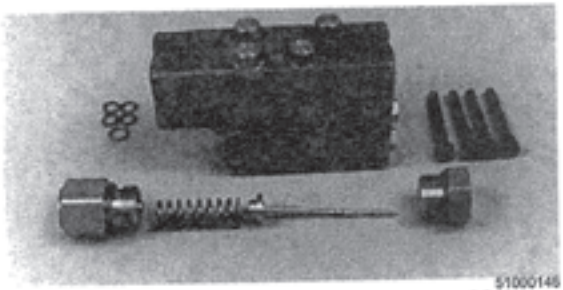


Fig. 50-130 - Pressure Compensator Valve Block Components

Minor Repair and Replacement - Variable Motor (Continued)

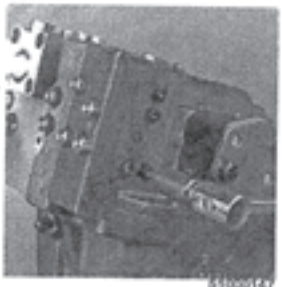


Fig. 50-131 - Install PCOR•PC Valve Block

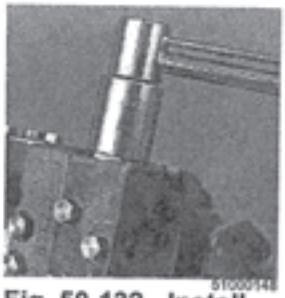


Fig. 50-132 - Install PCOR•PC Valve Plug

Install the valve block on the multi-function block and install the screws. Torque the screws to 11 Nm (8 ft•lbsf).

Install the valve block plug and torque to 54 Nm (40 ft•lbsf).

Fig. 50-133 - Install PCOR•PC Spring and Spool Valve

Fig. 50-134 - Install PCOR•PC Adjusting Screw

Install the pressure compensator spool assembly and the valve spring.

Install the adjusting screw and lock nut. Perform the PCOR or PC regulator pressure adjustment as described under "Component Adjustment."

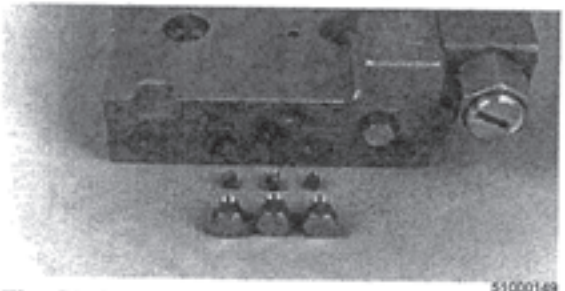


Fig. 50-135 - PCOR and PC Regulator Orifices

PCOR and PC Regulator Orifices

To gain access to the PCOR or PC regulator orifices, remove the three (3) plugs located between the defeat spool stop plugs on the multi-function block, using a 7/16" hex wrench. Remove the PCOR brake pressure defeat spool (if installed). Remove the orifice plug(s) and plain plug(s) with a 2.5 mm internal hex wrench.

Refer to the appropriate Service Parts Manual for information on orifice locations and sizes.

Install the orifice plug(s) and plain plug(s), and torque to 4 Nm (35 in•lbsf). Install the outer plugs and torque to 6 Nm (4 ft•lbsf). Reinstall the PCOR defeat spool (if removed).

Additional orifices are installed in the passages under the pressure compensator valve block.

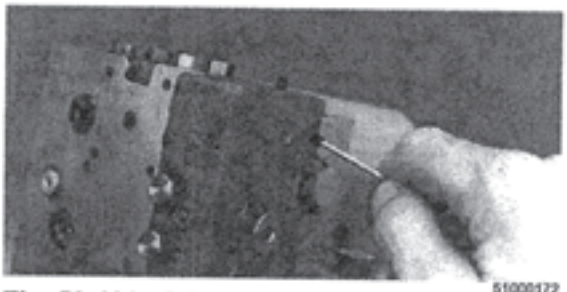


Fig. 50-136 - PCOR and PC Regulator Orifices

Minor Repair and Replacement - Variable Motor (Continued)

PCOR Brake Pressure Defeat Spool

Remove the PCOR defeat spool bore plugs or fittings with a hex wrench.

Remove the PCOR defeat spool stop plugs with a 7/16" hex wrench. Remove the defeat spool.

NOTE: The defeat spool may be removed from either end of its bore in the multi-function block.

Fig. 50-137 - Remove PCOR Defeat Spool Plug or Fitting

Fig. 50-138 - Remove PCOR Defeat Spool Stop Plug

Inspect the defeat spool for burrs or roughness. The spool must slide freely in its bore. Inspect the pins in the stop plugs for damage.

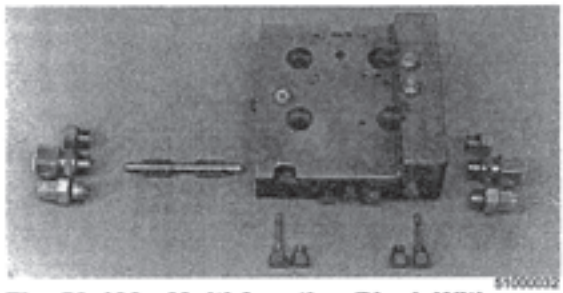


Fig. 50-139 - Multi-function Block With PCOR Defeat Spool Components

Install the PCOR defeat spool into its bore in the multi-function block.

Install the spool stop plugs into the multi-function block. Torque the stop plugs to 6 Nm (4 ft•lbsf).

Install the defeat spool bore plugs or fittings and torque to 27 Nm (20 ft•lbsf).

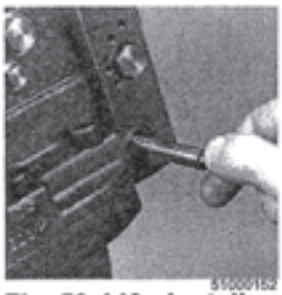


Fig. 50-140 - Install PCOR Defeat Spool

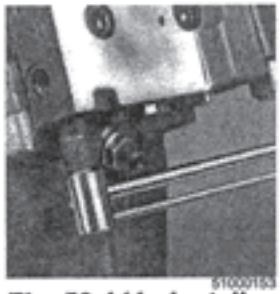


Fig. 50-141 - Install PCOR Defeat Spool Stop Plug

Minor Repair and Replacement - Variable Motor (Continued)

Fig. 50-142 - PC Regulator Components

Pressure Compensator Regulator (Type PC)

The PC regulator utilizes the multi-function block and pressure compensator valve to control the motor displacement.

Service procedures for these components are included in the "Multi-function Block" section of this manual.

Fig. 50-143 - Remove Valve Sleeve Bore Plug

Fig. 50-144 - Servo Drain Orifice (T7)

A valve sleeve bore plug is installed in the motor end cap in place of the valve spool sleeve. Remove the plug from the valve sleeve bore in the end cap. (An 8 mm threaded hole is provided in the plug for a puller screw.) Remove the O-ring from the plug.

A single servo drain orifice is installed in the valve sleeve bore plug. This orifice limits oil flow from the maximum displacement end of the servo piston to the motor case.

Install a new O-ring on the valve sleeve bore plug. Install the bore plug into the end cap.

The special plug and seal washer on the end cap opposite the multi-function block may be removed with a 13 mm hex wrench. When installing, torque this plug to 20 Nm (15 ft•lbsf).

Minor Repair and Replacement - Variable Motor (Continued)

Control Orifices

Orifices are installed in the motor end cap to regulate oil flow to the servo control valve and the servo piston.

To gain access to these orifice plugs, remove the three (3) plugs located on the motor end cap nearest the multi-function block or control, using a 7/16" or 9/16" hex wrench. Remove the orifice plugs (plain plugs for N2 control) with a 3 mm internal hex wrench.

Install the orifice plugs, and torque to 4 Nm (35 in•lbsf). Torque the 5/16" outer plugs to 9 Nm (7 ft•lbsf), and the 9/16" outer plug to 37 Nm (27 ft•lbsf).

Orifices are also installed in the servo control valve sleeve to control oil flow from the servo piston to the motor case.

Fig. 50-145 - Servo Pressure Supply Orifice (T1)

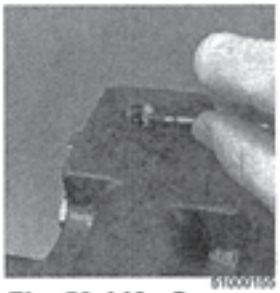


Fig. 50-146 - Servo Orifice for Maximum Displacement (T2)

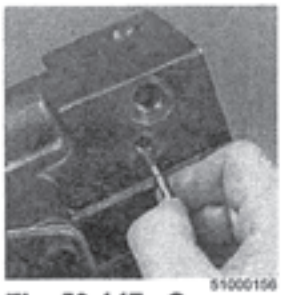


Fig. 50-147 - Servo Orifice for Minimum Displacement (T3)

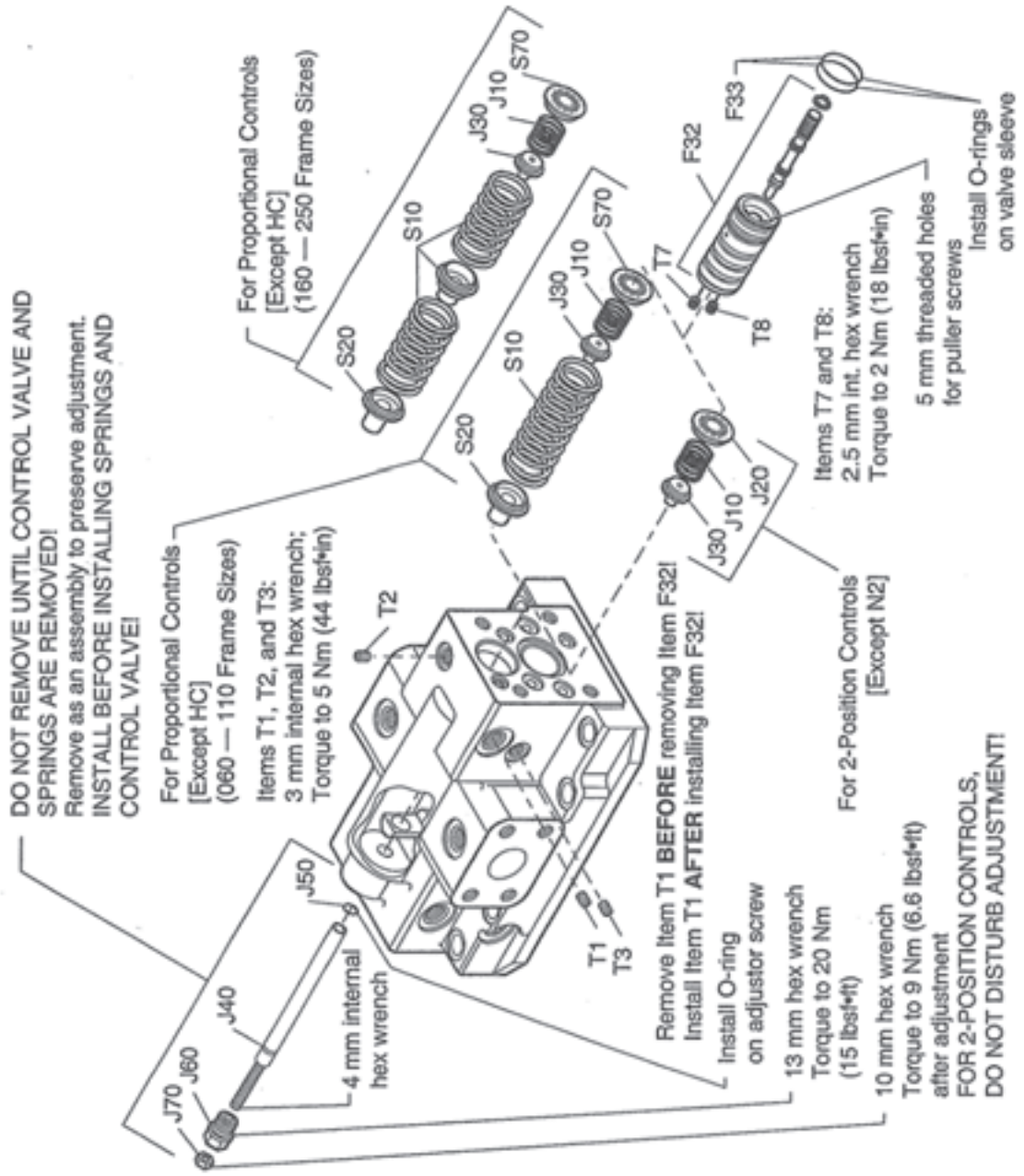
Fig. 50-148 - Servo Drain Orifices (T7 and T8)

Plug / Fitting Torques

If any plugs or fittings are removed from the unit during servicing, they should be torqued as indicated in the accompanying table.

Item	Torque
Pressure Gauge Ports (9/16—18 O-Ring Hex)	37 Nm (27 ft•lbsf)
Construction Plugs (9/16—18 O-Ring Int. Hex)	20 Nm (15 ft•lbsf)
Construction Plugs (5/16—24 O-Ring)	9 Nm (7 ft•lbsf)
Screw Plugs (M6 Int. Hex)	4 Nm (35 in•lbsf)

Minor Repair Instructions
4-Way Valve and Feedback Springs



Minor Repair Instructions
4-Way Valve and Feedback Springs - HC Control