Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
3361	4	DEF dosing valve; short circuit on high side
3361	6	DEF dosing valve; power at the end of injection too high
3361	7	DEF dosing valve blocked (SCR)
3519	3	DEF quality sensor, internal temperature sensor short circuit to battery or open load
3519	4	DEF quality sensor, internal temperature sensor short circuit to ground
3519	12	DEF tank temperature, temperature too high
3519	13	Temperature at UQS invalid
3520	2	DEF quality sensor, bad DEF quality detected or no DEF measuring possible
3520	3	DEF quality sensor, short circuit to battery or open load
3520	4	DEF quality sensor, short circuit to ground
3520	13	Urea quality at UQS invalid
3532	3	Sensor error DEF tank level; signal range check high
3532	3	The DEF Level at UQS out of max. physical range
3532	4	Sensor error DEF tank level; signal range check low
3532	4	Quality at UQS out of min. physical range
3699	0	Maximum standstill time reached; oil exchange request ignored
3699	2	Passive regeneration of DPF; plausibility error DPF differential pressure sensor and a further sensor or actuator CRT system defective
3699	2	Passive regeneration of DPF; DOC error Temperature sensor us. and ds. DOC simultaneously defect
3711	12	Temperature during stand-still main phase too low or too high
3936	14	Standstill request ignored too long
3936	14	Standstill time based escalation requests Inducement step 2
4171	2	Dynamic temperature check of temp before SCR
4243	11	SCR heater; Pressure line heater error and temperature condition to perform an afterrun (Group error diagnosis heater) SCR system heater diagnostic reports error; shut off SCR-system
4334	0	Supply module DEF, DEF pressure above upper physical threshold
4334	0	Urea pump pressure sensor; high signal not plausible
4334	1	Urea supply module pressure sensor; physical range check low (defect pressure sensor)

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
4334	1	Urea pump pressure sensor; low signal not plausible
4334	2	DEF supply module pressure, plausibility error
4341	3	SCR-heater DEF supply line; short circuit to battery
4341	4	SCR-heater DEF supply line; short circuit to ground
4341	5	SCR heater relay DEF supply line secondary side; open load
4341	5	SCR heater relay DEF supply line primary side; open load
4343	3	SCR heater DEF pressure line; short circuit to battery
4343	4	SCR heater DEF pressure line; short circuit to ground
4343	5	SCR heater relay DEF pressure line secondary side; open load
4343	5	SCR heater relay DEF pressure line primary side; open load
4343	11	SCR Monitoring; Pressure stabilization error, general pressure check error (SCR)
4343	12	Over Temperature error No detail information
4345	3	SCR heater DEF return line; short circuit to battery
4345	4	SCR heater DEF return line; short circuit to ground
4345	5	SCR heater relay DEF return line secondary side; open load
4345	5	SCR heater relay DEF return line primary side; open load
4345	11	Sensor back flow line pressure (SCR); plausibility error
4345	12	Over Temperature error No detail information
4360	0	Exhaust temperature upstream SCR-Cat, temperature above upper physical threshold
4360	1	Sensed exhaust temperature before SCR-Cat is < physical low limit
4360	2	Exhaust temperature sensor upstream SCR, plausibility error
4361	2	Signal error for CAN message No detail information
4361	3	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check high
4361	4	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check low
4365	0	DEF tank temperature too high
4365	2	Tank temperature signal error for CAN message
4365	3	Sensor error urea tank temperature: short circuit to battery
4365	3	DEF quality sensor, tank temperature; Short circuit to battery or open load

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
4365	4	Sensor error urea tank temperature; short circuit to ground
4365	4	DEF quality sensor, tank temperature; Short circuit to ground
4366	3	SCR Tank heating valve; short circuit to battery
4366	4	SCR Tank heating valve; short circuit to ground
4366	5	SCR main relay (secondary side): open load
4366	5	SCR main relay (secondary side); Shortcut to battery
4366	5	SCR main relay (secondary side), heat relay (secondary side), heating elements or heating valve short to ground
4366	5	SCR Tank heating valve secondary side: open load
4366	5	SCR tank heating valve primary side; open load
4366	12	SCR-heater relay urea tank power stage output; over temperature
4374	13	Pressure stabilization error dosing valve (SCR)
4375	3	Urea pump motor; short circuit to battery
4375	4	Urea pump motor; short circuit to ground
4375	5	Urea pump motor; open load
4376	3	SCR reversal valve; short circuit to battery
4376	4	SCR reversing valve; short circuit to ground
4376	4	eSCR reverting valve; short circuit to ground
4376	5	SCR reversal valve; open load
4376	5	SCR reverting valve; open load
4376	12	SCR reversing valve; over temperature
4376	12	SCR reverting valve; over temperature
4765	0	Temperature upstream DOC, temperature above upper shutoff threshold
4765	0	Temperature upstream DOC, temperature above upper warning threshold
4766	0	Temperature downstream DOC, temperature above upper shutoff threshold
4766	0	Temperature downstream DOC, temperature above upper warning threshold
4768	2	Temperature upstream DOC, plausibility error
4768	2	Exhaust gas temperature sensors up and downstream DOC are physically swapped
4768	3	Electrical error exhaust gas temperature upstream (DOC); signal range check high

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
4768	4	Electrical error exhaust gas temperature upstream (DOC); signal range check low
4769	2	Temperature downstream DOC, plausibility error
4769	2	Sensor exhaust gas temperature OxiCat downstream (normal operation); plausibility error
4769	2	Sensor exhaust gas temperature OxiCat downstream (regeneration); plausibility error
4769	3	Sensor error exhaust gas temperature downstream (DOC); signal range check high
4769	4	Sensor error exhaust gas temperature downstream (DOC); signal range check low
5763	0	Warning threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap
5763	1	Shut off threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap
5763	3	Position sensor error of actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery
5763	4	Position sensor error actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check low.
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground
5763	4	Actuator AGR valve (2.9;3.6) throttle valve (4.1;6.1;7.8); Voltage below threshold
5763	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
5763	5	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); open load
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high
5763	6	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (6.1,7.8); over current
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Overload by short-circuit
5763	7	Actuator position for EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8) not plausible.
5763	11	Power stage over temperature due to high current
520521	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
523008	1	Manipulation control was triggered
523008	2	Timeout error in Manipulation control

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523009	9	The pressure relief valve (PRV) has reached the number of allowed activations
523009	10	Open time of Pressure Relief Valve (PRV) for wear out monitoring had exceeded
523090	2	Engine Brake Pre-Selection switch; Plausibility Error
523211	9	Timeout Error of CAN-Receive-Frame EBC1
523212	9	Timeout Error of CAN-Receive-Frame ComEngPrt; Engine Protection
523213	12	Timeout Error of CAN-Transmit-Frame ERC1 No detail information
523216	9	Timeout Error of CAN-Receive-Frame PrHtEnCmd; pre-heat command, engine command
523240	9	Timeout CAN-message FunModCtl; Function Mode Control
523330	14	Immobilizer status; fuel blocked
523330	14	DFC to block the fuel by Sia No detail information
523330	14	DFC to indicate that TEN-code or UC-code received if ECU is learned No detail information
523330	14	DFC to indicate that no code is received via CAN. No detail information
523330	14	DFC to indicate that wrong code is received. No detail information
523350	4	Injector cylinder-bank 1; short circuit
523352	4	Injector cylinder-bank 2; short circuit
523354	12	Injector power stage output defect
523470	2	Pressure relief valve is forced to open, perform pressure increase
523470	2	Pressure Relief Valve (PRV) forced to open. Performed by pressure increase.
523470	7	Maximum rail pressure exceeded (PRV)
523470	11	Pressure Relief Valve (PRV) error; Rail pressure out of tolerance range
523470	11	Rail pressure out of tolerance range. The PRV can not be opened at this operating point with a pressure shock.
523470	12	Pressure Relief Valve (PRV) forced to open. Shutoff conditions
523470	12	Pressure Relief Valve (PRV) forced to open. Warning conditions
523470	14	Open Pressure Relief Valve (PRV)
523550	12	Terminal 50 was operated too long
523580	2	Data set variant with the desired number not found Invalid variant data set Identifier error No detail information

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523580	11	An error has occurred in the switch over to the desired data set variant in the code word Variant data set switching error No detail information
523580	11	The code word could not be read correctly from the EEPROM Variant dataset switching error; No detail information
523601	13	Failure of sensor supply voltage 3
523602	0	High fan speed; warning threshold exceeded
523602	0	High fan speed; shut off threshold exceeded
523603	9	Timeout Error of CAN-Receive-Frame AMB; Ambient Temperature Sensor
523605	9	Timeout Error of CAN-Receive-Frame TSC1AE; Traction Control
523606	9	Timeout Error of CAN-Receive-Frame TSC1AR; Retarder
523612	3	Reported Over Voltage of Supply
523612	4	Reported UnderVoltage of Supply
523612	12	Internal software error ECU; injection cut off
523612	12	Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	Injection system, electrical error injectors
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	Diagnostic fault check to report the accelerator pedal position error

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523612	12	Diagnostic fault check to report the engine speed error
523612	12	Error in the plausibility of the injection energizing time
523612	12	Error in the plausibility of the start of energizing angles
523612	12	Diagnostic fault check to report the error due to non plausibility in ZFC
523612	12	Diagnosis fault check to report the demand for normal mode due to an error in the PoI2 quantity
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI2 shut-off
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI3 efficiency factor
523612	12	Internal ECU monitoring detection reported error
523612	12	Monitoring of Fuel Quantity Correction
523612	12	Diagnostic fault check to report the plausibility error in rail pressure monitoring
523612	12	Diagnostic fault check to report the error due to torque comparison
523612	12	Diagnosis of curr path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of lead path limitation forced by ECU monitoring level 2
523612	12	Diagnosis of set path limitation forced by ECU monitoring level 2
523612	12	Diagnostic fault check to report WDA active due to errors in query-/response communication
523612	12	Diagnostic fault check to report ABE active due to undervoltage detection
523612	12	Diagnostic fault check to report ABE active due to overvoltage detection
523612	12	Diagnostic fault check to report WDA/ABE active due to unknown reason
523612	12	Internal software error ECU
523612	12	Engine starter, plausibility error of starter release condition
523612	14	Software reset CPU SWReset_0
523612	14	Software reset CPU SWReset_1
523612	14	Software reset CPU SWReset_2
523613	0	Rail pressure metering unit, Positive governor deviation
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure exceeded
523613	0	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure in metering unit exceeded (RailMeUn1).
523613	0	Rail pressure metering unit, Rail pressure below the target range (RailMeUn2) Rail system leakage detected. (RailMeUn10)

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523613	0	Rail pressure metering unit, Maximum rail pressure exceeded.
523613	0	Set point of metering unit in overrun mode not plausible
523613	1	Rail pressure metering unit, Minimum rail pressure exceeded (RailMeUn3) Negative deviation of rail pressure second stage (RailMeUn22)
523613	2	Rail pressure metering unit, Set point of metering unit in overrun mode not plausible.
523615	3	Metering unit (Fuel-System); short circuit to battery high side
523615	3	Metering unit (Fuel-System); short circuit to battery low side
523615	3	Metering unit, short circuit to battery
523615	4	Metering unit (Fuel-System); short circuit to ground high side
523615	4	Metering Unit (Fuel-System); short circuit to ground low side
523615	4	Metering unit, short circuit to ground
523615	5	Metering unit (Fuel-System); open load
523615	12	Metering unit (Fuel-System); power stage over temperature
523618	3	Gearbox oil temperature; Short circuit to battery or broken harness
523618	4	Gearbox oil temperature; Short circuit to ground
523619	2	Physical range check high for exhaust gas temperature up stream (SCR-CAT)
523632	0	Pressure overload of SCR-System
523632	1	Pressure build-up error SCR-System
523632	2	Signal error for CAN message No detail information
523632	3	Sensor error urea pump pressure; signal range check high
523632	4	Sensor error urea pump pressure; signal range check low
523632	11	Pump motor not available for actuation
523632	16	Pump pressure SCR metering unit too high
523632	18	Pump pressure SCR metering unit too low
523633	11	Long term adoption factor below threshold
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality)
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality); temperature range 1
523698	11	Shut off request from supervisory monitoring function
523699	3	Boost pressure control; negative governor deviation below limit

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523699	4	learning value too high No detail information
523704	12	Timeout Error of CAN-Transmit-Frame EEC3
523706	12	Timeout Error of CAN-Transmit-Frame FlEco No detail information
523717	12	Timeout Error of CAN-Transmit-Frame AmbCon; Weather environments
523718	3	SCR main relay (primary side); short circuit to battery
523718	3	SCR main relay; short circuit to battery (only CV56B)
523718	4	SCR main relay (primary side); short circuit to ground
523718	4	SCR main relay; short circuit to ground (only CV56B)
523718	5	tank heating valve; open load
523718	5	SCR main relay; open load (only CV56B)
523718	12	SCR main relay (primary side); power stage over temperature
523719	3	SCR heater DEF supply module; short circuit to battery
523719	4	SCR heater DEF supply module; short circuit to ground
523719	5	SCR heater relay DEF supply module secondary side; open load
523719	5	SCR heater relay DEF supply module primary side; open load
523719	12	Over Temperature error No detail information
523720	2	DEF supply module heater temperature; plausibility error (normal condition)
523720	2	Sensor DEF supply module heater temperature; plausibility error (cold start condition)
523720	8	DEF supply module heater temperature; duty cycle in failure range
523720	8	DEF supply module heater temperature; duty cycle in invalid range
523721	2	Sensor DEF supply module temperature; plausibility error (normal condition)
523721	2	Sensor DEF supply module temperature; plausibility error (cold start condition)
523721	8	DEF supply module temperature; duty cycle in failure range
523721	8	Urea supply module temperature; duty cycle in invalid range
523721	11	Urea supply module temperature measurement not available
523722	8	DEF supply module PWM signal; period outside valid range
523722	8	Detect faulty PWM signal from Supply Module
523741	14	Engine shut off request through CAN No detail information

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523752	0	Plausibility error during Rich to Lean switch over No detail information
523752	0	Monitoring of Nox signal readiness No detail information
523756	14	special pattern for special cases No detail information
523757	14	special pattern for special cases No detail information
523758	14	special pattern for special cases No detail information
523759	14	special pattern for special cases No detail information
523760	14	special pattern for special cases No detail information
523766	9	Timeout Error of CAN-Receive-Frame Active TSC1AE
523767	9	Timeout Error of CAN-Receive-Frame Passive TSC1AE
523768	9	Timeout Error of CAN-Receive-Frame Active TSC1AR
523769	9	Timeout Error of CAN-Receive-Frame Passive TSC1AR
523776	9	Timeout Error of CAN-Receive-Frame TSC1TE - active
523777	9	Passive Timeout Error of CAN-Receive-Frame TSC1TE; Set point
523778	9	Timeout Error of CAN-Receive-Frame TSC1TR
523779	9	Passive Timeout Error of CAN-Receive-Frame TSC1TR
523788	0	Waste gate plausibility error off CAN transmit message
523788	0	Timeout Error of CAN-Receive-Frame ComTrbChActr; Wastegate
523788	12	Timeout Error of CAN-Transmit-Frame TrbCH; Status Waste gate
523793	9	Timeout Error of CAN-Receive-Frame UAA10; AGS sensor service message
523794	9	Timeout Error of CAN-Receive-Frame UAA11; AGS sensor data
523803	9	Timeout error of CAN Receive Message RxEngPres; Status Burner Air Pump
523858	12	Timeout Error of CAN-Transmit-Frame UAA11
523867	12	Ansteuerung Brenner Luftpumpe; Timeout Error of CAN-Transmit-Frame UAA1 on CAN A
523889	3	over teperature of device driver of pressure control valve No detail information
523891	14	When AirHt_ctDefSRCLoOn_mp is less than AirHt_ctMaxDef_C . DFC to SRC Low error when heater is On No detail information
523895	13	Check of missing injector adjustment value programming (IMA) injector 1 (in firing order).
523896	13	check of missing injector adjustment value programming (IMA) injector 2 (in firing order).
523897	13	check of missing injector adjustment value programming (IMA) injector 3 (in firing order).

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523898	13	check of missing injector adjustment value programming (IMA) injector 4 (in firing order).
523899	13	check of missing injector adjustment value programming (IMA) injector 5 (in firing order).
523900	13	check of missing injector adjustment value programming (IMA) injector 6 (in firing order).
523906	3	Electrical fuel pre - supply pump; short circuit to battery
523906	4	Electrical fuel pre - supply pump. Short circuit to ground.
523906	5	Electrical fuel pre - supply pump; open load
523906	12	Electrical fuel pre - supply pump. ECU powerstage over temperature.
523910	0	Air Pump; operating voltage error
523910	6	Burner Control Air Pump; over current Air pump electrically overloaded
523910	7	Air pump; CAN communication interrupted no purge function available
523910	9	Burner Control; Air Pump - CAN Lost Air Pump; CAN communication lost
523910	12	Air Pump; internal error
523910	14	Air pump doesn't achieve air mass flow setpoint Burner Control - burner air pump
523911	0	Burner dosing valve (DV2); over current at the end of the injection phase
523911	3	Burner dosing valve (DV2); short circuit to battery
523911	4	Burner dosing valve (DV2); short circuit to ground
523911	11	Burner dosing valve (DV2); short circuit high side power stage
523911	12	Burner dosing valve (DV2); power stage over temperature
523912	0	Physical range check high for burner dosing valve (DV2) downstream pressure; shut off regeneration
523912	1	Physical range check low for burner dosing valve (DV2) downstream pressure; shut off regeneration. When burner injector is actuated, the measured pressure does not rise above ca. 1250mbar abs (expected: ca. 2400mbar).
523912	2	Burner dosing valve (DV2) downstream pressure sensor; plausibility error
523912	3	Sensor error burner dosing valve (DV2) downstream pressure sensor; signal range check high
523912	4	@ engines < 4l: Throttle valve error, Open Load or Short cut to Battery, blocked valve or wrong control signal for valve. @ engines with Burner T4i: Pressure Sensor error after valve (DV2), lower limit reached
523913	3	Sensor error glow plug control diagnostic line voltage; signal range check high
523913	4	Sensor error glow plug control diagnostic line voltage; signal range check low
523914	3	Glow plug control; short circuit to battery water pump control (PWM)

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523914	4	Glow plug control; short circuit to ground water pump control (PWM)
523914	5	Glow plug control; open load water pump control (PWM)
523914	12	Glow plug control; power stage over temperature
523915	0	HCI dosing valve (DV1); over current at the end of the injection phase
523915	3	HCI dosing valve (DV1); short circuit to battery
523915	3	HCI dosing valve (DV1); short circuit to battery high side
523915	4	HCI dosing valve (DV1); short circuit to ground
523915	7	HCI dosing valve (DV1); blocked open
523915	11	HCI dosing valve (DV1); short circuit high side power stage
523915	12	HCI dosing valve (DV1); power stage over temperature
523916	0	Physical range check high for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	1	Physical range check low for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	2	Sensor HCI dosing valve (DV1) downstream pressure; plausibility error
523916	3	Sensor error HCI dosing valve (DV1) downstream pressure; signal range check high
523916	4	Sensor error HCI dosing valve (DV1) downstream pressure; signal range check low
523917	3	Sensor error DV1 & DV2 upstream pressure; signal range check high
523917	4	Sensor error DV1 & DV2 upstream pressure; signal range check low
523918	3	Sensor error DV1 & DV2 upstream temperature; signal range check high
523918	4	Sensor error DV1 & DV2 upstream temperature; signal range check low
523919	0	DPF burner air pump pressure sensor, pressure above upper shutoff threshold
523919	1	DPF burner air pump pressure sensor, pressure below lower shutoff threshold
523919	2	DPF burner air pump pressure sensor, plausibility error
523919	2	Sensor air pump air pressure; plausibility error
523919	3	DPF burner air pump pressure sensor, short circuit to battery or open load
523919	4	DPF burner air pump pressure sensor, short circuit to ground
523920	0	Exhaust gas pressure upstream burner, pressure above upper shutoff threshold
523920	2	Exhaust gas pressure upstream burner, plausibility error
523920	2	Sensor exhaust gas back pressure burner; plausibility error

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523920	3	Exhaust gas pressure upstream burner, short circuit to battery or open load
523920	4	Exhaust gas pressure upstream burner, short circuit to ground
523921	0	Burner temperature, temperature above upper shutoff threshold
523921	1	Burner temperature, temperature below lower shutoff threshold
523921	2	Burner temperature sensor; Plausibility Check for burner temperature sensor Sensor burner temperature; plausibility error
523921	3	Sensor error burner temperature; signal range check high
523921	4	Sensor error burner temperature; signal range check low
523922	3	Burner shut of valve; short circuit to battery
523922	4	Burner Shut Off Valve; short circuit to ground
523922	5	Burner Shut Off Valve; open load
523922	7	Burner Control; Shut-off Valve - Blocked closed Burner Shut Off Valve; blocked closed
523922	7	Burner Shut Off Valve; blocked open
523922	12	Burner Shut Off Valve; power stage over temperature
523923	3	UB1; Short circuit to battery error of actuator relay 1
523923	4	Short circuit to ground error No detail information
523924	3	UB2; Short circuit to battery error of actuator relay 2
523924	4	UB2; Short circuit to ground actuator relay 2
523925	3	UB3: Short circuit to battery error of actuator relay 3
523925	4	UB3; Short circuit to ground actuator relay 3
523926	4	UB4; Short circuit to ground actuator relay 4
523927	3	UB5; Short circuit to battery error of actuator relay 5
523935	12	Timeout Error of CAN-Transmit-Frame EEC3VOL1; Engine send messages
523936	12	Timeout Error of CAN-Transmit-Frame EEC3VOL2; Engine send messages
523937	9	Timeout DFC for NOxSensGlbReqTx. No detail information
523938	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1IGCVol1.
523939	9	Broadcast Announce Message of the calibration message of the upstream catalytic NOx sensor has failed.
523940	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1IGCVol1
523941	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1OGCVol2

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523942	9	Calibration message 1 of the after catalyst NOx sensor has failed
523943	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2
523946	0	Zerofuel calibration injector 1 (in firing order); maximum value exceeded
523946	1	Zerofuel calibration injector 1 (in firing order); minimum value exceeded
523947	0	Zerofuel calibration injector 2 (in firing order); maximum value exceeded
523947	1	Zerofuel calibration injector 2 (in firing order); minimum value exceeded
523948	0	Zerofuel calibration injector 3 (in firing order); maximum value exceeded
523948	1	Zerofuel calibration injector 3 (in firing order); minimum value exceeded
523949	0	Zerofuel calibration injector 4 (in firing order); maximum value exceeded
523949	1	Zerofuel calibration injector 4 (in firing order); minimum value exceeded
523950	0	Zerofuel calibration injector 5 (in firing order); maximum value exceeded
523950	1	Zerofuel calibration injector 5 (in firing order); minimum value exceeded
523951	0	Zerofuel calibration injector 6 (in firing order); maximum value exceeded
523953	2	Healing takes place if the condition for error detection is not present. Air temprature monitoring plausibility check array No detail information
523955	2	Healing takes place if the condition for error detection is not present. Air temprature monitoring plausibility check array No detail information
523960	0	Physical range check high for EGR cooler downstream temperature.
523960	0	High exhaust gas temperature EGR cooler downstream; warning threshold exceeded.
523960	1	Physical range check low for EGR cooler downstream temperature.
523969	11	Fault entry for override control mode. No detail information
523973	14	SCR Tamper detection; derating timer below limit 1
523974	14	SCR Tamper detection; derating timer below limit 2
523975	14	Urea quality; derating timer below limit 1
523976	14	Urea qulaity; derating timer below limit 2
523977	14	Urea tank level; derating timer below limit 1
523978	14	Urea tank level; derating timer below limit 2
523981	11	SCR plausibility, OBD and diagnosis; Stuck in range check of DEF tank temperature sensor DEF-tank without heating function (heating phase)
523982	0	Power stage diagnosis disabled; high battery voltage

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
523982	1	Power stage diagnosis disabled; low battery voltage
523984	3	UB7; Short circuit to battery error of actuator relay 7
523986	4	UB6; Short circuit to ground actuator relais 6
523987	4	UB7; Short circuit to ground actuator relay 7
523992	9	
523993	9	
523995	13	Check of missing injector adjustment value programming (IMA) injector 7 (in firing order)
523996	13	check of missing injector adjustment value programming (IMA) injector 8 (in firing order)
523997	4	Injector cylinder bank 1 slave; short circuit
523998	4	Injector cylinder bank 2 slave; short circuit
523999	12	Injector power stage output Slave defect
524000	3	Injector 7 (in firing order); short circuit
524000	5	Injector 7 (in firing order); interruption of electric connection
524001	3	Injector 8 (in firing order); short circuit
524001	5	Injector 8 (in firing order); interruption of electric connection
524013	7	Burner Control; burner Flame; Burner does not start after x trials (burner flame lost detection) Burner flame unintentional deleted
524013	7	Burner Control; Flame lost max Burner operation is interrupted too often
524014	1	Air inlet EPV - pressure too low Air pressure glow plug flush line; below limit
524016	2	Burner Control; HFM - Plausibility error1 Amount of air is not plausible to pump speed
524016	11	Burner Control; HFM - Electrical Fault HFM sensor; electrical fault
524018	14	HMI engine derate service state DPF wasn't regenerated, power reduction phase 1 (manual regeneration request)
524019	11	Burner Control; Air Line - Blocked Air Pump; air lines blocked
524020	14	Burner Control: power reduction due to low lambda. Engine power; Not enough oxygen for regeneration.
524021	11	Burner Control; Fuel line ShutOff downstream - broken Burner fuel line pipe leak behind Shut Off Valve
524022	14	HMI engine derate stop state DPF wasn't regenerated, power reduction phase 2 (manual regeneration request)

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524024	11	Deviation of the exhaust gas temperature set point to actual value downstream (DOC) too high
524025	5	DPF system; operating voltage error
524025	8	Max. launch time for stand still exceeded (60min).
524025	14	Particulate filter regeneration. Regeneration after time X is not successful (The error occurs when the regeneration times (3x) over the max. has been aborted allowed recovery time)
524025	14	The standstill-regeneration mode time exceeds the long-limit. Vehicle was too long or too often in standstill mode. Make oil change and reset counter.
524025	14	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Make oil change and reset counter.
524028	2	CAN message PROEGRActr; plausibility error
524029	2	Timeout Error of CAN-Receive-Frame ComEGRActr - exhaust gas recirculation positioner
524030	7	EGR actuator; internal error
524031	13	EGR actuator, calibration error
524032	2	EGR actuator; status message "EGRCust" is missing
524033	7	EGR actuator; due to overload in Save Mode
524034	3	Disc separator; short circuit to battery
524034	4	Disc separator; short circuit to ground
524034	5	Disc Separator; open load
524034	12	Disc Separator; power stage over temperature
524035	12	Injector diagnostics; time out error in the SPI communication
524036	12	Injector diagnostics Slave; time out error in the SPI communication
524038	9	Timeout error of CAN-Receive-Frame ComMS_Sys1TO (error memory Slave); Master-Slave internal CAN message
524039	9	Timeout error of CAN-Receive-Frame ComMS_Sys2TO (error memory Slave); Master-Slave internal CAN message
524040	9	Timeout error of CAN-Receive-Frame ComMS_Sys3TO (error memory Slave); Master-Slave internal CAN message
524041	9	Timeout error of CAN-Receive-Frame ComMS_Sys4TO (error memory Slave); Master-Slave internal CAN message
524042	9	Timeout error of CAN-Receive-Frame ComMS_Sys5TO (error memory Slave); Master-Slave internal CAN message
524043	9	Timeout error of CAN-Receive-Frame ComMS_Sys6TO (error memory Slave); Master-Slave internal CAN message
524044	9	CAN message ComMS_Sys7 not received from slave

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524045	9	Master Slave, Error of message counter CAN receive message ComMSMoFOvR; ComMSMoFOvR1CNT
524046	9	Master-Slave CAN; Error Checksum of CAN-Receive Message
524047	9	Master-Slave CAN; Error of message length of CAN receive message ComMSMoFOvR;_ComMSMoFOvR1DLC
524048	9	Timeout error CAN message ComMSMoFOvR1TO error memory Slave
524052	11	Error memory Slave reports FID MSMonFC2 (collective error)
524052	11	Error memory Slave reports FID MSMonFC3 (collective error)
524052	11	Master ECU and Slave ECU data sets or software are not identical
524057	2	Fuel low pressure pump; error pressure build up
524058	2	Particulate filter; regeneration not successful
524063	3	SCR heater main relay; short circuit to battery
524063	4	SCR heater main relay load side (K31) on heating valve (Y31), Short cut to ground.
524063	5	Relay Urea back flow line heater: broken wiring detected (open load) Row engine: SCR-back flow line (K29) V-engine: Master: SCR-suction / back flow line (K32.1) Slave: SCR-suction / back flow line (K32.2)
524063	5	SCR main relay not connected
524063	5	SCR heater pressure line; open load
524063	5	Relay Urea suction line: broken wiring detected (open load) Row engine: SCR suction line (K28) V-engine: Master: common SCR-suction line (K28) Slave: common SCR back flow line (K29)
524063	5	SCR heater supply module; open load
524063	5	SCR heater tank; open load
524063	12	DEF supply module, time for defrosting too long
524063	12	DEF tank, time for defrosting too long
524065	0	Pressure sensor upstream SCR-CAT, pressure above upper physical threshold
524065	1	Pressure sensor upstream SCR-CAT, pressure below lower physical threshold
524065	2	Pressure sensor upstream SCR-CAT, plausibility error
524065	3	Pressure sensor upstream SCR-CAT; short circuit battery or open load
524065	4	Pressure sensor upstream SCR-CAT; short circuit ground
524066	3	SCR measurement heater output stage; short circuit battery or open load

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524067	0	DEF supply module, heater temperature above upper physical threshold
524067	0	DEF supply module, temperature above upper physical threshold
524067	1	DEF supply module, heater temperature below lower physical threshold
524067	1	DEF supply module, temperature below lower physical threshold
524067	2	Supply module heater temperature, plausibility error
524067	2	Supply module temperature, plausibility error
524068	2	Master ECU and Slave ECU have been identified as the same types
524069	9	Timeout Error of CAN-Receive-Frame MSMon_FidFCCTO; Master-Slave CAN communication faulty
524070	2	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream NOx value (Sensor self diagnostic DFC set by Deutz-SW) NOx-Sensor before SCR-Cat: Invalid upstream NOx value
524071	2	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream lambda value (Sensor self diagnostic DFC set by Deutz-SW)
524072	2	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream lambda value (Sensor self diagnostic DFC set by Deutz-SW)
524073	2	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream NOx value (Sensor self diagnostic DFC set by Deutz-SW)
524074	2	NOx-Sensor after SCR-Cat: Nox-Sensor dew point problem or plausibility problem
524074	9	NOx sensor downstream SCR-CAT, sensor internally open load
524075	11	NOx sensor downstream SCR-CAT, sensor internally short circuit
524076	2	NOx-Sensor before SCR-Cat: Nox-Sensor dew point problem or plausibility problem
524076	9	NOx sensor upstream SCR-CAT, sensor internally open line
524077	11	NOx sensor upstream SCR-CAT, sensor internally short circuit
524078	9	NOx sensor downstream SCR-CAT, lambda value above upper physical threshold
524079	9	NOx sensor downstream SCR-CAT, lambda value below lower physical threshold
524080	9	NOx sensor upstream SCR-CAT, lambda value above upper physical threshold
524081	9	NOx sensor upstream SCR-CAT, lambda value below lower physical threshold
524082	9	(Downstream NOx-Sensor) Diagnostic Fault Check for downstream NOx value over maximum limit (DFC set by Deutz-SW)
524083	9	NOx-Sensor downstream SCR-CAT, NOx value below minimum value.

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524084	9	NOx-Sensor upstream SCR-CAT, NOx value above maximum value.
524085	9	NOx sensor upstream SCR-CAT, NOx value below lower physical threshold
524087	3	Urea Error Lamp; short circuit battery
524087	4	Urea Error Lamp; short circuit ground
524087	5	Urea Error Lamp; open load
524087	12	Urea Error Lamp; temperature over limit
524096	14	Control of the SCR system; If the start stop counter (EPA-Counter) exceeds the threshold SCRCtl_ctEngStrtStopThresh_C. This counter will increment only once in each driving cycle in case of an SCR error. If the counter reaches the threshold, the DFC will be set to inhibit the engine start. Engine will not be started, because of EPA-Counter
524097	9	Timeout error of CAN-Transmit-Frame DPFBrnAirPmpCtl
524098	9	Timeout error of CAN-Transmit-Frame ComDPFBrnPT
524099	9	Timeout error of CAN-Transmit-Frame ComDPFC1
524100	9	Timeout error of CAN-Transmit-Frame ComDPFHisDat
524101	9	Timeout error of CAN-Transmit-Frame ComDPFTstMon
524102	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmpCtl
524103	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmp
524104	9	Timeout error of CAN-Receive-Frame ComRxDPFCtl
524105	9	Timeout error of CAN-Transmit-Frame ComEGRMsFlw (EGR Steller)
524106	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw1 (EGR actuator)
524107	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw2 (EGR actuator)
524108	9	Timeout error of CAN-Transmit-Frame ComEGRTVActr (EGR actuator)
524109	9	Timeout error of CAN-Receive-Frame ComRxEGRTVActr (EGR actuator)
524110	9	Timeout error of CAN-Transmit-Frame ComETVActrTO
524111	9	Timeout error of CAN-Receive-Frame ComRxETVActr
524112	9	Timeout ComIntake Throttle Valve Actr
524113	9	Timeout error of CAN-Receive-Frame ComRxITVActr
524114	9	Timeout error of CAN-Transmit-Frame A1DOC
524115	9	Timeout error of CAN-Transmit-Frame AT1S
524116	9	Timeout error of CAN-Transmit-Frame SCR2

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524117	9	Timeout error of CAN-Transmit-Frame SCR3
524118	9	Timeout error of CAN-Receive-Frame ComRxCM1
524119	9	Timeout error of CAN-Receive-Frame ComRxCustSCR3
524120	9	Timeout error of CAN-Receive-Frame ComRxSCRHtDiag
524121	9	Timeout error of CAN-Receive-Frame ComRxTrbChActr (wastegate actuator)
524122	9	Timeout error of CAN-Receive-Frame ComRxUQSens (Urea quality)
524123	9	Timeout error of CAN-Receive-Frame ComSCRHtCtl
524124	9	Timeout error of CAN-Receive-Frame ComTxAT1IMG
524125	9	Timeout error of CAN-Receive-Frame ComTxTrbChActr (Wastegate actuator)
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum warning threshold
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum warning threshold
524132	2	Fuel low pressure upstream fuel low pressure pump not plausible
524133	2	HMI system; set if restore button blocked
524134	0	DPF, ash load exceeds the shutoff threshold
524134	0	DPF, ash load exceeds the warning threshold
524135	0	DPF, soot load exceeds the shutoff threshold
524135	0	DPF, soot load exceeds the warning threshold
524135	14	DPF, soot load exceeds the service request threshold
524141	7	DEF dosing valve, dosing valve blocked
524147	7	SCR-System, reverting valve blocked
524147	13	SCR System, pressure build up not possible
524147	13	Set together with DFC_SCRCoBldUpLoPres. DFC_SCRCoBldUpLoPresRst is only used for inducement purposes. It ensures that legal inducement is working correctly.
524149	2	Plausibility error between pressure downstream turbine (PTrbnDs) and ambient air pressure (EnvP)
524149	2	Pressure downstream turbine, plausibility error
524152	2	Urea Quality Sensor; Timeout CAN message

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524153	2	Urea tank level & urea tank temperature via CAN bus, timeout of CAN message
524156	9	Timeout error of CAN-Receive-Frame ComRxEBC2
524157	9	Fan control; time out for fan governing
524159	0	Fan; short circuit battery or open load
524159	1	Fan; short circuit ground
524160	3	Fan; in/outlet valve 1; short circuit battery
524160	4	Fan; in/outlet valve 1; open load ground
524160	5	Fan; in/outlet valve 1; open load
524161	3	Fan; in/outlet valve 2; short circuit battery
524161	4	Fan; in/outlet valve 2; open load ground
524161	5	Fan; in/outlet valve 2; open load
524162	12	Fan; fan control; angle sensor defect
524163	12	Fan; fan control; fan or valve defect
524175	0	SCR-CAT, Nox emissions above maximum threshold
524177	7	SCR System, DEF suction line blocked
524178	7	SCR System, DEF pressure out of range
524189	9	Master / Slave Can disturbed
524190	14	Inducement level 1 active
524191	14	Inducement level 2 active
524193	8	The standstill-regeneration mode time exceeds the long limit threshold. Vehicle was too long or too often in standstill mode. Change oil and reset counter.
524194	8	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Change oil and reset counter.
524195	14	Standstill request due to crystallization ignored too long
524196	2	Variant handling, Synchronisation error
524196	13	Variant handling, address error
524202	11	SCR error code in master ECU active
524203	11	DEF tank level failure is in master ECU active
524204	11	SCR after run failure is in master ECU active

Table 3-5. Engine Fault Code Chart

SPN	FMI	Error Identification
524205	11	SCR Co2Off failure is in master ECU active
524206	11	SCR disable DEF dosing failure is in master ECU active
524230	11	Inducement HW Failure Slave
524231	11	Inducement SCR Tamp. Slave
524232	11	Inducement DEF Quality in Slave ECU
524239	11	SCR regeneration failure is in slave ECU active
524248	11	NOX sensor downstream error in slave ECU
524249	11	DEF dosing valve error in slave ECU
524251	11	DEF pressure problems in slave ECU
524252	11	Reverting valve error in slave ECU
524253	11	DEF back flow line heater error on slave ECU
524254	11	Error NOx-Tailpipe emissions exceeded on Slave ECU
524255	11	DEF suction line heater error on slave ECU
524256	11	DEF supply module heater error on slave ECU
524257	11	Error Exhaust pressure upstream SCR on Slave ECU
524258	11	Error Exhaust temperature upstream SCR on Slave ECU
524259	11	DEF pressure line heater error on slave ECU
524260	11	Error Urea pump temperature on Slave ECU
524261	11	Error DEF heater relays on Slave ECU
524267	14	Announcement triggers the Inducement Level 2

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1	110	11	226	Air flow sensor load correction factor exceeding the maximum drift limit; plausibility error.
8	132	1	226	The air mass flow AFS_dm is greater than or equal to AFS_PhysRng.Min_C. Physical Range Check low for air mass flow sensor No detail informationen!
9	172	2	226	Air inlet filter temperature, plausibility error.
26	523891	14	263	When AirHt_ctDefSRCLoOn_mp is less than AirHt_ctMaxDef_C. DFC to SRC Low error when heater is On No detail informationen!
28	523953	2	728	Healing takes place if the condition for error detection is not present. Air temprature monitoring plausibility check array No detail informationen!
30	523955	2	728	Healing takes place if the condition for error detection is not present. Air temprature monitoring plausibility check array No detail informationen!
36	523923	3	729	UB1; Short circuit to battery error of actuator relay 1.
37	523924	3	167	UB2; Short circuit to battery error of actuator relay 2.
38	523925	3	731	UB3: Short circuit to battery error of actuator relay 3.
40	523927	3	733	UB5; Short circuit to battery error of actuator relay 5, SCR-Heater/Rev.Valve.
41	523923	4	729	Short circuit to ground error No detail informationen!
42	523924	4	167	UB2; Short circuit to ground actuator relais 2.
43	523925	4	731	UB3; Short circuit to ground actuator relais 3.
44	523926	4	732	UB4; Short circuit to ground aktuator relais 4.
45	168	3	318	Sensor error battery voltage; signal range check high.
46	168	4	318	Sensor error battery voltage; signal range check low.
47	168	2	318	High battery voltage; warning threshold exceeded.
48	168	2	318	High battery voltage; shot off threshold exceeded.
55	523910	14	695	Air pump doesn´t achieve air mass flow setpoint . Burner Control - burner air pump.
56	524013	7	856	Burner Control; burner Flame;Burner does not start after x trials (burner flame lost detection). Burner flame unintentional deleted.
57	524020	14	863	Burner Control: power reduction due to low lambda. Engine power; Not enough oxygen for regeneration.
58	523911	0	723	Burner dosing valve (DV2); overcurrent at the end of the injection phase.
59	523911	12	723	Burner dosing valve (DV2); powerstage over temperature.
60	523911	3	723	Burner dosing valve (DV2); short circuit to battery.
62	523911	4	723	Burner dosing valve (DV2); short circuit to ground.
63	523911	11	723	Burner dosing valve (DV2); short circuit high side powerstage.
64	523912	2	722	Burner dosing valve (DV2) downstream pressure sensor; plausibility error.
66	523912	0	722	Physical range check high for burner dosing valve (DV2) downstream pressure; shut off regeneration.
69	523912	1	722	Physical range check low for burner dosing valve (DV2) downstream pressure; shut off regeneration. When burner injector is actuated, the measured pressure does not rise above ca. 1250mbar abs (expected: ca. 2400mbar).

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
72	523912	3	722	Sensor error burner dosing valve (DV2) downstream pressure sensor; signal range check high.
73	523912	4	722	@ engines < 4l:Throttle valve error, Open Load or Short cut to Battery, blocked valve or wrong control signal for valve. @ engines with Burner T4i: Pressure Sensor error after valve (DV2), lower limit reached.
74	523913	3	721	Sensor error glow plug control diagnostic line voltage; signal range check high.
75	523913	4	721	Sensor error glow plug control diagnostic line voltage; signal range check low.
76	523914	5	721	Glow plug control; open load water pump control (PWM).
77	523914	12	721	Glow plug control; powerstage over temperature.
78	523914	3	721	Glow plug control; short circuit to battery water pump control (PWM).
79	523914	4	721	Glow plug control; short circuit to ground.
82	1235	14	271	CAN-Bus 2 = CAN_C reports Bus-error (for engines <8L and CV52 it is the engine-CAN@250kbaud) CAN Bus error passive; warning CAN C - engine CAN.
83	16	0	271	No detail informationen!
84	639	14	271	CAN-Bus 0 "BusOff-Status"
85	1231	14	271	CAN-Bus 1 "BusOff-Status"
86	1235	14	271	CAN-Bus 2 = engine bus "BusOff-Status"
87	16	0	271	BusOff error CAN No detail informationen!
88	102	2	223	Charged air pressure above warning threshold.
89	102	2	223	Charged air pressure above shut off threshold.
90	110	2	225	defect fault check for Absolute plausibility test No detail informationen!
92	110	0	225	Physical Range Check high for Coolant temperature.
93	110	1	225	Physical Range Check low for Coolant temperature.
96	110	3	225	Sensor error coolant temperature; signal range check high.
97	110	4	225	Sensor error coolant temperature; signal range check low.
98	110	0	232	High coolant temperature; warning threshold exceeded.
99	110	0	232	Coolant temperature; system reaction initiated.
101	111	1	235	Coolant level too low.
106	598	2	325	Plausibility check for Clutch No detail informationen!
121	1109	2	341	Engine shut off demand ignored.
122	523698	11	591	Shut off request from supervisory monitoring function.
124	523969	11	774	Fault entry for override control mode. No detail informationen!
125	523717	12	595	Timeout Error of CAN-Transmit-Frame AmbCon; Weather environments.
126	523603	9	338	Timeout Error of CAN-Receive-Frame AMB; Ambient Temperature Sensor.
127	3224	2	596	DLC Error of CAN-Receive-Frame AT1IG1 NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect.
128	3224	9	597	Timeout Error of CAN-Receive-Frame AT1IG1; NOX sensor upstream.
129	3224	2	596	DLC Error of CAN-Receive-Frame AT1IG1Vol NOX sensor.
130	3224	9	597	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor.
133	523938	9	766	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1IGCVol1.
134	523939	9	766	Broadcast Announce Message of the calibration message of the upstream catalytic NOx sensor has failed.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
135	523940	9	766	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1IGCVol1
136	3234	2	114	DLC Error of CAN-Receive-Frame AT1O1 No detail informationen!
137	3234	9	117	Timeout Error of CAN-Receive-Frame AT1OG1; NOX sensor (SCR-system down-stream cat; DPF-system downstream cat).
138	3234	2	114	DLC Error of CAN-Receive-Frame AT1O1Vol NOX.
139	3234	9	117	Timeout Error of CAN-Receive-Frame AT1OG1Vol.
140	523941	9	767	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1OGCVol2.
141	523942	9	767	Calibration message 1 of the after catalyst NOx sensor has failed.
142	523943	9	767	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2.
153	523992	9	793	
155	0	0	-	
164	523211	9	331	Timeout Error of CAN-Receive-Frame EBC1.
167	523704	12	615	Timeout Error of CAN-Transmit-Frame EEC3.
168	523935	12	763	Timeout Error of CAN-Transmit-Frame EEC3VOL1; Engine send messages.
169	523936	12	764	Timeout Error of CAN-Transmit-Frame EEC3VOL2; Engine send messages.
171	523212	9	333	Timeout Error of CAN-Receive-Frame ComEngPrt; Engine Protection.
172	523741	14	618	Engine shut off request through CAN No detail informationen!
174	523213	12	334	Timeout Error of CAN-Transmit-Frame ERC1 No detail informationen!
178	523706	12	623	Timeout Error of CAN-Transmit-Frame FlEco No detail informationen!
179	523240	9	527	Timeout CAN-message FunModCtl; Function Mode Control.
193	523937	9	765	Timeout DFC for NOxSensGlbReqTx. No detail informationen!
196	3227	2	638	DFC SAE J1939 error No detail informationen!
198	523216	9	337	Timeout Error of CAN-Receive-Frame PrHtEnCmd; pre-heat command, engine command.
202	523793	9	678	Timeout Error of CAN-Receive-Frame UAA10; AGS sensor service message.
203	523794	9	678	Timeout Error of CAN-Receive-Frame UAA11; AGS sensor data.
212	523803	9	678	Timeout error of CAN Receive Message RxEngPres; Status Burner Air Pump.
273	3219	2	649	DFC SAE J1939 error No detail informationen!
281	523766	9	118	Timeout Error of CAN-Receive-Frame Active TSC1AE.
282	523767	9	118	Timeout Error of CAN-Receive-Frame Passive TSC1AE.
283	523768	9	119	Timeout Error of CAN-Receive-Frame Active TSC1AR.
284	523769	9	119	Timeout Error of CAN-Receive-Frame Passive TSC1AR.
291	523776	9	119	Timeout Error of CAN-Receive-Frame TSC1TE - active.
292	523777	9	119	Passive Timeout Error of CAN-Receive-Frame TSC1TE; Setpoint.
293	523778	9	118	Timeout Error of CAN-Receive-Frame TSC1TR.
294	523779	9	118	Passive Timeout Error of CAN-Receive-Frame TSC1TR.
299	523788	12	655	Timeout Error of CAN-Transmit-Frame TrbCH; Status Wastegate.
300	523605	9	118	Timeout Error of CAN-Receive-Frame TSC1AE; Traction Control.
301	523606	9	119	Timeout Error of CAN-Receive-Frame TSC1AR; Retarder.
305	898	9	118	Timeout Error of CAN-Receive-Frame TSC1TE; Setpoint.
306	520	9	119	Timeout Error of CAN-Receive-Frame TSC1TR; control signal.
313	523858	12	679	Timeout Error of CAN-Transmit-Frame UAA11.
322	523867	12	679	Ansteuerung Brenner Luftpumpe;_Timeout Error of CAN-Transmit-Frame UAA1 on CAN A.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
360	523982	0	737	Powerstage diagnosis disabled; high battery voltage.
361	523982	1	737	Powerstage diagnosis disabled; low battery voltage.
362	523090	2	329	Engine Brake Pre-Selection switch; Plausibility Error.
376	630	12	281	Access error EEPROM memory (delete).
377	630	12	281	Access error EEPROM memory (read).
378	630	12	281	Access error EEPROM memory (write).
381	411	4	693	Physical range check low for EGR differential pressure.
384	2791	12	415	Actuator EGR Valve; powerstage over temperature.
387	523612	12	555	Internal software error ECU; injection cut off.
388	190	0	214	Engine speed above warning threshold. Overspeed detection in component engine protection.
389	190	0	214	Engine speed above warning threshold (FOC-Level 1).
390	190	11	214	Engine speed above warning threshold (FOC-Level 2).
391	190	14	214	Engine speed above warning threshold (Overrun Mode).
411	108	11	292	DFC for CAN message.
412	108	3	292	Sensor error ambient air pressure; signal range check high.
413	108	4	292	Sensor error ambient air pressure; signal range check low.
415	171	0	312	Environment temperature sensor, temperature above upper physical threshold.
416	171	1	312	Environment Temperature Physical Range Check low.
417	171	3	312	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check high.
418	171	4	312	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check low.
419	190	8	212	Sensor camshaft speed; disturbed signal.
420	190	12	212	Sensor camshaft detection; out of range, signal disrupted; no signal.
421	190	2	213	Offset angle between crank- and camshaft sensor is too large.
422	190	8	212	Sensor crankshaft detection; out of range, signal disrupted; disturbed signal.
423	190	12	212	Speed detection; out of range, signal disrupted Sensor crankshaft speed; no signal.
455	975	5	238	PWM-Signal Fan, Open load or short-circuit ground.
457	975	3	238	PWM-Signal Fan, short-circuit to plus.
458	975	4	238	PWM-Signal Fan, open load or short circuit to ground.
459	1639	12	238	Fan speed sensor; electrical error or signal disturbed or very low fan speed.
460	1639	0	238	Sensor error fan speed; signal range check high or engine speed resp. fan speed too big.
461	1639	1	238	Sensor error fan speed; signal range check low or fan speed too low.
462	523602	0	238	High fan speed; warning threshold exceeded.
463	523602	0	238	High fan speed; shut off threshold exceeded.
464	97	3	228	Sensor error water in fuel; signal range check high.
465	97	4	228	Sensor error water in fuel; signal range check low.
472	94	3	216	Sensor error low fuel pressure; signal range check high.
473	94	4	216	Sensor error low fuel pressure; signal range check low.
474	94	1	216	Low fuel pressure; warning threshold exceeded.
475	94	1	216	Low fuel pressure; shut off threshold exceeded.
483	174	11	227	DFC for fuel temperature plausibility check function No detail informationen!

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
486	523618	3	133	Gearbox oil temperature; Short circuit to battery or broken harness.
487	523618	4	133	Gearbox oil temperature; Short circuit to ground.
488	523619	2	133	Physical range check high for exhaust gas temperature upstrem (SCR-CAT).
500	523915	0	165	HCl dosing valve (DV1); overcurrent at the end of the injection phase.
501	523915	12	166	HCl dosing valve (DV1); powerstage overtemperature.
502	523915	3	159	HCl dosing valve (DV1); short circuit to battery.
503	523915	3	164	HCl dosing valve (DV1); short circuit to battery high side.
504	523915	4	159	HCl dosing valve (DV1); short circuit to ground.
505	523915	11	164	HCl dosing valve (DV1); short circuit high side powerstage.
506	523916	2	719	Sensor HCl dosing valve (DV1) downstream pressure; plausibility error.
508	523916	0	719	Physical range check high for HCl dosing valve (DV1) downstream pressure; shut off regeneration.
511	523916	1	719	Physical range check low for HCl dosing valve (DV1) downstream pressure; shut off regeneration.
514	523916	3	719	Sensor error HCl dosing valve (DV1) downstream pressure; signal range check high.
515	523916	4	719	Sensor error HCl dosing valve (DV1) downstream pressure; signal range check low.
524	523917	3	718	Sensor error DV1 & DV2 upstream pressure; signal range check high.
525	523917	4	718	Sensor error DV1 & DV2 upstream pressure; signal range check low.
534	523918	3	717	Sensor error DV1 & DV2 upstream temperature; signal range check high.
535	523918	4	717	Sensor error DV1 & DV2 upstream temperature; signal range check low.
542	1638	2	314	Hydraulic oil temperature check for Shut off condition No detail informationen!
543	676	11	263	Cold start device relay error.
544	676	11	263	Cold start aid relay open load.
545	729	5	263	Cold start aid relay open load.
547	729	12	263	Cold start aid relay; over temperature error.
549	729	3	263	Intake Air Heater Device; Short circuit to battery.
551	729	4	263	Air intake heater; Short circuit to ground error for powerstage on CJ945.
559	523895	13	158	Check of missing injector adjustment value programming (IMA) injector 1 (in firing order).
560	523896	13	158	check of missing injector adjustment value programming (IMA) injector 2 (in firing order).
561	523897	13	158	check of missing injector adjustment value programming (IMA) injector 3 (in firing order).
562	523898	13	158	check of missing injector adjustment value programming (IMA) injector 4 (in firing order).
563	523899	13	158	check of missing injector adjustment value programming (IMA) injector 5 (in firing order).
564	523900	13	158	check of missing injector adjustment value programming (IMA) injector 6 (in firing order).
565	523350	4	151	Injector cylinder-bank 1; short circuit.
566	523352	4	152	Injector cylinder-bank 2; short circuit.
567	523354	12	153	Injector powerstage output defect.
568	651	5	154	Injector 1 (in firing order); interruption of electric connection.
569	652	5	155	Injector 2 (in firing order); interruption of electric connection.
570	653	5	156	Injector 3 (in firing order); interruption of electric connection.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
571	654	5	161	Injector 4 (in firing order); interruption of electric connection.
572	655	5	162	Injector 5 (in firing order); interruption of electric connection.
573	656	5	163	Injector 6 (in firing order); interruption of electric connection.
575	523756	14	155	special pattern for special cases No detail informationen!
576	523757	14	156	special pattern for special cases No detail informationen!
577	523758	14	161	special pattern for special cases No detail informationen!
578	523759	14	162	special pattern for special cases No detail informationen!
579	523760	14	163	special pattern for special cases No detail informationen!
580	651	3	154	Injector 1 (in firing order); short circuit.
581	652	3	155	Injector 2 (in firing order); short circuit.
582	653	3	156	Injector 3 (in firing order); short circuit.
583	654	3	161	Injector 4 (in firing order); short circuit.
584	655	3	162	Injector 5 (in firing order); short circuit.
585	656	3	163	Injector 6 (in firing order); short circuit.
590	655	4	162	High side to low side short circuit in the injector 5 (in firing order).
591	656	4	163	High side to low side short circuit in the injector 6 (in firing order).
592	523615	5	135	Metering unit (Fuel-System); open load.
593	523615	12	135	Metering unit (Fuel-System); powerstage over temperature.
594	523615	3	135	Metering unit (Fuel-System); short circuit to battery highside.
595	523615	4	135	Metering unit (Fuel-System); short circuit to ground high side.
596	523615	3	135	Metering unit (Fuel-System); short circuit to battery low side.
597	523615	4	135	Metering Unit (Fuel-System); short circuit to ground low side.
598	523615	3	135	Metering unit, short circuit to battery.
599	523615	4	135	Metering unit, short circuit to ground.
604	1323	12	241	Too many recognized misfires in cylinder 1 (in firing order).
611	1346	0	241	Misfire detection monitoring No detail informationen!
612	523612	12	555	Internal ECU monitoring detection reported error.
613	523612	12	555	ECU reported internal software error. Internal ECU monitoring detection reported error.
614	523612	12	555	ECU reported internal software error.
615	523612	12	555	ECU reported internal software error.
616	523612	12	555	ECU reported internal software error.
617	523612	12	555	ECU reported internal software error.
618	523612	12	555	ECU reported internal software error.
619	523612	12	555	Injection system, electrical error injectors.
620	523612	12	555	ECU reported internal software error.
621	523612	12	555	ECU reported internal software error.
623	523612	12	555	ECU reported internal software error.
624	523612	12	555	ECU reported internal software error.
625	523612	12	555	ECU reported internal software error.
627	523612	12	555	ECU reported internal software error.
628	523612	12	555	ECU reported internal software error.
629	523612	12	555	Diagnostic fault check to report the accelerator pedal position error.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
630	523612	12	555	Diagnostic fault check to report the engine speed error.
631	523612	12	555	Error in the plausibility of the injection energizing time.
632	523612	12	555	Error in the plausibility of the start of energising angles.
633	523612	12	555	Diagnostic fault check to report the error due to non plausibility in ZFC.
634	523612	12	555	Diagnosis fault check to report the demand for normal mode due to an error in the PoI2 quantity.
635	523612	12	555	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI2 shut-off.
636	523612	12	555	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI3 efficiency factor.
637	523612	12	555	Internal ECU monitoring detection reported error.
638	523612	12	555	Monitoring of Fuel Quantity Correction.
639	523612	12	555	Diagnostic fault check to report the plausibility error in rail pressure monitoring.
640	523612	12	555	Diagnostic fault check to report the error due to torque comparison.
641	523612	12	555	Diagnosis of curr path limitation forced by ECU monitoring level 2.
642	523612	12	555	Diagnosis of lead path limitation forced by ECU monitoring level 2.
643	523612	12	555	Diagnosis of set path limitation forced by ECU monitoring level 2.
644	523612	3	555	Reported Over Voltage of Supply.
646	523612	4	555	Reported UnderVoltage of Supply.
648	523008	1	424	Manipulation control was triggered.
649	523008	2	424	Timeout error in Manipulation control.
654	2634	12	757	Early opening defect of main relay No detail informationen!
656	2634	12	757	DFC for stuck main relay error No detail informationen!
659	3226	2	813	Nox feed back fault detection No detail informationen!
692	523752	0	758	Plausibiliti error during Rich to Lean switch over No detail informationen!
693	523752	0	758	Monitoring of Nox signal readyness No detail informationen!
714	523612	12	555	Diagnostic fault check to report WDA active due to errors in query-/response communication.
715	523612	12	555	Diagnostic fault check to report ABE active due to undervoltage detection.
716	523612	12	555	Diagnostic fault check to report ABE active due to overvoltage detection.
717	523612	12	555	Diagnostic fault check to report WDA/ABE active due to unknown reason.
720	98	2	211	Plausibility Check. No detail informationen!
732	100	3	224	Sensor error oil pressure; signal range check high.
733	100	4	224	Sensor error oil pressure sensor; signal range check low.
734	100	0	231	High oil pressure; warning threshold exceeded.
735	100	0	231	High oil pressure; shut off threshold exceeded.
736	100	1	231	Low oil pressure; warning threshold exceeded.
737	100	1	231	Low oil pressure; shut off threshold exceeded.
743	175	3	144	Sensor error oil temperature; signal range check high.
744	175	4	144	Sensor error oil temperature; signal range check low.
745	175	0	144	High oil temperature; warning threshold exceeded.
746	175	0	144	High oil temperature; shut off threshold exceeded.
747	1237	2	145	Override switch; plausibility error.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
750	107	3	136	Sensor error airfilter differential pressure; short circuit to battery.
751	107	0	136	Sensor error airfilter differential pressure; short circuit to ground.
752	107	0	136	Air filter differential pressure; short circuit to ground.
753	523919	2	694	DPF burner air pump pressure sensor, plausibility error.
755	523919	0	694	DPF burner air pump pressure sensor, pressure above upper shutoff threshold.
758	523919	1	694	DPF burner air pump pressure sensor, pressure below lower shutoff threshold.
761	523919	3	694	DPF burner air pump pressure sensor, short circuit to battery or open load.
762	523919	4	694	DPF burner air pump pressure sensor, short circuit to ground.
763	523920	2	716	Exhaustgaspressure upstream burner, plausibility error.
765	523920	0	716	Exhaustgaspressure upstream burner, pressure above upper shutoff threshold.
770	523920	3	716	Exhaustgaspressure upstream burner, short circuit to battery or open load.
771	523920	4	716	Exhaustgaspressure upstream burner, short circuit to ground.
772	102	2	223	Pressure downstream charge air cooler, plausibility error.
774	102	1	223	Pressure downstream charge air cooler, pressure below lower physical threshold.
776	102	3	223	Pressure downstream charge air cooler, short circuit to battery or open load.
777	102	4	223	Pressure downstream charge air cooler, short circuit to ground.
780	523699	3	113	Boost pressure control; negative governor deviation below limit.
781	523699	4	113	learning valu too high No detail informationen!
785	523889	3	113	over teperature of device driver of pressure control valve No detail informationen!
791	411	0	693	delta pressure across venturi in EGR line above physical high limit.
793	411	11	693	Plausibility Check fault for deviation of desired and actual EGR-mass flow, where the latter is calculated out of EGR Delta Pressure Sensor.
795	411	3	693	Sensor error differential pressure Venturiunit (EGR), signal range check low.
796	411	4	693	Sensor error differential pressure Venturiunit (EGR), signal range check high.
805	524025	14	845	Particulate filter regeneration. Regeneration after time X is not successful (The error occurs when the regeneration times (3x) over the max. has been aborted allowed recovery time).
806	524058	2	844	Particulate filter; regeneration not successful.
807	3253	2	692	Differential pressure DPF, plausibility error.
809	3251	0	692	Differential pressure DPF maximum value is exceeded.
810	3251	0	692	Differential pressure sensor across DPF exceeds warning high limit.
812	3251	1	692	Differential pressure DPF, pressure below lower shutoff threshold.
813	3251	1	692	Differential pressure DPF, pressure below lower warning threshold.
814	3253	3	692	Electrical error differential pressure B58 (DPF). (signal range check high).
815	3253	4	692	Electrical error differential pressure (DPF). signal range check low.
825	523009	9	253	The pressure relief valve (PRV) has reached the number of allowed activations.
826	523470	2	146	Pressure relief valve is forced to open, perform pressure increase.
827	523470	2	146	Pressure Relief Valve (PRV) forced to open. Performed by pressure increase.
828	523470	12	146	Pressure Relief Valve (PRV) forced to open. Shutoff conditions.
829	523470	12	146	Pressure Relief Valve (PRV) forced to open. Warning conditions.
830	523470	14	146	Open Pressure Relief Valve (PRV).
831	523470	11	146	Pressure Relief Valve (PRV) error; Rail pressure out of tolerance range.
832	523470	11	146	Rail pressure out of tolerance range. The PRV can not be opened at this operating point with a pressure shock.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
833	523009	10	253	Open time of Pressure Relief Valve (PRV) for wear out monitoring had exceeded.
834	523906	5	761	Electrical fuel pre - supply pump; open load.
835	523906	12	761	Electrical fuel pre - supply pump. ECU powerstage over temperature.
836	523906	3	761	Electrical fuel pre - supply pump; short circuit to battery.
837	523906	4	761	Electrical fuel pre - supply pump. Short circuit to ground.
847	1176	0	139	Pressure sensor upstream turbine, Physical Range Check high.
848	1176	1	139	Pressure sensor upstream turbine, Physical Range Check low.
849	1176	3	141	Pressure sensor upstream turbine, signal range check (SRC) high.
850	1176	4	141	Pressure sensor upstream turbine, signal range check (SRC) low.
856	523613	0	134	Rail pressure metering unit, Positive governor deviation.
857	523613	0	134	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure exceeded.
858	523613	0	134	Rail pressure metering unit, Rail pressure disrupted. Maximum positive deviation of rail pressure in metering unit exceeded (RailMeUn1).
859	523613	0	134	Rail pressure metering unit, Rail pressure below the target range. (RailMeUn2) Railsystem leakage detected.(RailMeUn10).
861	523613	1	134	Rail pressure metering unit, Minimum rail pressure exceeded (RailMeUn3). Negative deviation of rail pressure second stage (RailMeUn22).
862	523613	0	134	Rail pressure metering unit, Maximum rail pressure exceeded.
864	523613	2	134	Rail pressure metering unit, Setpoint of metering unit in overrun mode not plausible.
865	523613	0	134	Setpoint of metering unit in overrun mode not plausible.
874	157	0	147	Rail pressure raw value is intermittent No detail informationen!
875	157	1	147	rail pressure raw value is above maximum offset No detail informationen!
876	523470	7	146	Maximum rail pressure exceeded (PRV).
877	157	3	147	Sensor error rail pressure. Sensor voltage above upper limit.
878	157	4	147	Sensor error rail pressure. Sensor voltage below lower limit.
881	523633	11	149	Lonterm adaption factor below threshold.
882	523633	11	149	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality).
883	523633	11	149	Nox conversion rate insufficient (SCR-Cat defect, bad DEF quality); temperature range 1.
887	3234	11	184	DFC for plausibility error Min for NOx sensor downstream of SCR Cat.
889	3224	1	185	DFC for plausibility error Max for NOx sensor upstream of SCR Cat.
892	4345	11	236	Sensor backflow line pressure (SCR); plausibility error.
893	4343	11	871	SCR Monitoring; Pressure stabilisation error, general pressure check error (SCR).
894	4374	13	872	Pressure stabilisation error dosing valve (SCR).
897	523632	16	875	Pump pressure SCR metering unit too high.
898	523632	18	876	Pump pressure SCR metering unit too low.
899	523632	0	877	Pressure overload of SCR-System.
900	523632	1	878	Pressure build-up error SCR-System.
903	4365	0	881	DEF tank temperature too high.
905	3241	0	883	Sensor SCR catalyst upstream temperature too high; plausibility error.
908	3361	7	886	DEF dosing valve blocked (SCR).
914	523720	2	148	DEF supply module heater temperature; plausibility error (normal condition).

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
915	523720	2	148	Sensor DEF supply module heater temperature; plausibility error (cold start condition).
916	523721	2	689	Sensor DEF supply module temperature; plausibility error (normal condition).
917	523721	2	689	Sensor DEF supply module temperature; plausibility error (cold start condition).
918	523981	11	243	SCR plausibility, OBD and diagnosis; Stuck in range check of DEF tank temperature sensor. DEF-tank without heating function (heating phase).
919	523330	14	131	Immobilizer status; fuel blocked.
920	523330	14	131	DFC to block the fuel by Sia No detail informationen!
921	523330	14	131	DFC to indicate that TEN-code or UC-code received if ECU is learned. No detail informationen!
922	523330	14	131	DFC to indicate that no code is received via CAN. No detail informationen!
923	523330	14	131	DFC to indicate that wrong code is received. No detail informationen!
925	523720	8	148	DEF supply module heater temperature; duty cycle in failure range.
926	523720	8	148	DEF supply module heater temperature; duty cycle in invalid range.
927	523721	11	689	Urea supply module temperature measurement not available.
928	523722	8	691	DEF supply module PWM signal; period outside valid range.
929	523722	8	691	Detect faulty PWM signal from Supply Modul.
930	523721	8	689	DEF supply module temperature; duty cycle in failure range.
931	523721	8	689	Urea supply module temperature; duty cycle in invalid range.
932	29	3	126	Handthrottle idle validation switch; short circuit to battery.
935	91	3	226	Sensor error accelerator pedal. signal range check high.
937	29	4	126	Handthrottle; short circuit to ground.
940	91	4	226	Sensor error accelerator pedal. Signal is below the range.
942	523921	3	714	Sensor error burner temperature; signal range check high.
943	3532	3	127	Sensor error DEF tank level; signal range check high.
944	523921	4	714	Sensor error burner temperature; signal range check low.
945	3532	4	127	Sensor error DEF tank level; signal range check low.
946	1079	13	282	Failure of sensor supply voltage 1.
947	1080	13	282	Failure of sensor supply voltage 2.
948	523601	13	282	Failure of sensor supply voltage 3.
952	523580	2	555	Data set variant with the desired number not found Invalid variant dataset Identifier error. No detail informationen!
953	523580	11	555	An error has occurred in the switch over to the desired data set variant in the code word. Variant dataset switching error No detail informationen!
954	523580	11	555	The code word could not be read correctly from the EEPROM Variant dataset switching error. No detail informationen!
956	677	3	512	Starter relay high side. Short circuit to battery.
957	677	4	512	Starter relay high side short circuit to ground.
958	677	5	512	Starter relay low side no load error.
959	677	12	512	Starter relay powerstage over temperature.
960	677	3	512	Starter relay low side short circuit to battery.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
961	677	4	512	Starter relay low side short circuit to ground.
965	523922	3	715	Burner shut of valve; short circuit to battery.
969	624	5	513	SVS lamp; open load.
970	624	12	513	SVS lamp: powerstage over temperature.
971	624	3	513	SVS lamp; short circuit to battery.
972	624	4	513	SVS lamp; short circuit to ground.
973	523612	14	555	Softwarereset CPU SWReset_0.
974	523612	14	555	Softwarereset CPU SWReset_1.
975	523612	14	555	Softwarereset CPU SWReset_2.
976	91	11	226	Plausibility error between APP1 and APP2 or APP1 and idle switch.
978	29	2	126	Plausibility error between sensor and idle switch, Acceleratio Pedal Detection. In case of Hand Throttle with Low Idle Switch, it is the plausibility check between hand throttle and idle switch.
980	523550	12	515	Terminal 50 was operated too long.
981	172	3	226	Air flow temperature sensor; short circuit to battery or open load.
982	172	4	226	Air flow temperature sensor; short circuit to ground.
986	523921	0	714	Burner temperature, temperature above upper shutoff threshold.
989	523921	1	714	Burner temperature, temperature below lower shutoff threshold.
992	105	1	128	Charged Air cooler down stream temperature. Temperature below lower physical threshold.
994	105	3	128	Electrical error charged air temperature. Signal range check high.(SRC).
995	105	4	128	Electrical error charged air temperature. Signal range check low.
996	105	0	233	Charged air cooler temperature. System reaction initiated. High charged air cooler temperature. Warning threshold exceeded.
997	105	0	233	Low charged air cooler temperature. Shut off threshold exceeded.
998	105	11	128	Diagnostic fault check for charged air cooler downstream temperature sensor. No detail informationen!
1007	412	3	682	Electrical error EGR cooler downstream temperature. Signal range check high.
1008	412	4	682	electrical error EGR cooler downstream temperature. Signal range check low.
1011	523960	0	771	Physical range check high for EGR cooler downstream temperature.
1012	523960	1	771	Physical range check low for EGR cooler downstream temperature.
1014	5763	6	594	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.
1015	520521	5	594	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low.
1016	5763	7	594	Actuator position for EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8) not plausible.
1022	5763	6	594	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high.
1023	5763	5	594	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low.
1024	5763	3	594	Position sensor error of actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check high.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1025	5763	4	594	Position sensor error actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8). Signal range check low.
1026	4769	2	684	Temperature downstream DOC, plausibility error.
1029	4766	0	684	Temperature downstream DOC, temperature above upper shutoff threshold.
1030	4766	0	684	Temperature downstream DOC, temperature above upper warning threshold.
1034	4769	3	684	Sensor error exhaust gas temperature downstream (DOC); signal range check high.
1035	4769	4	684	Sensor error exhaust gas temperature downstream (DOC); signal range check low.
1036	4768	2	683	Temperature upstream DOC, plausibility error.
1039	4765	0	683	Temperature upstream DOC, temperature above upper shutoff threshold.
1040	4765	0	683	Temperature upstream DOC, temperature above upper warning threshold.
1044	4768	3	683	Electrical error exhaust gas temperature upstream (DOC); signal range check high.
1045	4768	4	683	Electrical error exhaust gas temperature upstream (DOC); signal range check low.
1047	3248	4	685	Sensor error particle filter downstream temperature; signal range check low.
1067	1180	3	556	Sensor error exhaust gas temperature upstream turbine; signal range check high.
1068	1180	4	556	Sensor error exhaust gas temperature upstream turbine; signal range check low.
1069	4360	0	668	Exhaust temperature upstream SCR-Cat, temperature above upper physical threshold.
1070	4360	1	668	Sensed exhaust temperature before SCR-Cat is < physical low limit.
1071	4361	2	668	Signal error for CAN message . No detail informationen!
1072	4361	3	668	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check high.
1073	4361	4	668	Sensor error DEF catalyst exhaust gas temperature upstream; signal range check low.
1074	1761	14	127	DEF tank level; warning threshold exceeded.
1075	3361	6	677	DEF dosing valve; power at the end of injection too high.
1077	3361	3	677	DEF dosing valve; short circuit to battery on low side.
1078	3361	3	677	DEF dosing valve; short circuit to battery or open load on high side.
1079	3361	4	677	Urea dosing valve; short circuit to ground or open load on low side.
1080	3361	4	677	DEF dosing valve; short circuit on high side.
1081	4345	5	674	SCR heater relay DEF returnline sekondary side; open load.
1082	4366	5	762	SCR main relay (secondary side): open load.
1083	4343	5	673	SCR heater relay DEF pressureline secondary side; open load.
1084	4366	5	762	SCR main relay (secondary side); Shortcut to battery.
1085	4366	5	762	SCR main relay (secondary side), heat relay (secondary side), heating elements or heating valve short to ground.
1086	4341	5	675	SCR heater relay DEF supplyline secondary side; open load.
1087	523719	5	672	SCR heater relay DEF supply modul secondary side; open load.
1088	4366	5	671	SCR Tank heating valve secundary side: open load.
1089	4243	11	783	SCR heater; Pressure line heater error and temperature condition to perform an afterrun (Group error diagnosis heater). SCR system heater diagnostic reports error; shut off SCR-system.
1090	4345	5	674	SCR heater relay DEF returnline primary side; open load.
1091	4345	12	674	Over Temperature error . No detail informationen!

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1092	4345	3	674	SCR heater DEF returnline; short circuit to battery.
1093	4345	4	674	SCR heater DEF returnline; short circuit to ground.
1094	4343	5	673	SCR heater relay DEF pressureline primary side; open load.
1095	4343	12	673	Over Temperature error No detail informationen!
1096	4343	3	673	SCR heater DEF pressureline; short circuit to battery.
1097	4343	4	673	SCR heater DEF pressureline; short circuit to ground.
1098	523718	5	676	SCR main relay (primary side); open load.
1099	523718	12	676	SCR main relay (primary side); powerstage over temperature.
1100	523718	3	676	SCR main relay (primary side); short circuit to battery.
1101	523718	4	676	SCR main relay (primary side); short circuit to ground.
1102	4341	5	675	SCR heater relay DEF supply line primary side; open load.
1104	4341	3	675	SCR-heater DEF supplyline; short circuit to battery.
1105	4341	4	675	SCR-heater DEF supply line; short circuit to ground.
1106	523719	5	672	SCR heater relay DEF supplymodule primary side; open load.
1107	523719	12	672	Over Temperature error . No detail informationen!
1108	523719	3	672	SCR heater DEF supplymodule; short circuit to battery.
1109	523719	4	672	SCR heater DEF supplymodule; short circuit to ground.
1110	4366	5	671	SCR tank heating valve primary side; open load.
1111	4366	12	671	SCR-heater relay urea tank powerstage output; over temperature.
1112	4366	3	671	SCR Tank heating valve; short circuit to battery.
1113	4366	4	671	SCR Tank heating valve; short circuit to ground.
1117	523632	11	666	Pump motor not available for actuation.
1118	4375	5	666	Urea pump motor; open load.
1120	4375	3	666	Urea pump motor; short circuit to battery.
1121	4375	4	666	Urea pump motor; short circuit to ground.
1122	4334	0	665	Supply module DEF, DEF pressure above upper physical threshold.
1123	4334	1	665	Urea supply module pressure sensor; physical range check low (defect pressure sensor).
1124	4334	0	665	Urea pump pressure sensor; high signal not plausible.
1125	4334	1	665	Urea pump pressure sensor; low signal not plausible.
1126	523632	2	665	Signal error for CAN message. No detail informationen!
1127	523632	3	665	Sensor error urea pump pressure; signal range check high.
1128	523632	4	665	Sensor error urea pump pressure; signal range check low.
1129	4376	5	667	SCR reversal valve; open load.
1130	4376	12	667	SCR reversing valve; over temperature.
1131	4376	3	667	SCR reversal valve; short circuit to battery.
1132	4376	4	667	SCR reversing valve; short circuit to ground.
1135	3031	0	669	DEF tank, DEF temperature in DEF tank is to high.
1136	3031	1	669	DEF tank, DEF temperature below lower physical threshold.
1137	4365	2	669	Tank temperature signal error for CAN message.
1138	4365	3	669	Sensor error urea tank temperature: short circuit to battery.
1139	4365	4	669	Sensor error urea tank temperature; short circuit to ground.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1157	97	12	228	Water in fuel level prefilter; maximum value exceeded.
1158	523946	0	772	Zero fuel calibration injector 1 (in firing order); maximum value exceeded.
1159	523947	0	772	Zero fuel calibration injector 2 (in firing order); maximum value exceeded.
1160	523948	0	772	Zero fuel calibration injector 3 (in firing order); maximum value exceeded.
1161	523949	0	772	Zero fuel calibration injector 4 (in firing order); maximum value exceeded.
1162	523950	0	772	Zero fuel calibration injector 5 (in firing order); maximum value exceeded.
1163	523951	0	772	Zero fuel calibration injector 6 (in firing order); maximum value exceeded.
1164	523946	1	772	Zero fuel calibration injector 1 (in firing order); minimum value exceeded.
1165	523947	1	772	Zero fuel calibration injector 2 (in firing order); minimum value exceeded.
1166	523948	1	772	Zero fuel calibration injector 3 (in firing order); minimum value exceeded.
1167	523949	1	772	Zero fuel calibration injector 4 (in firing order); minimum value exceeded.
1168	523950	1	772	Zero fuel calibration injector 5 (in firing order); minimum value exceeded.
1170	523612	12	555	Internal software error ECU.
1171	175	2	144	Customer oil temperature: signal unplausible.
1173	523973	14	779	SCR Tamper detection; derating timer below limit 1.
1174	523974	14	779	SCR Tamper detection; derating timer below limit 2.
1175	523975	14	175	Urea quality; derating timer below limit 1.
1176	523976	14	175	Urea qulaity; derating timer below limit 2.
1177	523977	14	781	Urea tank level; derating timer below limit 1.
1178	523978	14	781	Urea tank level; derating timer below limit 2.
1180	168	0	318	Physical range check high for battery voltage.
1181	168	1	318	Physical range check low for battery voltage.
1183	172	1	226	Air inlet filter sensor out of physical range check.
1193	1180	0	556	Physical range check high for exhaust gas temperature upstream turbine.
1194	1180	1	556	Physical range check low for exhaust gas temperature upstream turbine.
1219	524018	14	786	HMI engine derate service state. DPF wasn´t regenerated, power reduction phase 1 (manuell regeneration request).
1220	524022	14	786	HMI engine derate stop state. DPF wasn´t regenerated, power reduction phase 2 (manuell regeneration request).
1222	190	14	212	Camshaft- and Crankshaft speed sensor signal not available on CAN.
1223	5763	5	594	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); open load.
1224	5763	6	594	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (6.1,7.8); over current.
1226	5763	3	594	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery.
1227	5763	3	594	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery.
1228	5763	4	594	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground.
1229	5763	4	594	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground.
1230	5763	6	594	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Overload by short-circuit.
1231	5763	11	594	Power stage over temperature due to high current.
1232	5763	4	594	actuator AGR valve (2.9;3.6) throttle valve (4.1;6.1;7.8); Voltage below threshold.
1239	523984	3	788	UB7; Short circuit to battery error of actuator relay 6.
1241	523986	4	176	Relais SCR-Heater, Short Circuit to Ground (High side Control side).
1242	523987	4	791	UB6; Short circuit to ground actuator relay 6.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1247	524019	11	862	Burner Control; Air Line - Blocked. Air Pump; air lines blocked.
1248	523910	9	695	Burner Control; Air Pump - CAN Lost. Air Pump; CAN communication lost.
1249	523910	7	695	Air pump; CAN communication interrupted no purge function available.
1250	523910	12	695	Air Pump; internal error.
1252	523910	0	695	Air Pump; operating voltage error.
1254	524014	1	858	Air inlet EPV - pressure too low. Air pressure glow plug flush line; below limit.
1255	524013	7	857	Burner Control; Flame lost max. Burner operation is interrupted too often.
1257	523915	7	853	HCl dosing valve (DV1); blocked open.
1258	524016	11	859	Burner Control; HFM - Electrical Fault. HFM sensor; electrical fault.
1259	524016	2	859	Burner Control; HFM - Plausibilitätsfehler 1. Amount of air is not plausible to pump speed.
1261	523910	6	695	Burner Control Air Pump; over current. Air pump electrically overloaded.
1262	523922	7	854	Burner Control; Shut-off Valve - Blocked closed. Burner Shut Off Valve; blocked closed.
1263	524021	11	864	Burner Control; Fuel line ShutOff downstream - broken. Burner fuel line pipe leak behind Shut Off Valve.
1264	523922	7	855	Burner Shut Off Valve; blocked open.
1282	523993	9	794	
1285	524038	9	824	Timeout error of CAN-Receive-Frame ComMS_Sys1TO (error memory Slave); Master-Slave internal CAN message.
1286	524039	9	825	Timeout error of CAN-Receive-Frame ComMS_Sys2TO (error memory Slave); Master-Slave internal CAN message.
1287	524040	9	826	Timeout error of CAN-Receive-Frame ComMS_Sys3TO (error memory Slave); Master-Slave internal CAN message.
1288	524041	9	827	Timeout error of CAN-Receive-Frame ComMS_Sys4TO (error memory Slave); Master-Slave internal CAN message.
1289	524042	9	828	Timeout error of CAN-Receive-Frame ComMS_Sys5TO (error memory Slave); Master-Slave internal CAN message.
1290	524043	9	829	Timeout error of CAN-Receive-Frame ComMS_Sys6TO (error memory Slave); Master-Slave internal CAN message.
1291	524045	9	831	Master Slave, Error of message counter CAN receive message ComMSMoFOvR; ComMSMoFOvR1CNT.
1292	524046	9	832	Master-Slave CAN; Error Checksum of CAN-Receive Message.
1293	524047	9	833	Master-Slave CAN; Error of message length of CAN receive message ComMSMoFOvR;_ComMSMoFOvR1DLC.
1294	524048	9	834	Timeout error CAN message ComMSMoFOvR1TO error memory Slave.
1299	523788	0	655	Wastegate plauisibility error off CAN transmit message.
1300	523788	0	655	Timeout Error of CAN-Receive-Frame ComTrbChActr; Wastegate.
1302	524024	11	866	Deviation of the exhaust gas temperature setpoint to actual value downstream (DOC) too high.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1324	523995	13	795	Check of missing injector adjustment value programming (IMA) injector 7 (in firing order).
1325	523996	13	796	check of missing injector adjustment value programming (IMA) injector 8 (in firing order).
1326	523997	4	797	Injector cylinder bank 1 slave; short circuit.
1327	523998	4	798	Injector cylinder bank 2 slave; short circuit.
1328	523999	12	799	Injector powerstage output Slave defect.
1329	524000	5	177	Injector 7 (in firing order); interruption of electric connection.
1330	524001	5	178	Injector 8 (in firing order); interruption of electric connection.
1333	524000	3	177	Injector 7 (in firing order); short circuit.
1334	524001	3	178	Injector 8 (in firing order); short circuit.
1337	2797	4	565	Timeout of Short-Circuit Ground Diagnosis Cyl. Bank 0;_IVDiaShCirGndToutBnk_0.
1338	2798	4	566	Timeout of Short-Circuit Ground Diagnosis Cyl. Bank 1;_IVDiaShCirGndToutBnk_1.
1339	2797	4	565	Injector diagnostic; Short circuit to ground cylinder bank 0.
1340	2798	4	566	Injector diagnostic; Short circuit to ground cylinder bank 1.
1341	524035	12	555	Injector diagnostics; time out error in the SPI communication.
1342	524036	12	555	Injector diagnostics Slave; time out error in the SPI communication.
1345	524069	9	896	Timeout Error of CAN-Receive-Frame MSMon_FidFCCT0; Master-Slave CAN communication faulty.
1357	524052	11	836	Error memory Slave reports FID MSMonFC2 (collective error).
1368	524052	11	836	Error memory Slave reports FID MSMonFC3 (collective error).
1378	523919	2	694	Sensor air pump airpressure; plausibility error.
1379	523920	2	716	Sensor exhaust gas back pressure burner; plausibility error.
1380	3253	2	692	Sensor differential pressure (DPF); plausibility error.
1381	164	2	839	Rail pressure safety function is not executed correctly ().
1389	523922	5	715	Burner Shut Off Valve; open load.
1390	523922	12	715	Burner Shut Off Valve; powerstage over temperature.
1392	523922	4	715	Burner Shut Off Valve; short circuit to ground.
1395	523921	2	714	Burner temperature sensor; Plausibility Check for burner temperature sensor. Sensor burner temperature; plausibility error.
1398	1136	0	681	Physical range check high for ECU temperature.
1402	4769	2	684	Sensor exhaust gas temperature OxiCat downstream (normal operation); plausibility error.
1403	4769	2	684	Sensor exhaust gas temperature OxiCat downstream (regeneration); plausibility error.
1411	1188	11	814	Wastegate actuator; internal error.
1412	1188	11	814	Wastegate actuator; EOL calibration not performed correctly.
1413	1188	13	814	Wastegate actuator calibration deviation too large, recalibration required.
1414	1188	2	814	Wastegate; status message from ECU missing.
1415	1188	7	814	Wastegate actuator; blocked.
1417	1188	11	814	Wastegate actuator; over temperature (> 135°C).
1418	1188	11	814	Wastegate actuator; operating voltage error.
1423	5763	0	594	Warning threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1424	5763	1	594	Shut off threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap.
1425	172	0	226	air temperature within air filter box above maximum physical value.
1431	524028	2	815	CAN message PROEGRActr; plausibility error.
1432	524029	2	815	Timeout Error of CAN-Receive-Frame ComEGRActr - exhaust gas recirculation positioner.
1436	524034	5	816	Disc Separator; open load.
1437	524034	12	816	Disc Separator; powerstage over temperature.
1438	524034	3	816	Disc separator; short circuit to battery.
1439	524034	4	816	Disc separator; short circuit to ground.
1440	524030	7	815	EGR actuator; internal error.
1441	524031	13	815	EGR actuator, calibration error.
1442	524032	2	815	EGR actuator; status message "EGRCust" is missing.
1443	524033	7	815	EGR actuator; due to overload in Save Mode.
1455	3711	12	711	Temperature during stand-still main phase too low or too high.
1458	523960	0	771	High exhaust gas temperature EGR cooler downstream; warning threshold exceeded.
1464	0	0	-	
1466	0	0	-	
1467	0	0	-	
1469	0	0	-	
1470	0	0	-	
1471	0	0	-	
1472	0	0	-	
1481	524025	5	845	DPF system; operating voltage error.
1482	524044	9	188	CAN message ComMS_Sys7 not received from slave.
1484	524068	2	895	Master ECU and Slave ECU have been identified as the same types.
1485	524052	11	836	Master ECU and Slave ECU data sets or software are not identical.
1486	523718	5	676	SCR mainrelay; open load (only CV56B).
1488	523718	3	676	SCR mainrelay; short circuit to battery (only CV56B).
1489	523718	4	676	SCR mainrelay; short circuit to ground (only CV56B).
1490	4376	5	667	SCR reverting valve; open load.
1491	4376	12	667	SCR reverting valve; over temperature.
1493	4376	4	667	SCR reverting valve; short circuit to ground.
1505	524057	2	843	Fuel low pressure pump; error pressure build up.
1523	2659	2	822	Exhaust Gas Recirculation AGS Sensor; signal not plausible.
1524	2659	0	822	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value above maximum physical value.
1525	2659	1	822	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value below minimum physical value.
1526	2659	12	822	Exhaust Gas Recirculation AGS Sensor; plausibility error, AGS sensor has not passed the burn off process.
1527	2659	2	822	Exhaust Gas Recirculation AGS Sensor; Temperature of EGR mass not plausible.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1529	524070	2	897	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream NOx value (Sensor self diagnostic DFC set by Deutz-SW). NOx-Sensor before SCR-Cat: Invalid upstream NOx value.
1530	524071	2	898	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream lambda value (Sensor self diagnostic DFC set by Deutz-SW).
1531	524072	2	899	(Upstream NOx-Sensor) Diagnostic Fault Check for invalid upstream lambda value (Sensor self diagnostic DFC set by Deutz-SW).
1532	524073	2	245	(Downstream NOx-Sensor) Diagnostic Fault Check for invalid downstream NOx value (Sensor self diagnostic DFC set by Deutz-SW).
1533	524074	9	246	NOx sensor downstream SCR-CAT, sensor internally open load.
1534	524075	11	247	NOx sensor downstream SCR-CAT, sensor internally short circuit.
1535	524076	9	248	NOx sensor upstream SCR-CAT, sensor internally open line.
1536	524077	11	249	NOx sensor upstream SCR-CAT, sensor internally short circuit.
1537	524078	9	255	NOx sensor downstream SCR-CAT, lambda value above upper physical threshold.
1538	524079	9	256	NOx sensor downstream SCR-CAT, lambda value below lower physical threshold.
1539	524080	9	257	NOx sensor upstream SCR-CAT, lambda value above upper physical threshold.
1540	524081	9	258	NOx sensor upstream SCR-CAT, lambda value below lower physical threshold.
1541	524082	9	259	(Downstream NOx-Sensor) Diagnostic Fault Check for downstream NOx value over maximum limit (DFC set by Deutz-SW).
1542	524083	9	261	NOx-Sensor downstream SCR-CAT, NOx value below minimum value.
1543	524084	9	911	NOx-Sensor upstream SCR-CAT, NOx value above maximum value.
1544	524085	9	912	NOx sensor upstream SCR-CAT, NOx value below lower physical threshold.
1545	524149	2	968	Plausibility error between pressure downstream turbine (PTrbnDs) and ambient air pressure (EnvP).
1555	524063	5	869	SCR heater return line; open load.
1556	524063	5	869	SCR main relay not connected.
1557	524063	5	869	SCR heater pressure line; open load.
1558	524063	3	869	SCR heater main relay; short circuit to battery.
1559	524063	4	869	SCR heater main relay load side (K31) on heating valve (Y31), Short cut to ground.
1560	524063	5	869	SCR relay for suction line not connected.
1561	524063	5	869	SCR heater supply module; open load.
1562	524063	5	869	SCR heater tank; open load.
1565	524065	0	892	Pressure sensor upstream SCR-CAT, pressure above upper physical threshold.
1566	524065	1	892	Pressure sensor upstream SCR-CAT, pressure below lower physical threshold.
1569	524065	3	892	Pressure sensor upstream SCR-CAT; short circuit battery or open load.
1570	524065	4	892	Pressure sensor upstream SCR-CAT; short circuit ground.
1579	524066	3	893	SCR measurement heater output stage; short circuit battery or open load.
1581	524067	0	894	DEF supply module, heater temperature above upper physical threshold.
1582	524067	1	894	DEF supply module, heater temperature below lower physical threshold.
1585	524067	0	894	DEF supply module, temperature above upper physical threshold.
1586	524067	1	894	DEF supply module, temperature below lower physical threshold.
1593	1761	0	129	DEF tank, DEF level above upper physical threshold.
1594	1761	1	129	DEF tank, DEF level below lower physical threshold.
1597	524149	2	968	Pressure downstream turbine, plausibility error.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1598	524065	2	892	Pressure sensor upstream SCR-CAT, plausibility error.
1616	3699	2	818	Passive regeneration of DPF; plausibility error. DPF differential pressure sensor and a further sensor or actuator CRT system defective.
1617	3699	2	818	Passive regeneration of DPF; DOC error. Temperature sensor us. and ds. DOC simultaneously defect.
1619	524087	5	884	Urea Error Lamp; open load.
1620	524087	12	884	Urea Error Lamp; temperatur over limit.
1621	524087	3	884	Urea Error Lamp; short circuit battery.
1622	524087	4	884	Urea Error Lamp; short circuit ground.
1630	524132	2	955	Fuel low pressure upstream fuel low pressure pump not plausible.
1631	524132	0	955	Fuel low pressure upstream fuel low pressure pump, pressure above maximum warning threshold.
1632	524132	0	955	Fuel low pressure upstream fuel low pressure pump, pressure above maximum shut off threshold.
1633	524132	1	955	Fuel low pressure upstream fuel low pressure pump, pressure below minimum shut off threshold.
1634	524132	1	955	Fuel low pressure upstream fuel low pressure pump, pressure below minimum warning threshold.
1635	3699	0	818	Maximum standstill time reached; oil exchange request ignored.
1639	524147	13	966	SCR System,pressure build up not possible.
1646	524063	12	869	DEF supply modul, time for defrosting too long.
1647	524063	12	869	DEF tank, time for defrosting too long.
1654	1761	14	138	Urea Tank Signal to HMI for indicating the Urea Tank-Level (Urea tank volume ratio low threshold 1).
1655	1761	14	138	DEF tank, DEF level below first warning threshold.
1656	1761	14	138	DEF tank, DEF level below second warning threshold.
1658	524096	14	196	Control of the SCR system; If the start stop counter (EPA-Counter) exceeds the threshold. SCRCtl_ctEngStrtStopThresh_C. This counter will increment only once in each driving cycle in case of an SCR error. If the counter reaches the threshold, the DFC will be set to inhibit the engine start. Engine will not be started, because of EPA-Counter.
1659	524114	9	938	Timeout error of CAN-Transmit-Frame A1DOC.
1660	524115	9	939	Timeout error of CAN-Transmit-Frame AT1S.
1661	524116	9	194	Timeout error of CAN-Transmit-Frame SCR2.
1662	524117	9	941	Timeout error of CAN-Transmit-Frame SCR3.
1663	524097	9	921	Timeout error of CAN-Transmit-Frame DPFBrnAirPmpCtl.
1664	524098	9	922	Timeout error of CAN-Transmit-Frame ComDPFBrnPT.
1665	524099	9	923	Timeout error of CAN-Transmit-Frame ComDPFC1.
1666	524100	9	924	Timeout error of CAN-Transmit-Frame ComDPFHisDat.
1667	524101	9	925	Timeout error of CAN-Transmit-Frame ComDPFTstMon.
1668	524105	9	929	Timeout error of CAN-Transmit-Frame ComEGRMsFlw.
1669	524108	9	932	Timeout error of CAN-Transmit-Frame ComEGRTVActr.
1670	524110	9	934	Timeout error of CAN-Transmit-Frame ComETVActrTO.
1671	524112	9	936	Timeout ComIntake Throttle Valve Actr.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1672	524118	9	942	Timeout error of CAN-Receive-Frame ComRxCM1.
1673	524119	9	943	Timeout error of CAN-Receive-Frame ComRxCustSCR3.
1674	524102	9	926	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmpCtl.
1675	524103	9	927	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmp.
1676	524104	9	928	Timeout error of CAN-Receive-Frame ComRxDPFCtl.
1677	524106	9	195	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw1.
1678	524107	9	931	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw2.
1679	524109	9	933	Timeout error of CAN-Receive-Frame ComRxEGRTVActr.
1680	524111	9	935	Timeout error of CAN-Receive-Frame ComRxETVActr.
1681	524113	9	937	Timeout error of CAN-Receive-Frame ComRxITVActr.
1682	524120	9	944	Timeout error of CAN-Receive-Frame ComRxSCRHtDiag.
1683	524121	9	945	Timeout error of CAN-Receive-Frame ComRxTrbChActr.
1684	524122	9	946	Timeout error of CAN-Receive-Frame ComRxUQSens.
1685	524123	9	947	Timeout error of CAN-Receive-Frame ComSCRHtCtl.
1686	524124	9	948	Timeout error of CAN-Receive-Frame ComTxAT1IMG.
1687	524125	9	949	Timeout error of CAN-Receive-Frame ComTxTrbChActr
1698	524133	2	956	HMI system; set if restore button blocked.
1699	524134	0	957	DPF, ash load exceeds the shutoff threshold.
1700	524134	0	957	DPF, ash load exceeds the warning threshold.
1701	524135	0	958	DPF, soot load exceeds the shutoff threshold.
1702	524135	14	958	DPF, soot load exceeds the service request threshold.
1703	524135	0	958	DPF, soot load exceeds the warning threshold.
1705	524156	9	972	Timeout error of CAN-Receive-Frame ComRxEBC2.
1752	2791	7	415	EGR actuator, actuator blocked.
1753	2791	2	415	EGR actuator, CAN error.
1754	2791	13	415	EGR actuator, EOL calibration error.
1755	2791	12	415	EGR Actuator, internal electrical fault.
1756	2791	13	415	EGR actuator, learning process aborted.
1757	2791	6	415	EGR actuator current is above maximum threshold.
1758	2791	3	415	EGR actuator supply voltage is above the maximum threshold.
1759	2791	4	415	EGR actuator supply voltage is below minimum threshold.
1760	2791	13	415	EGR actuator, learning process out of range.
1761	2791	7	415	EGR actuator, broken spring detected.
1762	2791	16	415	EGR actuator, temperature high.
1763	2791	0	415	EGR actuator, temperature critical high.
1788	1188	7	814	Turbocharger wastegate, mechanical blocking detected.
1789	1188	2	814	Turbocharger wastegate, CAN Error.
1790	1188	13	814	Turbocharger wastegate, EOL calibration error.
1791	1188	12	814	Turbocharger wastegate, internal electrical error.
1792	1188	13	814	Turbocharger wastegate, learning process aborted.
1793	1188	6	814	Turbocharger wastegate, current above maximum threshold.
1794	1188	3	814	Turbocharger wastegate, supply voltage above maximum threshold.
1795	1188	4	814	Turbocharger wastegate, supply voltage below minimum threshold.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1796	1188	13	814	Turbocharger wastegate, learning process out of range.
1797	1188	7	814	Turbocharger wastegate, broken spring detected.
1799	1188	0	814	Turbocharger wastegate, temperature critical high.
1827	524141	7	192	DEF dosing valve, dosing valve blocked.
1857	523612	12	555	Engine starter, plausibility error of starter release condition.
1858	524147	7	966	SCR-System, reverting valve blocked
1859	524175	0	993	SCR-CAT, Nox emissions above maximum threshold.
1860	524074	2	246	NOx-Sensor after SCR-Cat: Nox-Sensor dew point problem or plausibility problem.
1861	524076	2	248	NOx-Sensor before SCR-Cat: Nox-Sensor dew point problem or plausibility problem.
1863	524177	7	995	SCR System, DEF suction line blocked.
1864	524178	7	996	SCR System, DEF pressure out of range.
1865	4360	2	668	Exhaust temperature sensor upstream SCR, plausibility error.
1866	4334	2	665	DEF supply module pressure, plausibility error.
1867	524067	2	894	Supply module heater temperature, plausibility error.
1868	524067	2	894	Supply module temperature, plausibility error.
1869	1761	2	129	DEF tank level, plausibility error.
1870	3031	2	669	Urea tank temperature outside of plausible thresholds.
1874	524152	2	971	Urea Quality Sensor; Timeout CAN message.
1875	524153	2	997	Urea tank level & urea tank temperature via CAN bus, timeout of CAN message.
1880	1761	14	138	DEF tank, DEF level below third warning threshold.
1881	4768	2	683	exhaust gas temperature sensors up- and downstream DOC are physically swapped
1882	524025	14	845	The standstill-regeneration mode time exceeds the long-limit. Vehicle was too long or too often in standstill mode. Make oil change and reset counter.
1883	524025	14	845	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Make oil change and reset counter.
1889	524189	9	269	Master / Slave Can disturbed.
1891	524190	14	272	Inducement level 1 activ.
1892	524191	14	273	Inducement level 2 activ.
1893	524193	8	275	The standstill-regeneration mode time exceeds the long limit threshold. Vehicle was too long or too often in standstill mode. Change oil and reset counter.
1894	524194	8	276	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode. Change oil and reset counter.
1895	3519	12	277	DEF tank temperature, temperature too high
1896	3520	3	278	DEF quality sensor, short circuit to battery or open load
1897	3520	4	278	DEF quality sensor, short circuit to ground
1898	3519	3	277	DEF quality sensor, internal temperature sensor short circuit to battery or open load
1899	3519	4	277	DEF quality sensor, internal temperature sensor short circuit to ground.
1900	524195	14	279	Standstill request due to crystalisation ignored too long.
1901	524196	13	283	Variant handling, address error.
1902	524196	2	283	Variant handling, Synchronisation error.

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
1904	3520	2	278	DEF quality seonsor, bad DEF quality detected or no DEF measuring possible.
1907	3520	13	278	Urea quality at UQS invalid.
1908	3519	13	277	Temperature at UQS invalid.
1911	3532	3	127	The DEF Level at UQS out of max. physical range.
1912	3532	4	127	Quality at UQS out of min. physical range.
1914	4365	3	669	DEF qualitysensor, tank temperatur; Short circuit to battery or open load.
1915	4365	4	669	DEF qualitysensor, tank temperatur; Short circuit to ground.
1917	3936	14	286	Standstill request ignored too long.
1918	3936	14	286	Standstill time based escalation requests Inducement step 2.
1921	51	5	594	Intake Throttle Flap, H-Bridge, wiring harness broken at connected actuator.
1922	51	6	594	Intake Throttle Flap, H-Bridge, current above maximum threshold.
1924	51	3	594	Intake Throttle Flap, H-Bridge, short circuit to battery (A02).
1925	51	3	594	Intake Throttle Flap, H-Bridge, short circuit to battery (A67).
1926	51	4	594	Intake Throttle Flap, H-Bridge, short circuit to ground (A02).
1927	51	4	594	Intake Throttle Flap, H-Bridge, short circuit to ground (A67).
1931	51	7	594	Intake Throttle Flap, H-Bridge, position of actuator not plausible (deviation from setpoint more than 7%).
1935	51	3	594	Intake Throttle Flap, H-Bridge, short circuit to battery oder broken wiring harness.
1936	51	4	594	Intake Throttle Flap, H-Bridge, short circuit to ground.
1943	524202	11	313	SCR error code in master ECU active.
1944	524203	11	313	DEF tank level failure is in master ECU active.
1945	524204	11	313	SCR afterrun failure is in master ECU active.
1946	524205	11	313	SCR Co2Off failure is in master ECU active.
1947	524206	11	313	SCR disable DEF dosing failure is in master ECU active.
1971	524230	11	315	Inducement HW Failure Slave.
1972	524231	11	315	Inducement SCR Tamp. Slave.
1973	524232	11	315	Inducement DEF Qualitity in Slave ECU.
1980	524239	11	315	SCR regeneration failure is in slave ECU active.
1989	524248	11	315	NOX sensor downstream error in slave ECU.
1990	524249	11	315	DEF dosing valve error in slave ECU.
1992	524251	11	315	DEF pressure problems in slave ECU.
1993	524252	11	315	Reverting valve error in slave ECU.
1994	524253	11	315	DEF back flow line heater error on slave ECU.
1995	524254	11	315	Error NOx-Tailpipe emissions exceeded on Slave ECU.
1996	524255	11	315	DEF suction line heater error on slave ECU.
1997	524256	11	315	DEF supply module heater error on slave ECU.
1998	524257	11	315	Error Exhaust pressure upstream SCR on Slave ECU.
1999	524258	11	315	Error Exhaust temperature upstream SCR on Slave ECU.
2000	524259	11	315	DEF pressure line heater error on slave ECU.
2001	524260	11	315	Error Urea pump temperature on Slave ECU.
2002	524261	11	315	Error DEF heater relais on Slave ECU.
2007	524266	14	287	Announcement triggers the Inducement Level 2.
2008	524267	14	845	Max. launch time for stand still exceeded (60min).

Table 3-6. Deutz Trouble Codes (D2.9L4 Engine)

KWP-Code	SPN	FMI	Blink code	Error Identification
2011	4171	2	668	Dynamic temperatur check of temp before SCR.
2013	524147	13	996	Set together with DFC_SCRCoBldUpLoPres. DFC_SCRCoBldUpLoPresRst is only used for inducement purposes. It ensures that legal inducement is working correctly.

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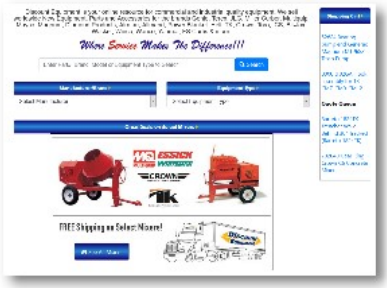

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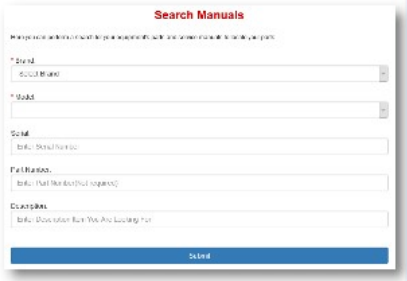

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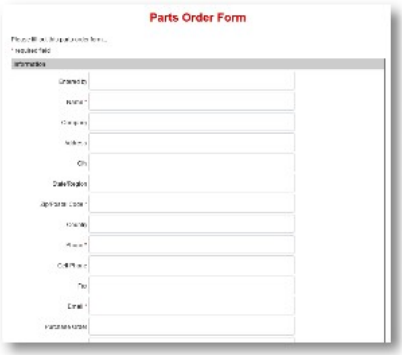

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SECTION 4. BOOM & PLATFORM

4.1 BOOM SYSTEMS

Platform Control Enable System

The platform controls make use of a time dependent enable circuit to limit the time availability of "live" or enabled controls. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any control. The controls will remain enabled as long as the operator continues to use any function and will remain enabled 7 seconds after the last function has been used. While the controls are "live", the enabled light will be illuminated in the platform display panel. When the time limit has been reached, the enabled light will turn off and the controls will be disabled. To continue use of the machine the controls must be re-enabled to start the timer system over again. This is done by releasing all functions, then releasing and re-depressing the footswitch.

Platform Load Sensing System (LSS)

The Platform Load Sensing System consists of four load cells, mounted between the boom and platform support, and a dedicated CAN Bus harness connecting the sensor to the platform console. The operator selects the modes (restricted or un-restricted zones) he wishes to work in using a dual capacity switch on the platform control. The indicators in platform control changes to match the selection.

This system measures the weight in the platform and check if it exceeds the capacity limit according to the mode currently selected.

The LSS weight reading plays no role in determining the dual capacity control actions. But it will set correct trigger value for weight based on dual capacity switch locations. If the load in platform exceeds the trigger value, the platform overload indicator will flash, the platform alarm will sound at the standard JLG duty cycle of 5 seconds on / 2 seconds off, and all platform controls (except emergency descent) will be disabled.

The platform load sensing system is optional for ANSI Export and Japan machines at this moment.

Above Elevation (Above Horizontal) - Drive Speed Cutback System

The above elevation cutout system uses the same angle sensor mounted in the pivot end of the lift cylinder to sense when the boom is raised substantially above horizontal. The articulated jib of the 460SJ may be in any position. When "above elevation", the drive motors are automatically restricted to their maximum displacement position (slow speed).

Additionally, when used in conjunction with the "tilt indicator system", the elevation sensor will cause an alarm to sound and automatically put the machine in the creep speed mode. With the exception of the speed cutback, this is a warning system only. The machine will continue to function. The operator is responsible to prevent the machine from attaining an unstable position. The "safe" condition of the machine is when high engine and high speed is allowed (at low boom angles).

Transport Position Interlock System

The transport position interlock system uses the "Transport Position Sensing System" to sense when the boom is out of the transport (nearly stowed) position. The articulated jib of the 460SJ and H460SJ may be in any position. All controls are simultaneously functional when the booms are within the transport position as on the standard machine. When the booms are outside of the transport position, the control functions are interlocked to prevent simultaneous operation of any boom function with drive/steer.

The first function set to be operated in this mode, becomes the master function set. In other words, while operating drive/steer functions the boom functions are inoperable. Likewise, while operating boom functions drive/steer functions are inoperable. In addition to being an interlock, this system also disallows high speed operation while the booms are beyond the transport position. While in this position, the machine will respond in the same way as described in the "Above Elevation Cutout System" does. As described in the Positive Opening Switch System, the "safe" condition of the machine is when the use of multiple function operation is allowed (at low boom angles and short boom lengths).

Function Speed Control System

The platform controls for the platform rotation, platform leveling, jib lift, and main boom telescoping are controlled through a common infinitely variable speed control knob. This knob provides a common control signal allowing a smooth ramp up, controlled maximum output speed, and ramp down. Each function has its own personality settings allowing the characteristics of each function to be modified using the standard analyzer. Not all functions will respond the same to the changes in the function speed knob position.

Emergency Decent System

The emergency descent system allows the boom and jib to be lowered in the event of primary power (engine power) loss. This system uses electrically powered solenoid valves and the force of gravity to lower the booms and jib. The following functions are included in this system and will operate normally if the engine is not running and the "auxiliary power" switch has been activated.

- Main Lift Down
- Jib Down
- Fly boom telescope in or out
- Turn table swing

Main Boom Lift End of Stroke Damping

When the lift cylinder is activated to lower or raise the main boom, the UGM monitors the main boom angle through an angle sensor. When the boom is approaching maximum angle and is within 5° of end of stroke, the UGM will slow down the travelling speed of the cylinder to provide end of stroke damping by controlling hydraulic valve flow rate of the lift cylinder. The damping rate can be adjusted by personal settings through JLG hand analyzer.

Jib Lift End of Stroke Damping

The Jib Lift cylinder is constructed in a way that causes the Jib Lift cylinder oil flow to be restricted by an orifice while lowering the jib near the end of stroke at minimum elevation. This flow restriction reduces the speed of this function just before bottoming out the cylinder.

Machine Safety Override (MSSO) (CE Market Only)

The Machine Safety System Override allows the boom and jib to be lowered in the event that a machine safety system is preventing machine operation. This system uses an additional button found on the Ground Panel to allow all boom functions to function from the Ground Station with the engine running. When MSSO is used, an event will be logged in the JLG Control System and will require service access to clear.

Transport Position Sensing System

The transport position sensing system is consisted of a boom angle sensor (this sensor has built-in redundancy to meet safety related regulations) mounted in the pivot end of the lift cylinder, and two boom length proxy switches mounted near the pivot end of the base boom. The system uses these three sensor/switches combination to sense if the boom is in the position associated with high speed travel. The control circuit reads two redundant angular sensor signals from the boom angle sensor.

Above transport angle is recognized when one angular sensor signal from the boom angle sensor reads more than 5° greater than horizontal (with respect to the turntable), and resets to within transport position when both angular sensor signals read less than 3° greater than horizontal (with respect to the turntable).

Transport length is recognized when any one of the two length switches reads more than 24 inch extension of fly boom. During failures of either of the two length switches, the system will sense a disagreement. Then it will assume the boom is extended out past the limit. The position of the articulated jib is not considered.

This system is used to control the following systems:

- Above Elevation (Above Horizontal) - Drive Speed Cutback System
- Drive/Steer – Boom Function Interlock System
- Oscillating Axle lock up System
- Lift cylinder end of stroke electrical damping stop

The transport position sensing system uses the following components:

- Boom angle sensor
- Boom length sensors

BOOM ANGLE SENSOR

The boom angle sensor measures boom position to control drive speed and the oscillating axle. The redundant sensor reading is used as a safety redundancy in case one sensor fails.The boom angle sensor is mounted on the pivot end of the lift cylinder as shown in Figure 4-3., Transport Switches Installation.

In transport:

- The boom angle sensor reads the main boom is less than 3° below horizontal with respect to the turntable
  - **a.** Drive speed and oscillating axle are not affected

Out of transport:

- The boom angle sensor reads the main boom is more than 5° above horizontal with respect to the turntable
  - **a.** Drive speed is cut back and the oscillating axle locks

Dual capacity:

- The boom angle sensor reads more than 51° above horizontal with respect to the turntable

Boom Angle Sensor Circuit

The boom angle sensor circuit uses a redundant reading to ensure the sensor is operating properly and the machine stays within safe operating conditions. With the main boom completely lowered on the rest, activate the lift up function and the sensor will read the following:

Ground Module: Plug J7 Pin 4

- Voltage starts at 4.5 volts when the boom is on the boom rest
- As the boom is raised the voltage decreases to 0.5 volts
- As the boom is lowered the voltage increases to 4.5 volts

Ground Module: Plug J7 Pin 7

- Voltage starts at 0.5 volts when the boom is on the boom rest
- As the boom is raised the voltage increases to 4.5 volts
- As the boom is lowered the voltage decreases to 0.5 volts

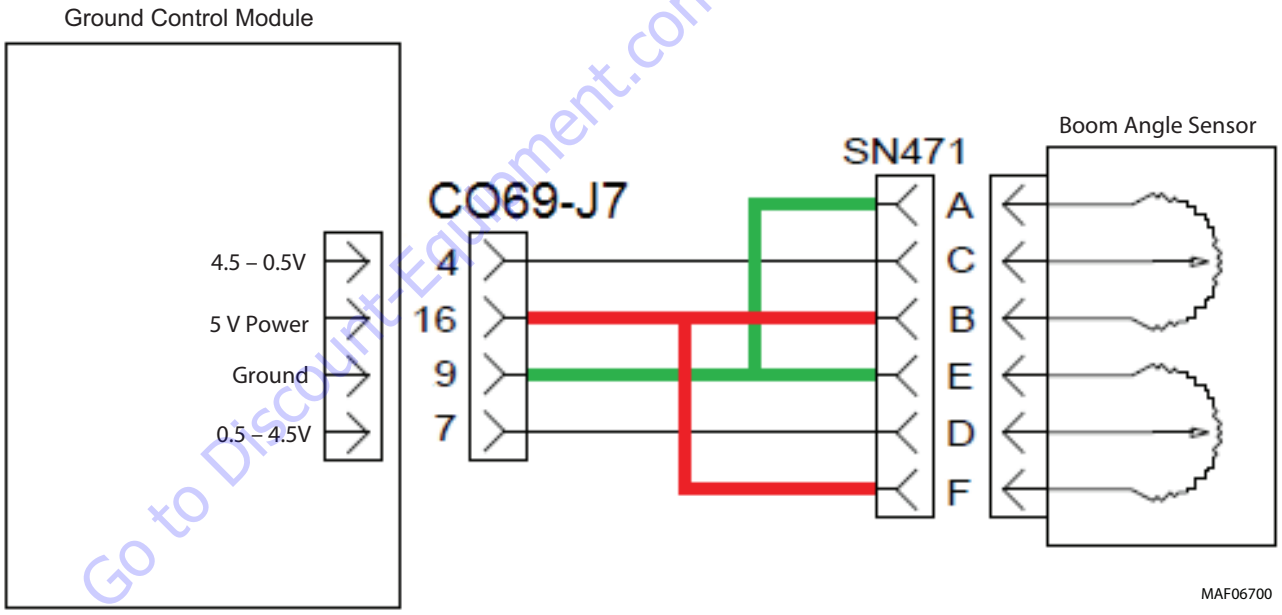


Figure 4-1. Boom Angle Sensor Circuit

BOOM LENGTH SENSORS

The boom length sensors measure boom length to control drive speed and the oscillating axle based on that measurement. The two proximity sensor system is used as a safety redundancy in case one sensor fails. The boom length sensors are mounted on the left side of the base boom, near the pivot end, as shown Figure 4-3., Transport Switches Installation.

In transport:

- Both of the two length switches reads less than 12 in (30.5 cm) of extension of the fly boom
  - **a.** Drive speed and oscillating axle are not affected

Out of transport:

- Both of the two length switches reads more than 12 in (30.5 cm) of extension of the fly boom
  - **a.** Drive speed is cut back and the oscillating axle locks

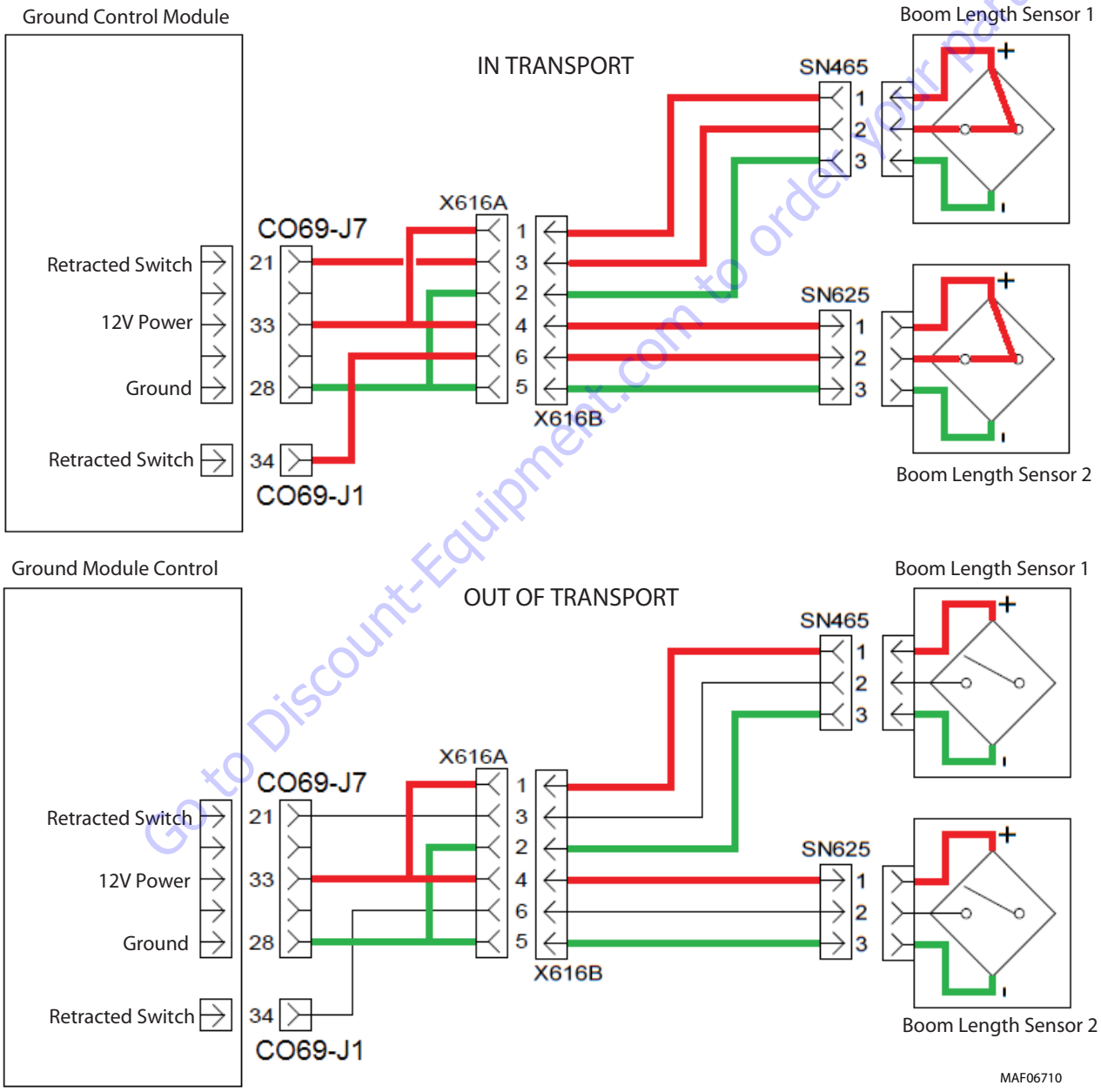


Figure 4-2. Boom Length Sensors Circuit

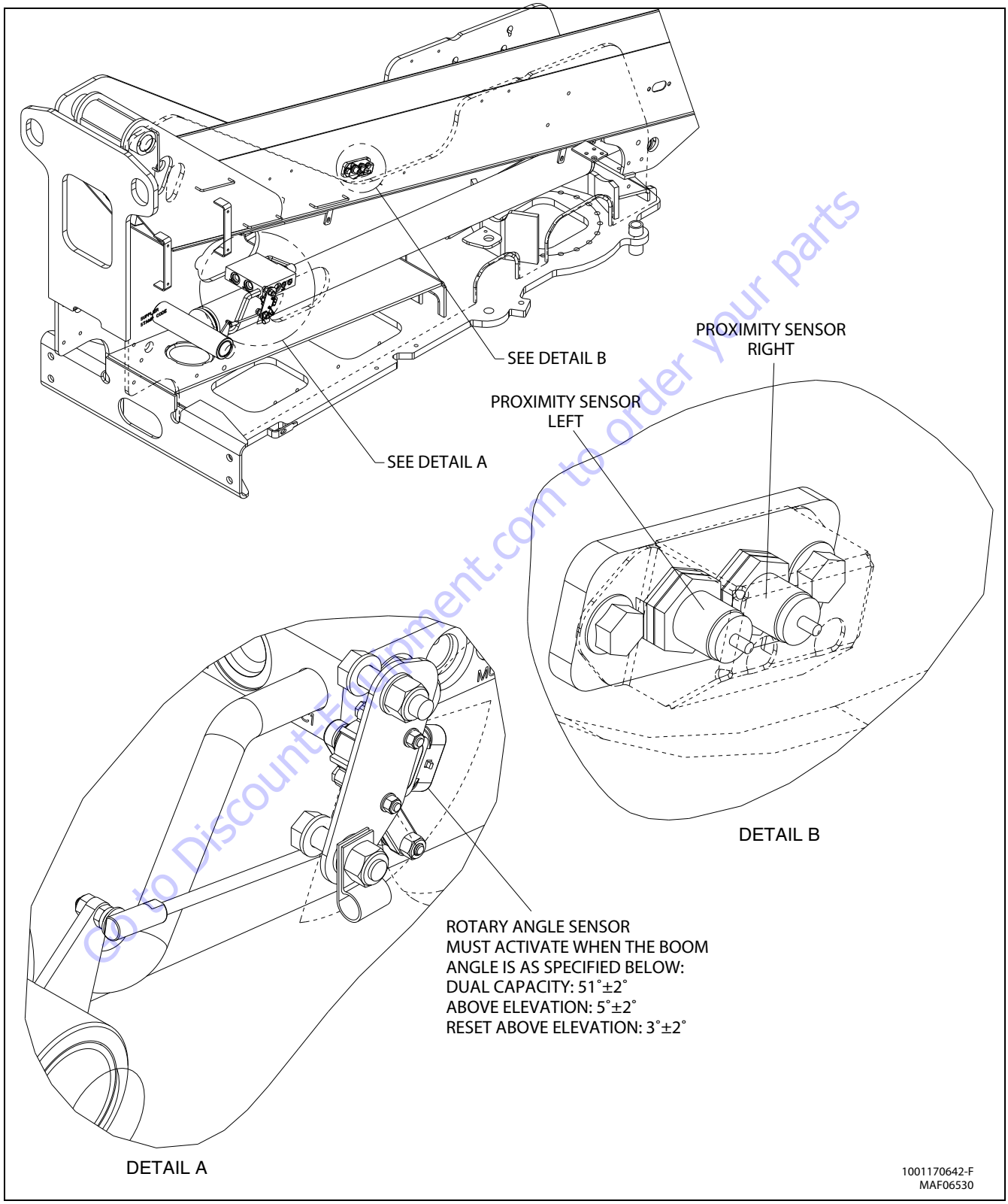


Figure 4-3. Transport Switches Installation

Dual Capacity Selection and Indicator System

The dual capacity selection and indicator system consists of a capacity mode toggle switch in platform control box, a set of fly boom position redundant proximate sensors, and a main boom angle sensor.

The operator selects the mode he wishes to work in (600 lb /270 kg or 1000 lb / 450 kg). The light indicator in the platform control box will change to match the selected mode, unless there is a system DTC that forces the machine into 1000 lb / 450 kg mode.

The system uses the boom length proximity sensors and boom angle sensor to prevent the platform from entering the unrestricted 600 lb / 270 kg zone if the restricted 1000 lb / 450 kg mode is selected.

When the dual capacity switch is in the 1000 lb / 450 kg restricted position, the platform will move but stop at the boundaries of the restricted zone. The platform will not be able to enter the unrestricted zone. When the machine control system senses the platform is already on the boundaries of the restricted zone, it only allows the retraction of the fly boom, or lifting up of the main boom since these movements place the platform further away from the unrestricted zone.

If the platform is already inside the restricted zone, and the dual capacity switch is flipped to 1000 lb / 450 kg position at that time, the machine will only allow the fly boom to retract, and will only allow the base boom to lift up, since these actions will bring the platform towards the restricted zone.

When the dual capacity switch is in the 600 lb / 270 kg position, the platform can go anywhere within the whole boundaries.

The above paragraph only applies to the 400SC. The 460SJC are single capacity machines (600 lb / 270 kg).

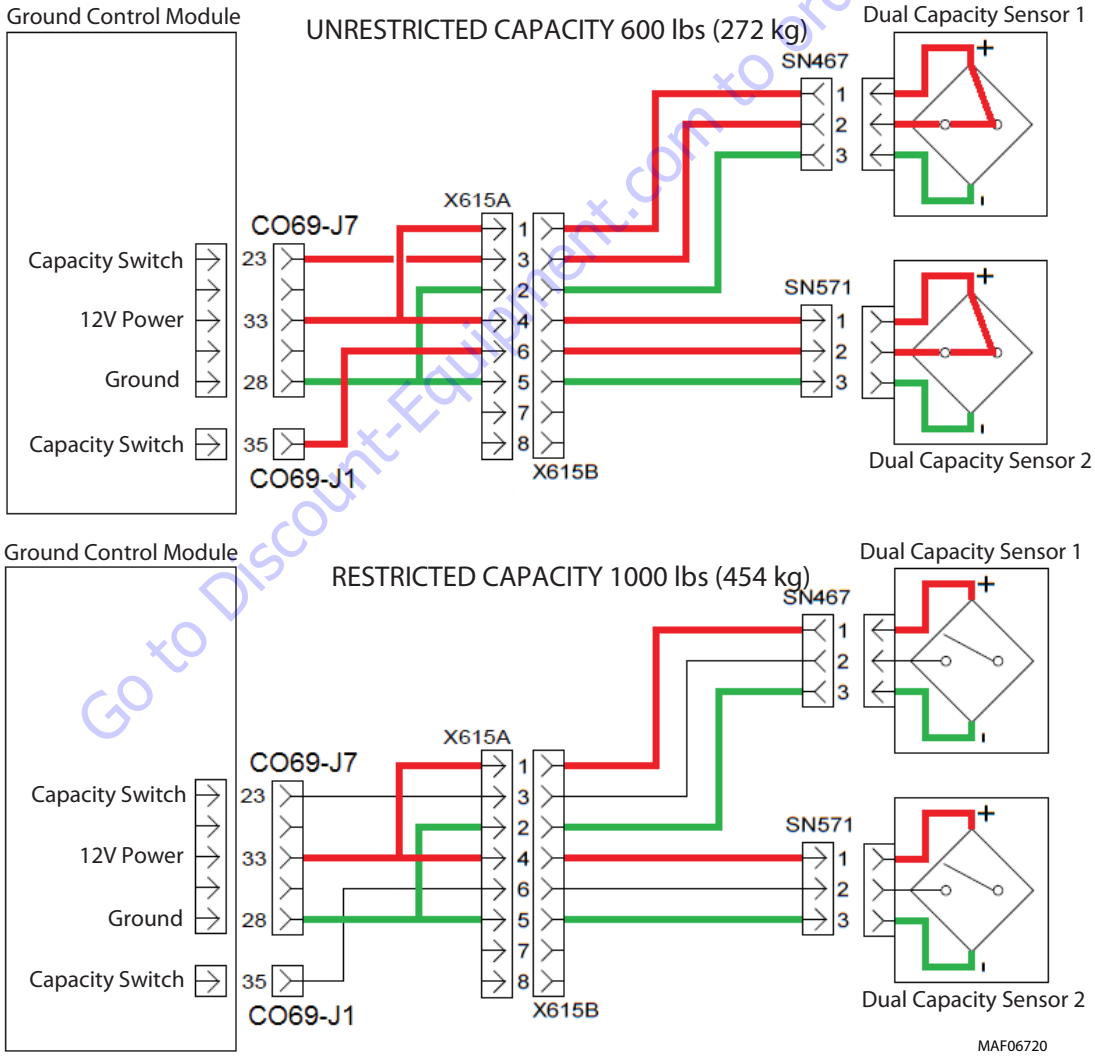


Figure 4-4. Dual Capacity Sensor Circuit

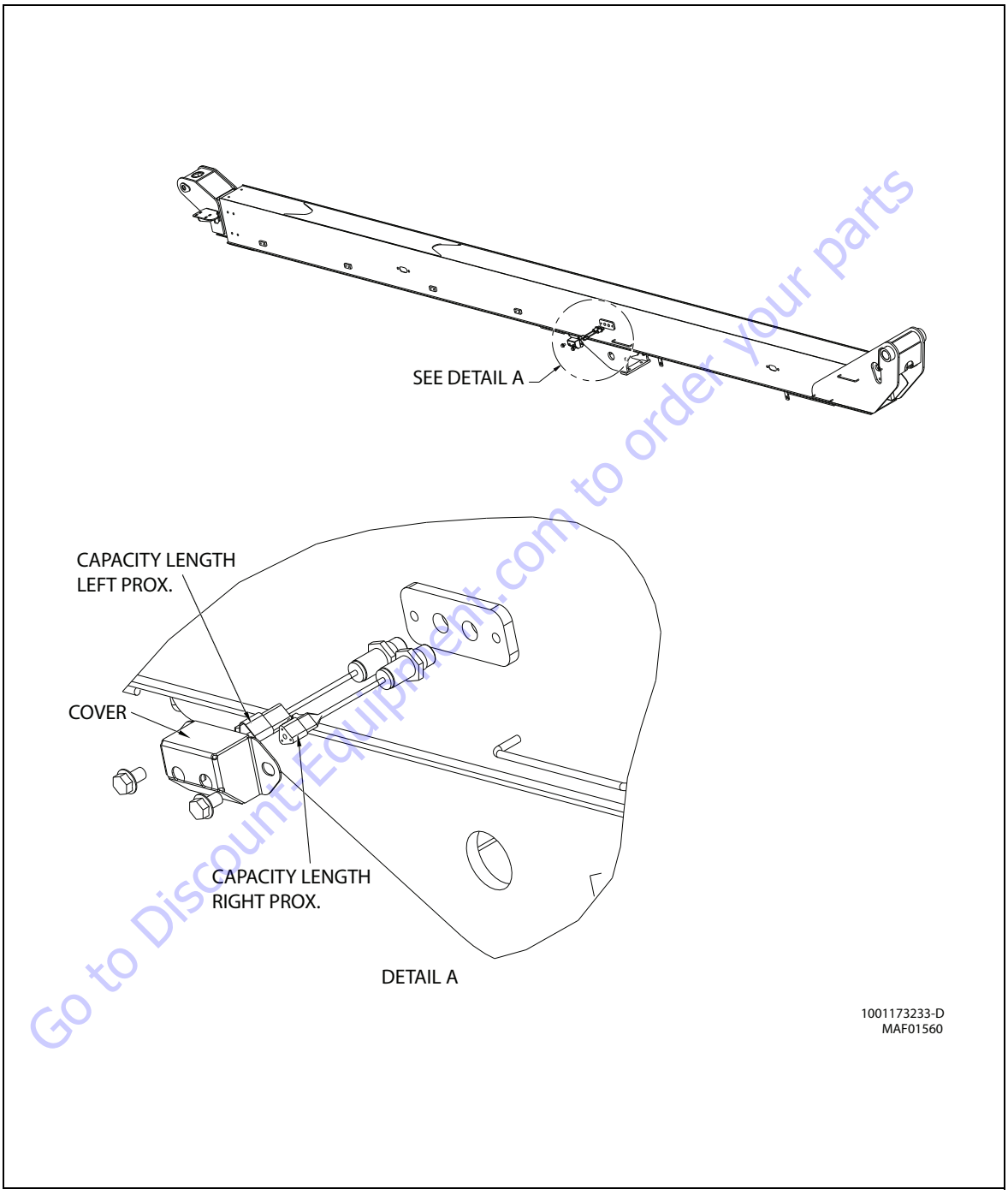


Figure 4-5. Capacity Switch Installation

4.2 PLATFORM

Platform/Support Removal

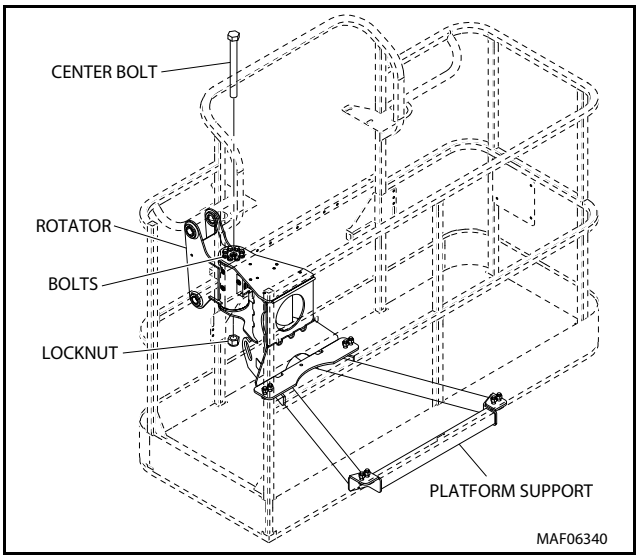
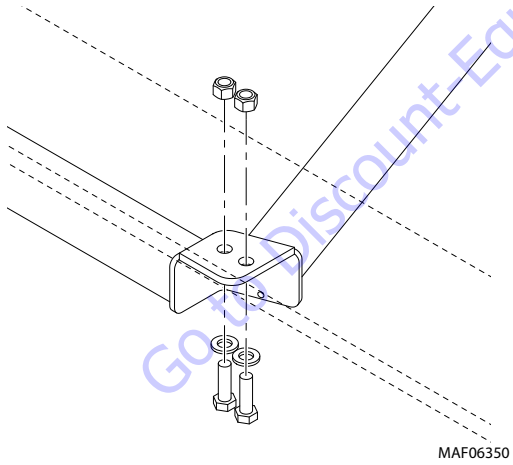


Figure 4-6. Location of Components

1. Disconnect electrical cable from control console.

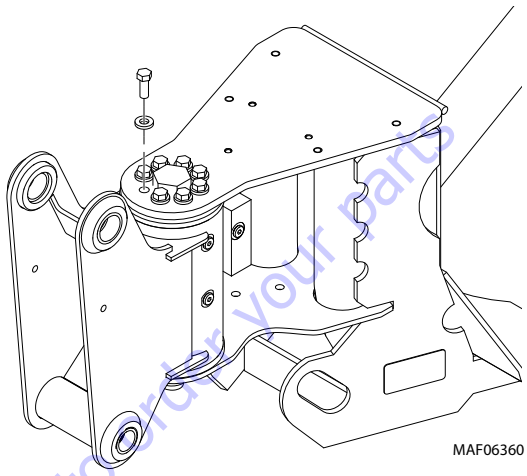
NOTE: *The platform weighs approximately 176 lb (80 kg).*

2. Remove the bolts securing the platform to the platform support, then remove the platform.

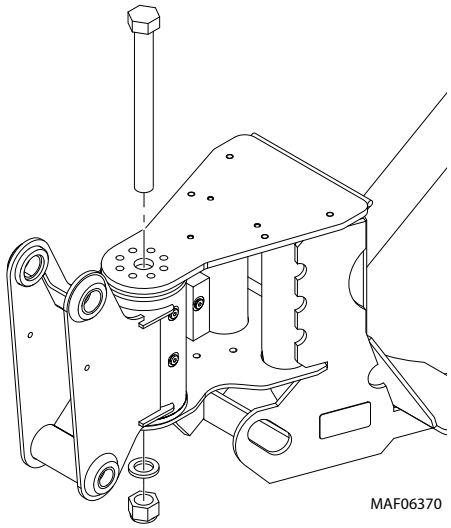


NOTE: *The platform support weighs approximately 132 lb (60 kg).*

3. Using a suitable device, support the platform support.
4. Remove the bolts and washers securing the support to the rotator.



5. Using a suitable brass drift and hammer, remove the center bolt and locknut.

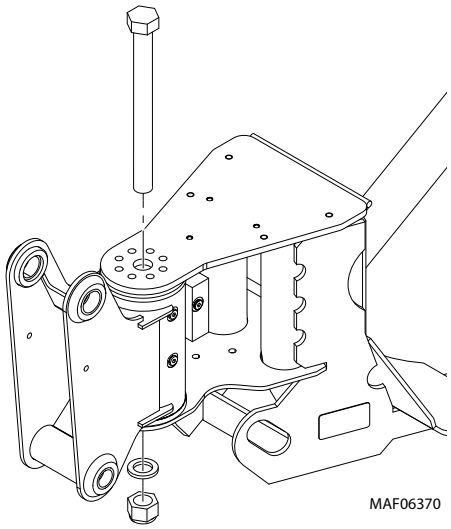


6. Remove the platform support from rotator.

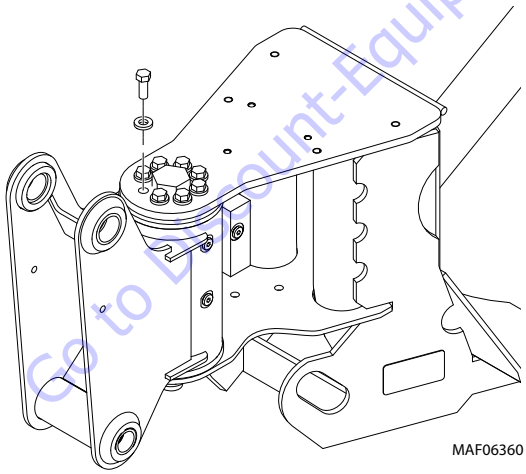
Platform/Support Installation

NOTE: *The platform support weighs approximately 132 lb (60 kg).*

1. Using a suitable device, support the platform support and position it on the rotator.
2. Install the rotator center bolt and locknut.



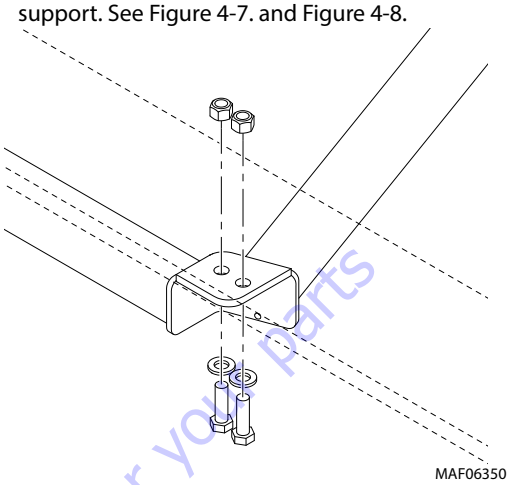
3. Apply Medium Strength Threadlocking Compound to the eight bolts securing the support to the rotator and install the bolts.



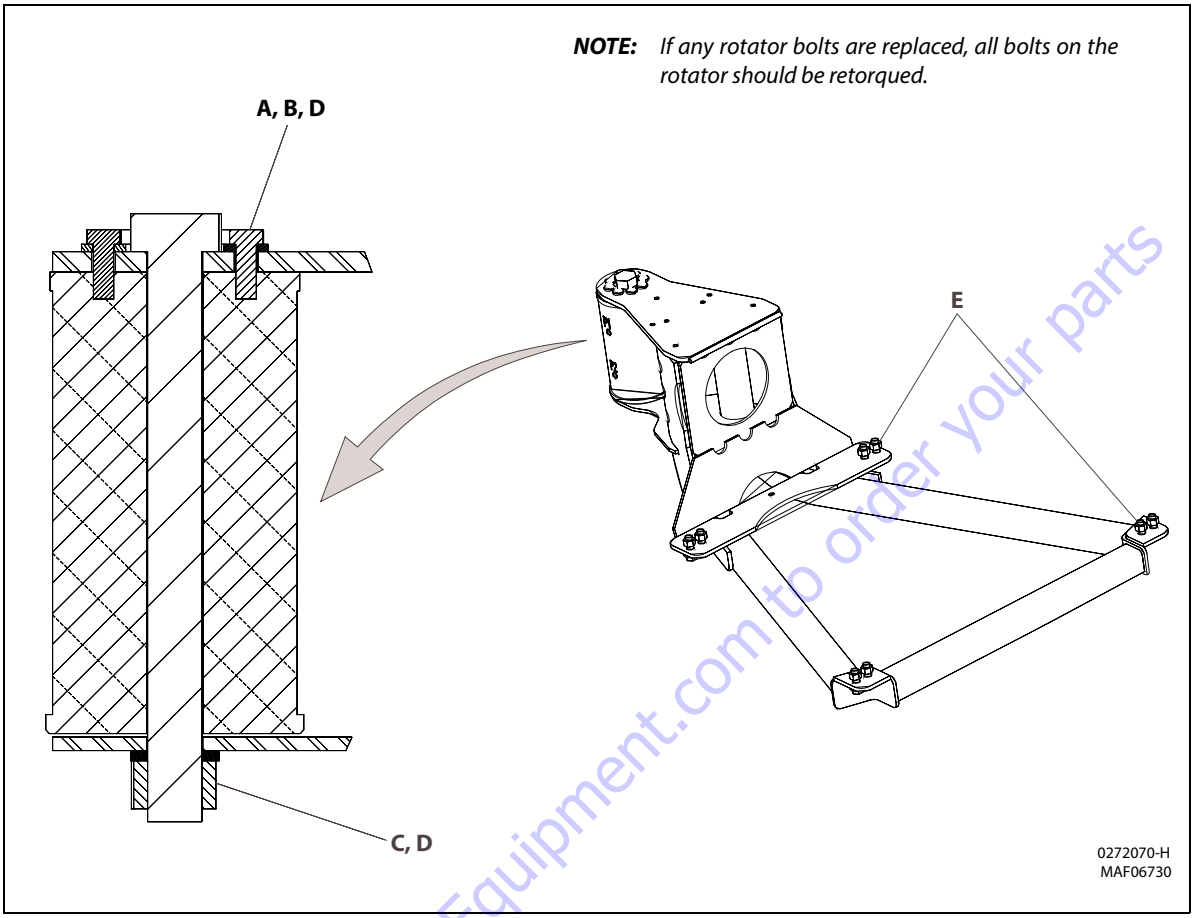
4. Torque the nut on the rotator center bolt and the retaining bolts. See Figure 4-7. and Figure 4-8.

NOTE: *The platform weighs approximately 176 lb (80 kg).*

5. Position the platform on the platform support and install the bolts securing the platform to the platform support. See Figure 4-7. and Figure 4-8.

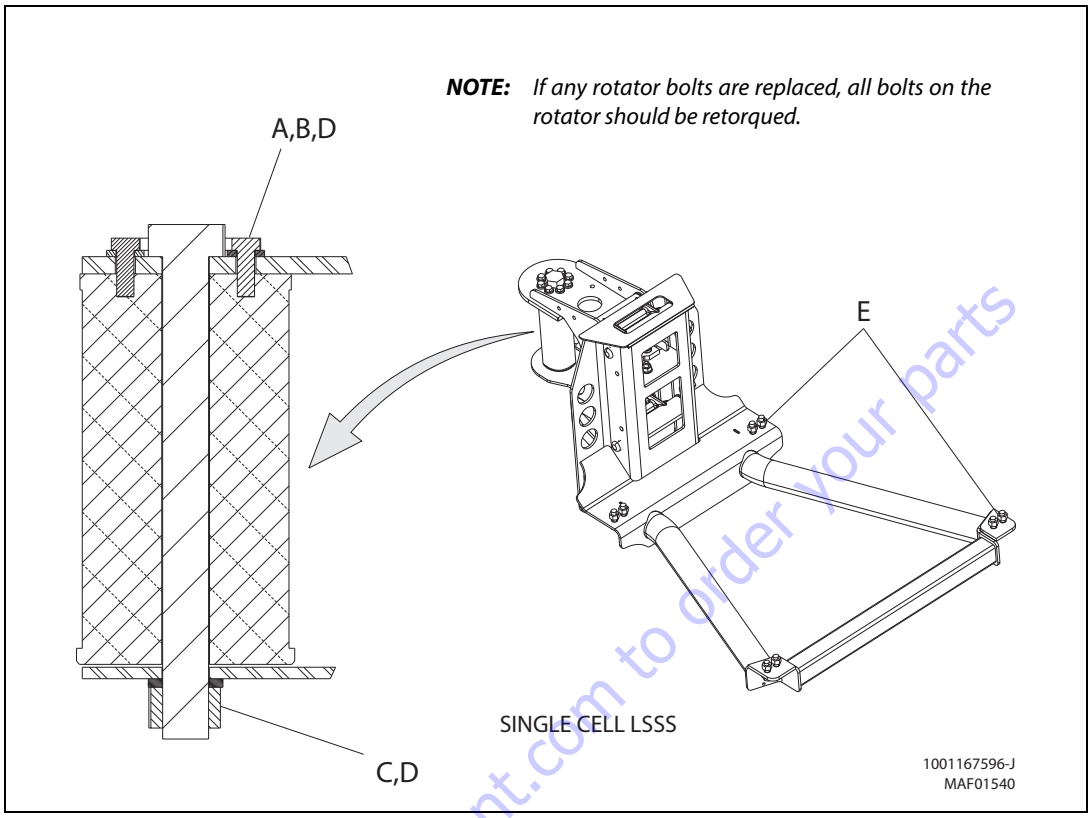


6. Connect the electrical harness to the platform control console.



A Torque to 40 ft. lbs. (55 Nm)
B Medium Strength Threadlocking Compound
C Torque to 586 ft. lbs. (795 Nm)
D Check torque every 150 hours of operation
E Torque to 75 ft. lbs. (102 Nm)

Figure 4-7. Platform Support Torque Values (Without LSS)



A Torque to 40 ft. lbs. (55 Nm)
B Medium Strength Threadlocking Compound
C Torque to 586 ft. lbs. (795 Nm)
D Check torque every 150 hours of operation
E Torque to 65 ft. lbs (88 Nm)

Figure 4-8. Platform Support Torque Values (Single Cell LSS)

4.3 MAIN BOOM POWERTRACK

Removal

1. Disconnect wiring harness connectors located in turntable.

NOTICE

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

2. Tag and disconnect hydraulic lines from connectors at boom assembly. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
3. Remove hydraulic lines and electrical cables from powertrack.
4. Using suitable lifting equipment, adequately support powertrack weight along entire length.

NOTE: *The powertrack weighs approximately 21 lb (9 kg).*

5. Remove bolt #1 securing the push tube on the fly boom section.
6. With powertrack supported and using all applicable safety precautions, remove bolts #2, and #3 securing rail to the carrier tube and push tube. Remove powertrack from boom section.

Installation

1. Using suitable lifting equipment, adequately support the powertrack weight along entire length.

NOTE: *The powertrack weighs approximately 21 lb (9 kg).*

2. With powertrack supported and using all applicable safety precautions, align and install bolts #2 and #3 securing rail to the carrier tube and push tube.
3. Install bolts #1 securing the push tube on the fly boom section.
4. Remove tag and reconnect all hydraulic lines and electrical cable to the powertrack.

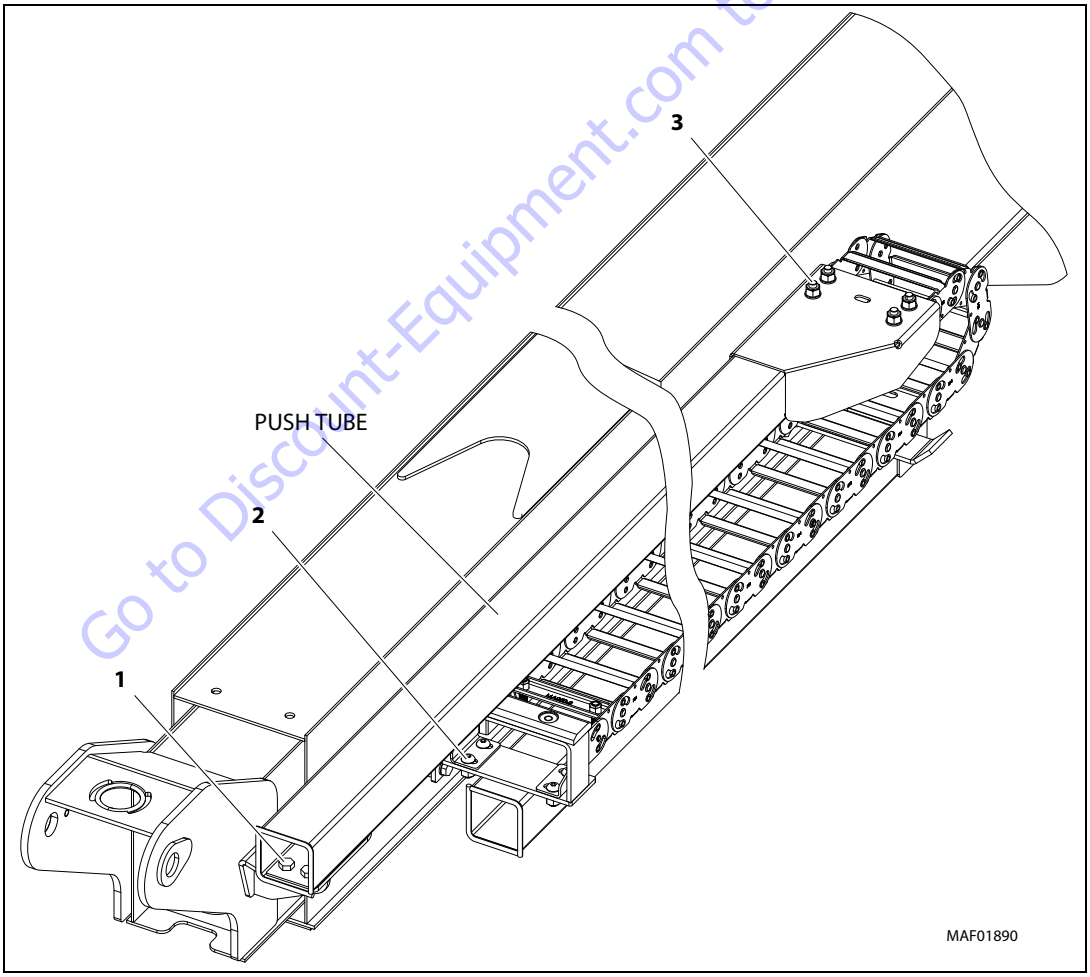


Figure 4-9. Location of Components - Main Boom Powertrack

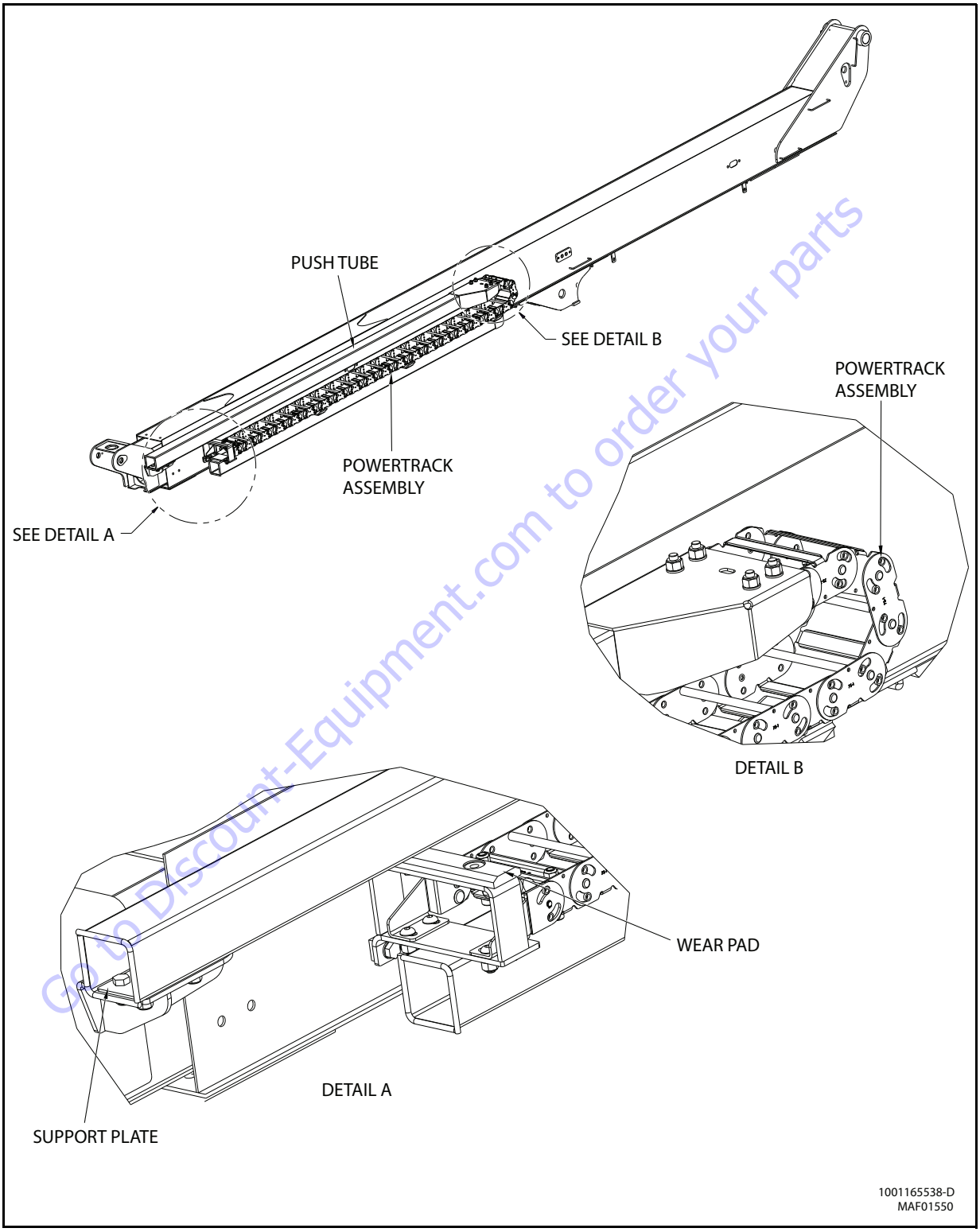


Figure 4-10. Powertrack Installation Main Boom

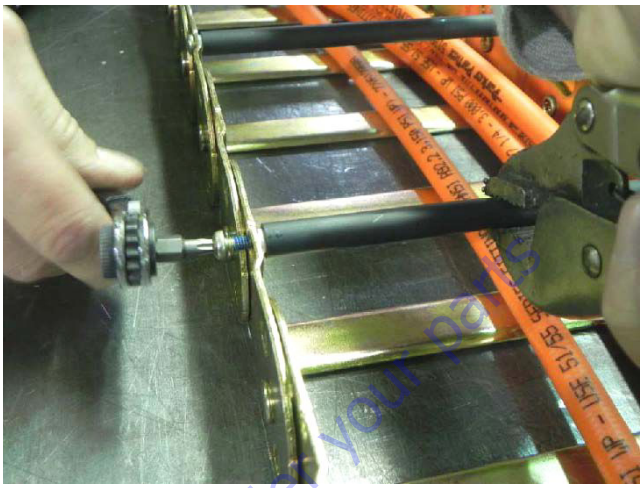
Powertrack Maintenance

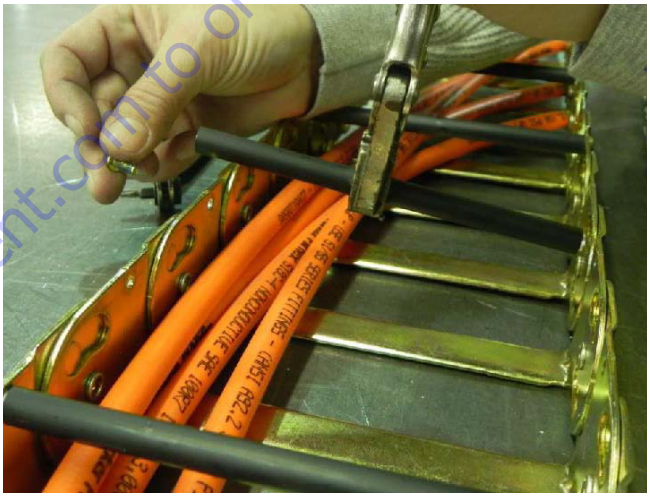
REMOVE LINK

NOTE: *Hoses shown in powertrack are for example only. Actual hose and cable arrangements are different.*

1. Clamp bar and poly roller tightly so they do not spin when removing screw. With a small 1/4 in. ratchet and a T-20 torx bit, remove 8-32 x 0.500 screw from one side.

2. Repeat step 1 and remove screw from other side of track. Remove bar/poly roller from powertrack.

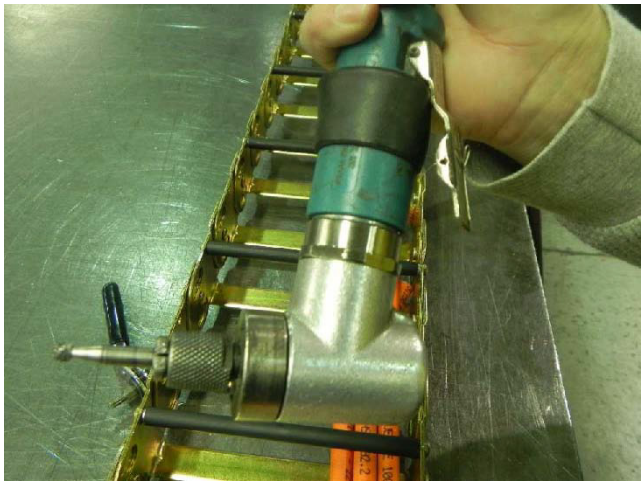




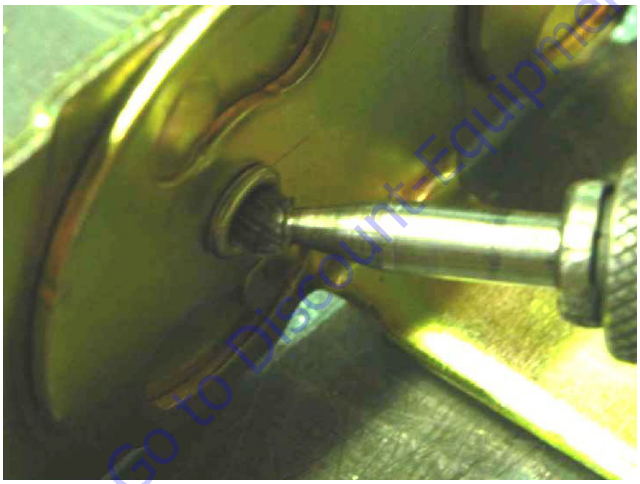
NOTICE

REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

1. To remove a link, rivets holding links together must be removed. Use a right-angle pneumatic die grinder with a 1/4 in. ball double cut bur attachment.

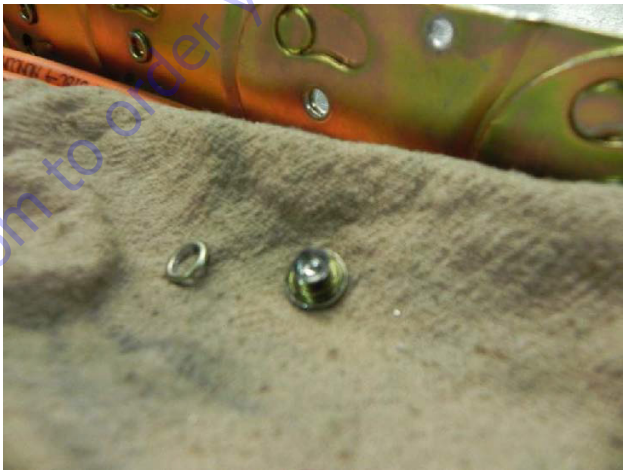


2. Insert tool into rolled over end of rivet. Grind out middle of rivet until rolled over part of rivet falls off. Repeat for all rivets to be removed.

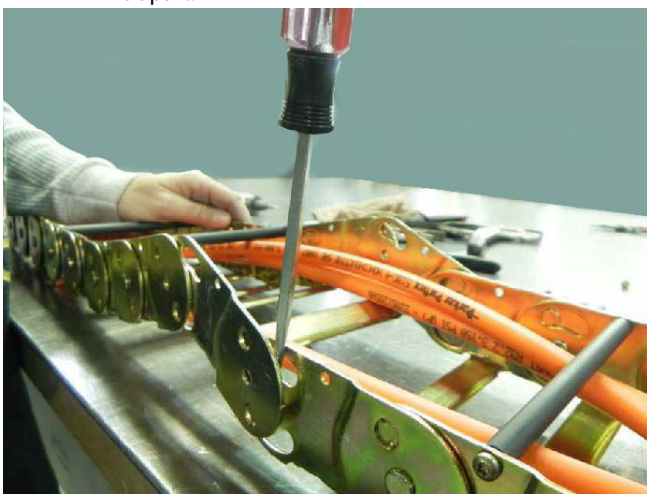


3. After grinding it may be necessary to use a center punch with a hammer to remove rivet.

NOTE: *It may be necessary to loosen fixed end brackets from machine to move track section enough to disconnect links.*



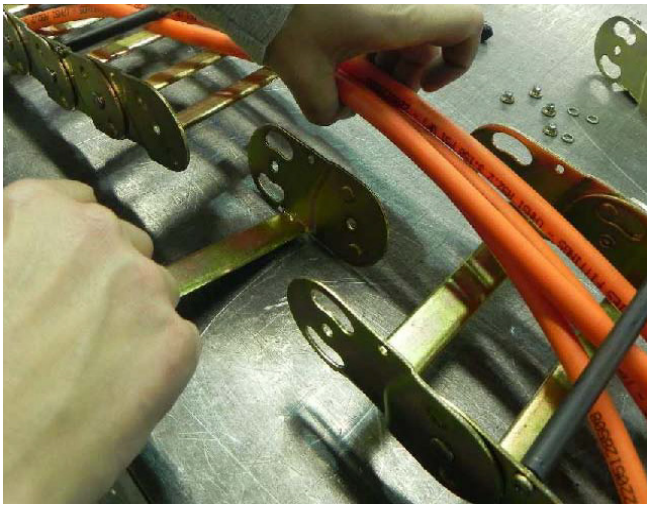
4. Insert flat head screwdriver between links. Twist and pull links apart.



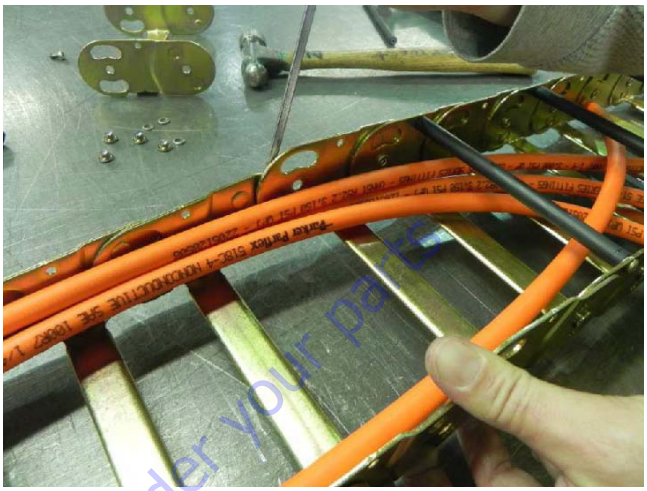
5. Remove link from other section of powertrack using screwdriver.

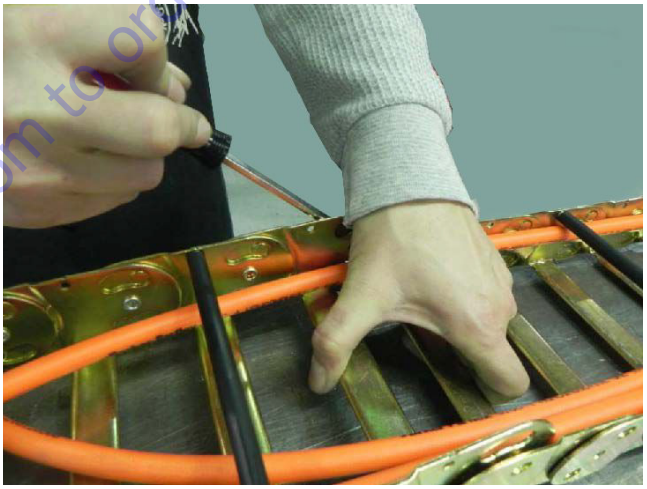
INSTALL NEW LINK

1. Squeeze cut-out end of new link into half-shear (female) end of track section.

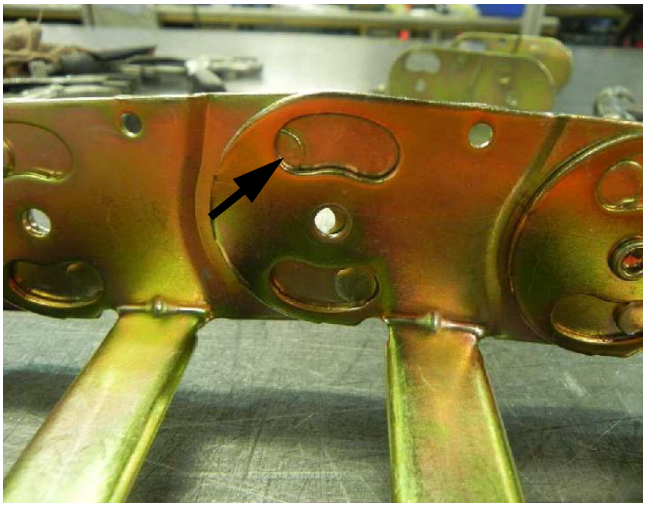


2. Spread half-shear (female) end of new link and slide cut-out end of track section into it. Use a screwdriver if necessary.

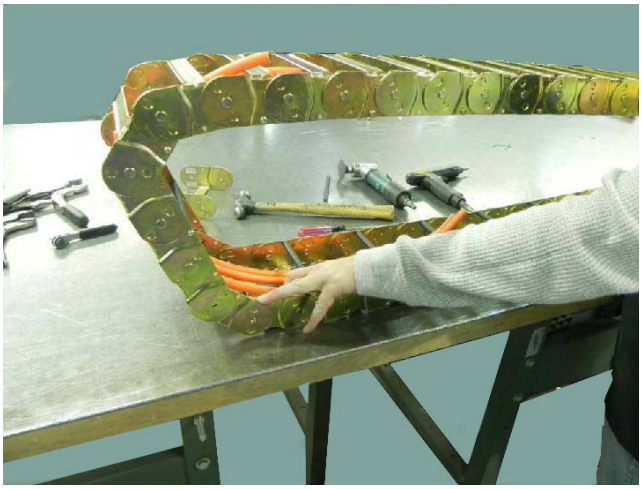


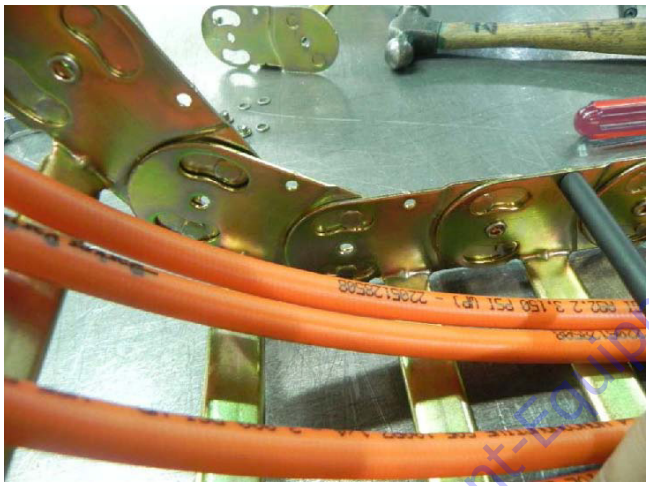


3. After new link is installed round half-shears do not fit properly in cut-outs.

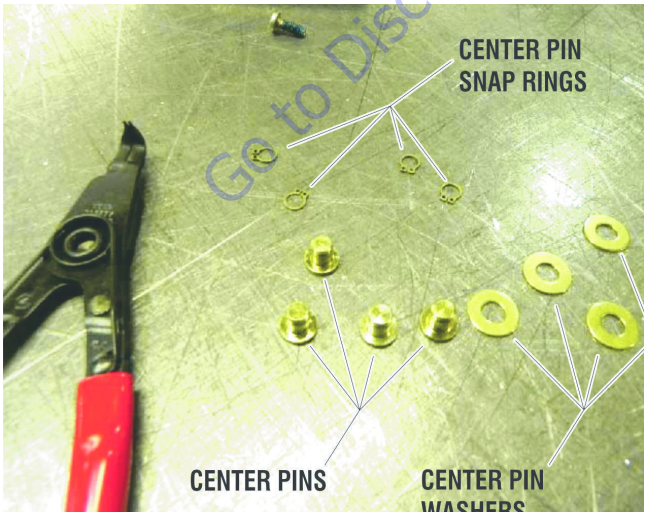


4. Pull moving end over track so new connection is positioned in curve of powertrack. Round half-shears will rotate into cut-outs.



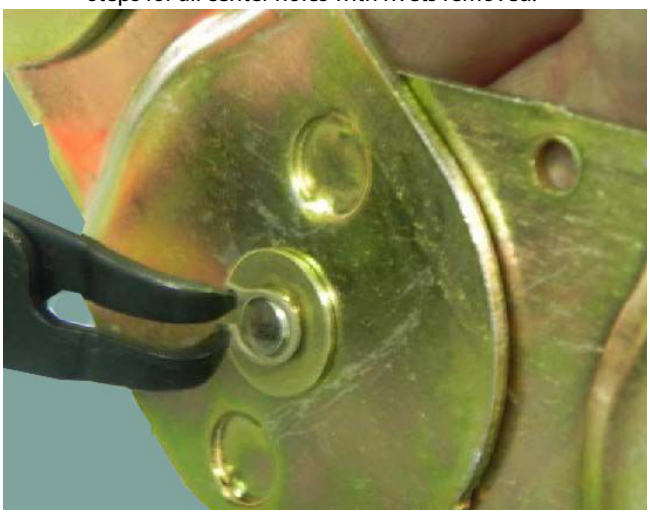


5. Parts shown below connect new link to powertrack.

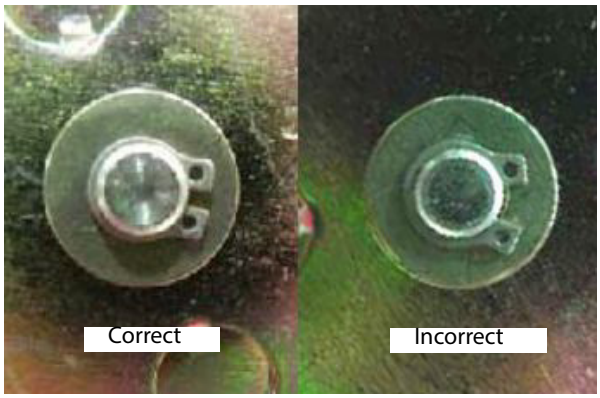


6. Push pin through center hole then slide washer on pin.

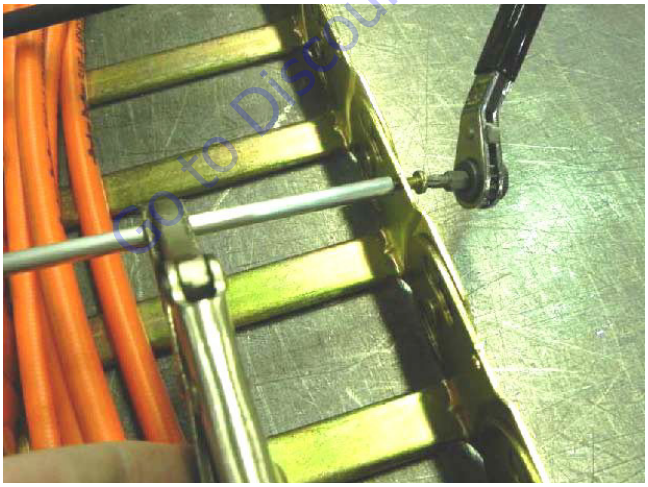
7. Install snap ring in groove on pin. Repeat pin installation steps for all center holes with rivets removed.



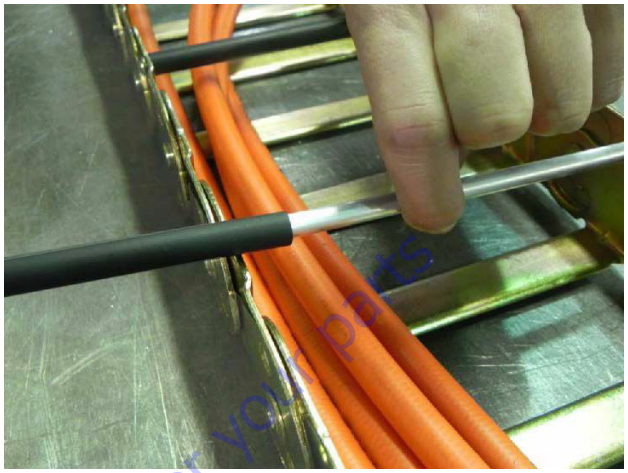
NOTE: *Make sure snap rings are seated in pin groove and closed properly.*



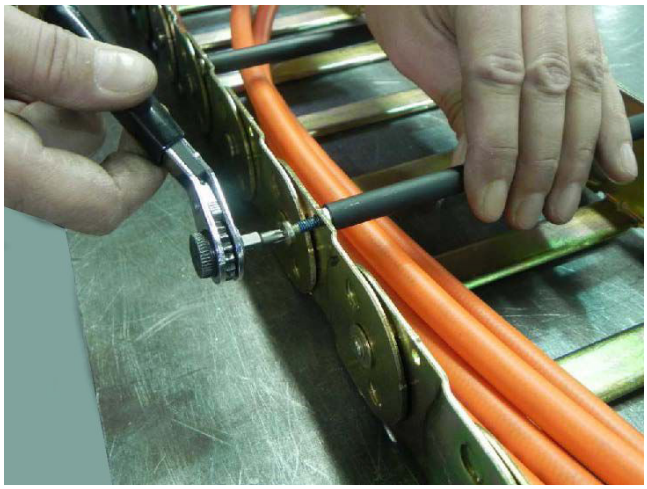
1. Install new 8-32 x 0.500 self-threading torx head screw in end of new aluminum round bar. Torque to 18-20 in. lbs. (2-2.25 Nm).



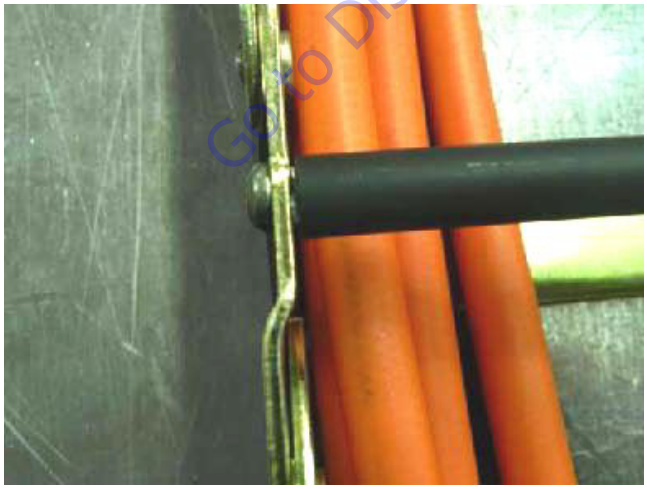
2. Pull up on other end of round bar and slide new poly roller on bar.



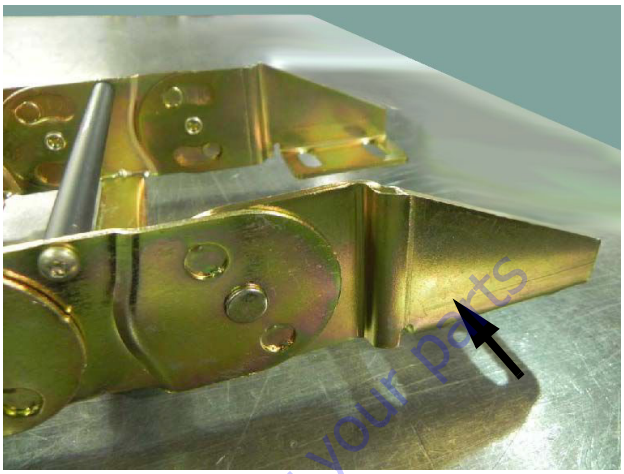
3. Install new 8-32 x 0.500 self threading screw on other side. Torque to 18-20 in. lbs. (2-2.25 Nm).



NOTE: *When tightening screws make sure screw head is seated against link with no space in between link and underside of screw head.*



REPLACE FIXED END BRACKETS



NOTICE

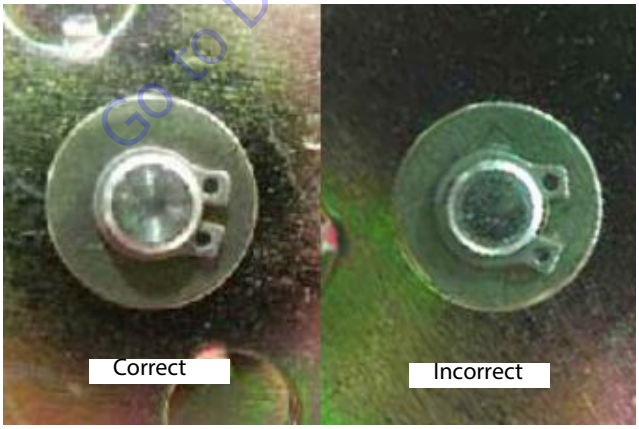
REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

1. Remove rivets as shown in link removal instructions on page 15.

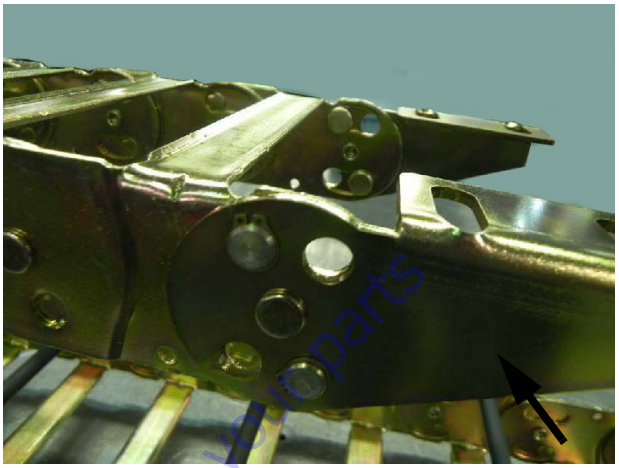
2. Parts used: Bracket Center Pin and Center Pin Snap Ring.

3. Take new bracket and install bracket center pin and snap ring. Repeat on other bracket if replacing it.

NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



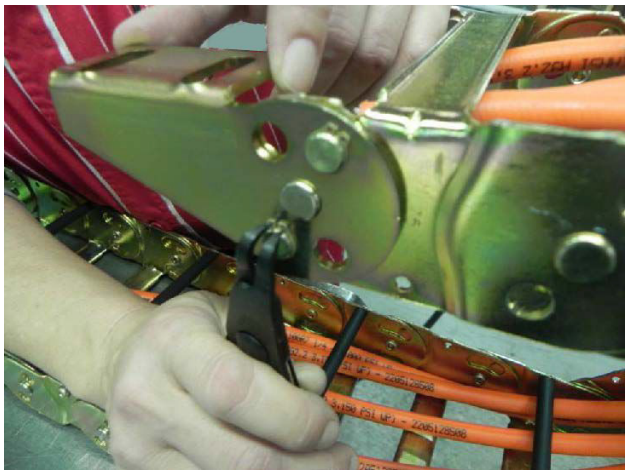
REPLACE MOVING END BRACKETS



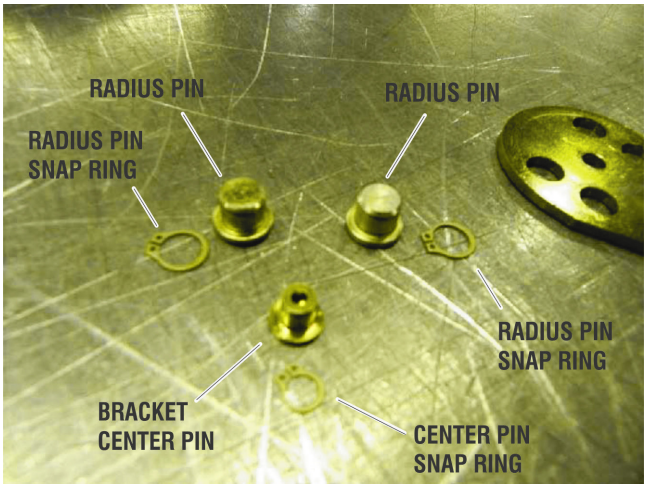
NOTICE

REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

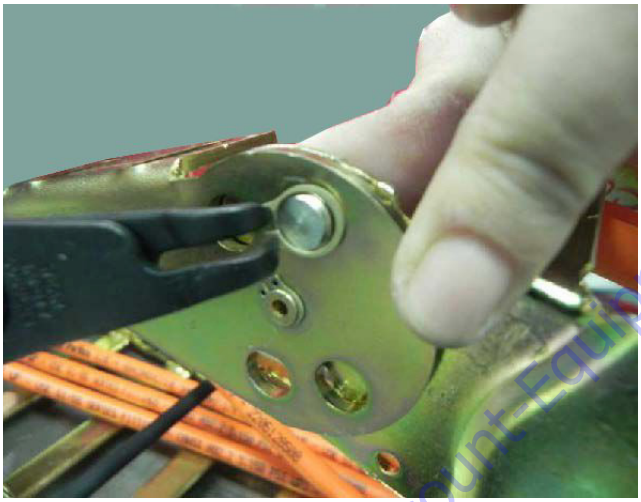
1. Remove existing pins and center rivet. Remove rivet as shown in link removal instructions on page 15. Repeat on other bracket if replacing it.



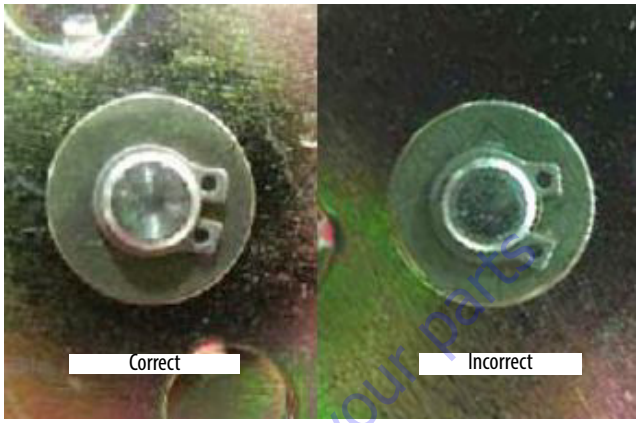
2. Install center pin with snap ring in new bracket.



3. Install radius pins and snap rings in original locations. Repeat with other moving end if replacing it.



NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



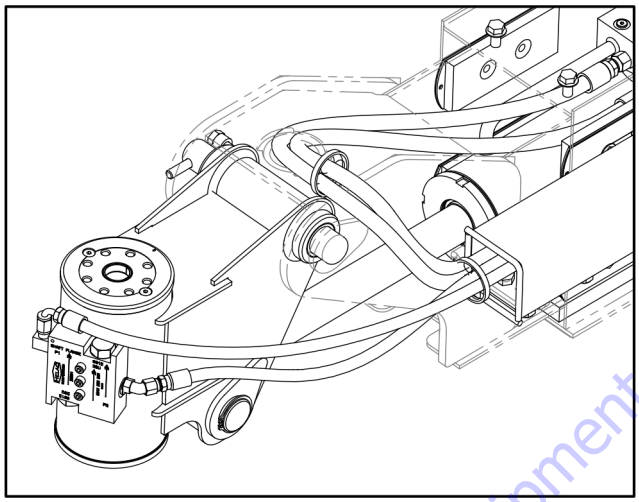
4. Make sure both brackets rotate correctly.

4.4 BOOM MAINTENANCE

Removal - 400SC

Remove platform, platform support, and rotator as an assembly as follows:

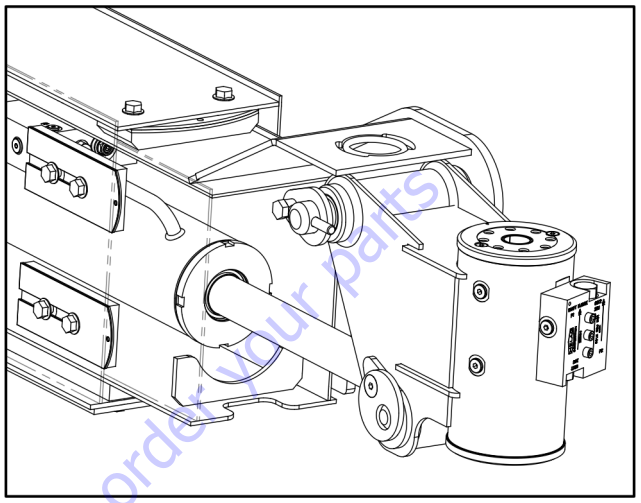
1. Disconnect electrical cable from platform control console.
2. Using an overhead crane or suitable lifting device, use nylon support straps to support the assembly.
3. Tag and disconnect hydraulic hoses running to the rotator and slave cylinder.



NOTE: *The platform, support, and rotator assembly will weigh approximately 150 to 170 kg (330 to 375 lb) depending upon platform configuration. These values DO NOT reflect any optional equipment attached to the platform.*

NOTE: *When removing retaining pin from rod end of the level cylinder, make sure cylinder is properly supported.*

4. Remove the hardware securing pin attaching level cylinder to rotator. Using a suitable brass drift and hammer, remove retaining pin from the rotator and level cylinder
5. Remove bolts and keeper pins that secure retaining pins attaching platform support to the boom. Using a suitable brass drift and hammer, remove retaining pins from the platform support and boom nose.



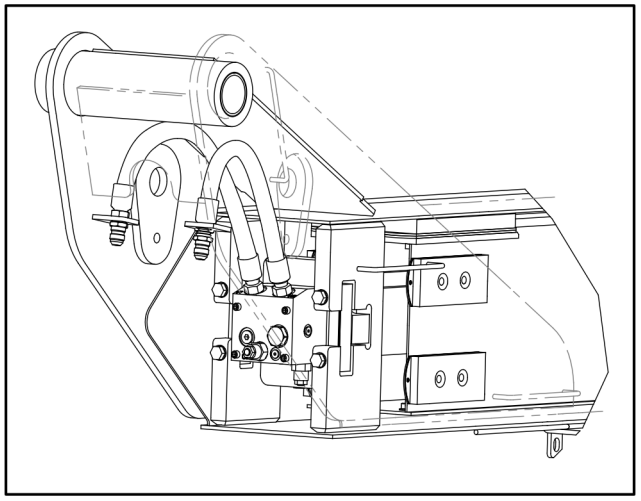
Remove boom from turntable as follows:

1. Disconnect wiring harness from ground control harness connector.

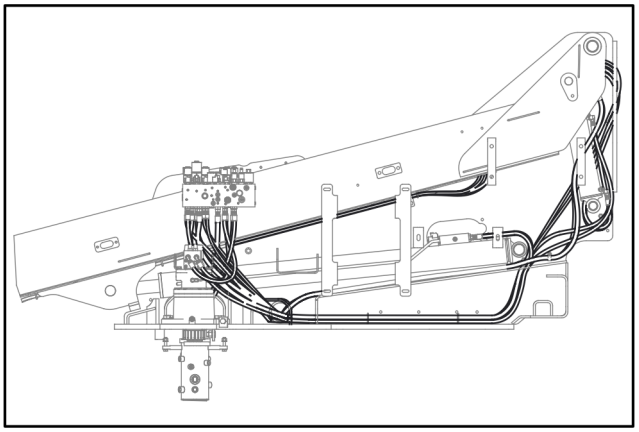
⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

2. Tag and disconnect hydraulic lines from telescope cylinder. Use a suitable container to catch escaping hydraulic fluid. Cap all hydraulic lines and ports.



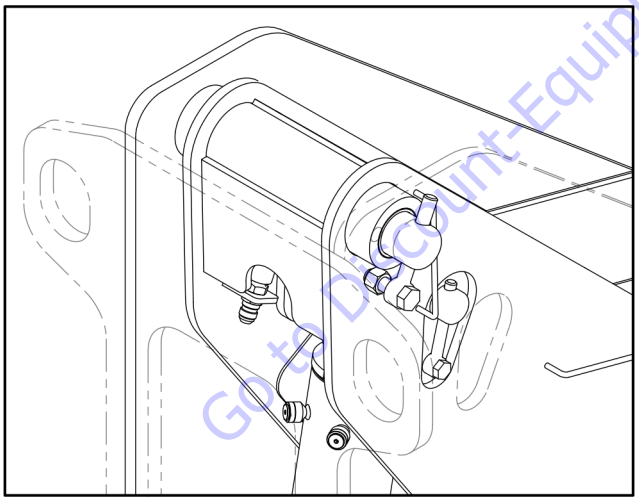
3. Tag and disconnect hydraulic lines from boom to the main control valve. Use a suitable container to catch escaping hydraulic fluid. Cap all hydraulic lines and ports.



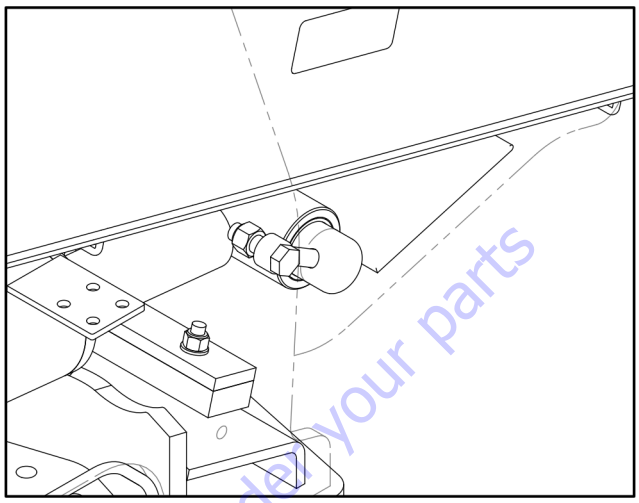
NOTE: *Boom weighs approximately 695 kg (1525 lb). This weight does not include platform or rotator.*

4. Using a suitable lifting device, adequately support boom weight along entire length.

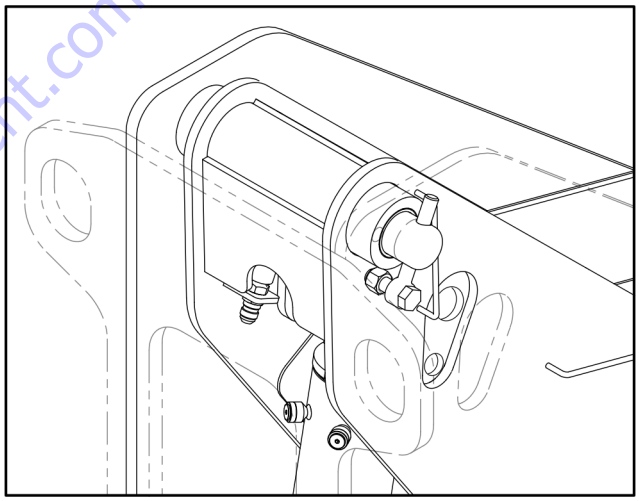
5. Tag and disconnect hydraulic hoses from boom master cylinder. Cap or plug all openings. Remove bolts and keeper pins securing upper master cylinder pivot pin. Remove pivot pin.



6. Ensure lift cylinder is adequately supported. Remove bolts and keeper pins securing lift cylinder pivot pin. Using a suitable brass drift and hammer, remove pivot pin from boom.



7. Remove hardware securing boom pivot pin. Using a suitable brass drift and hammer, remove pin from turntable.



8. Carefully lift boom assembly clear of turntable and lower to ground or suitable supported work surface.

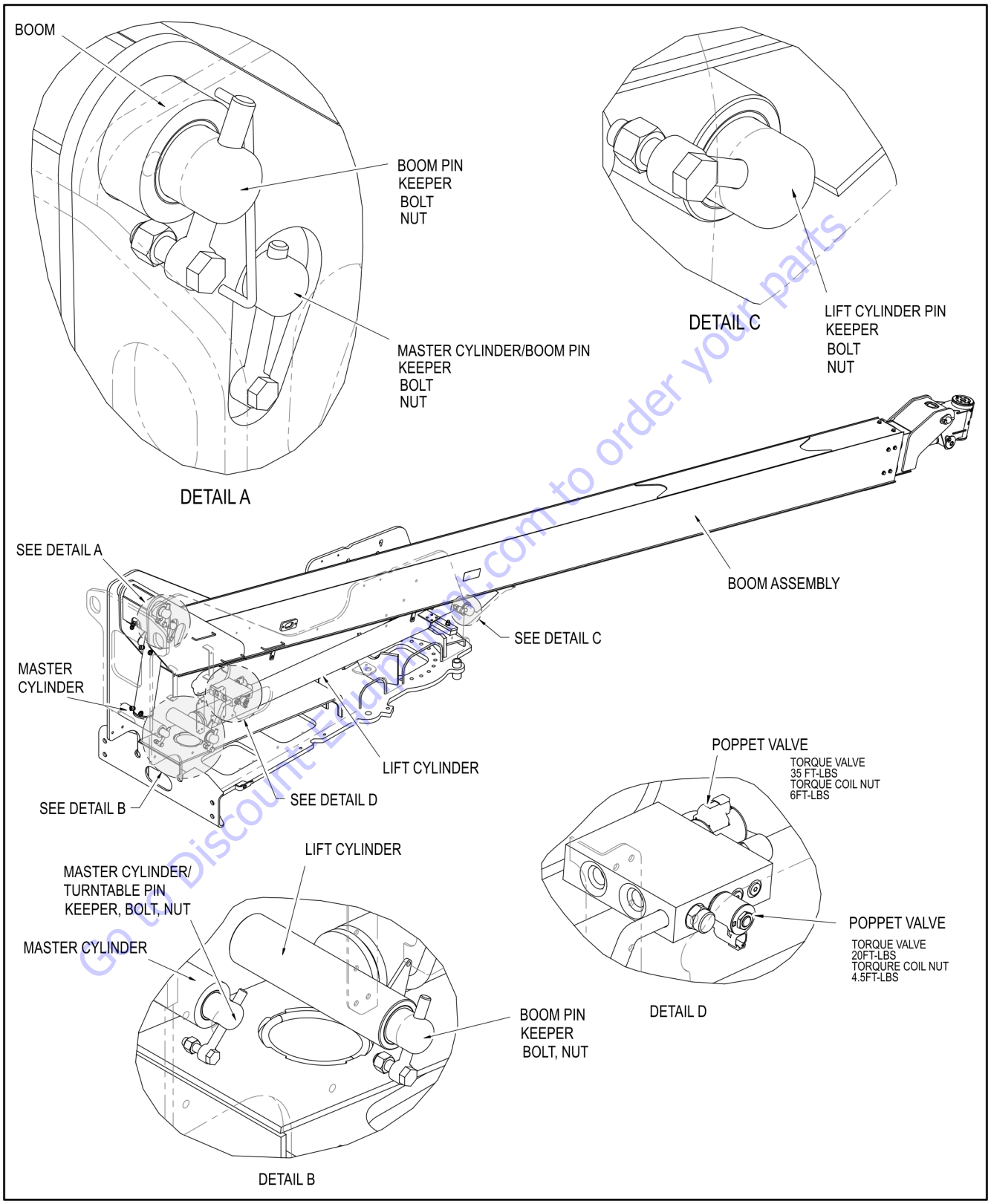


Figure 4-11. Boom Installation - 400SC

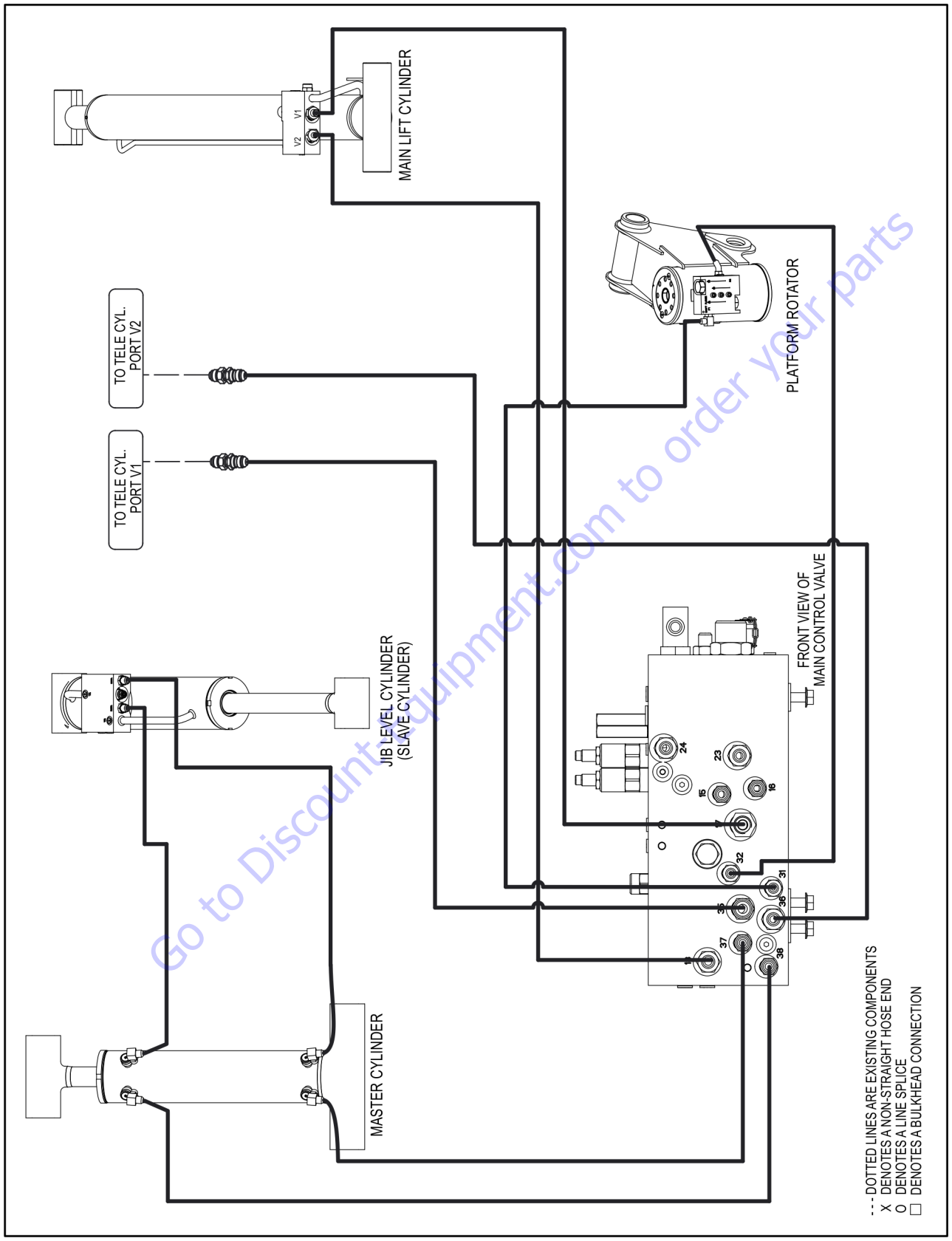


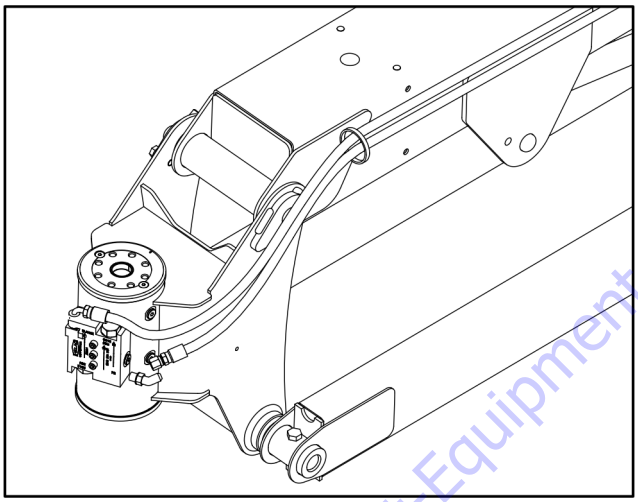
Figure 4-12. Boom Hydraulic System - 400SC

Removal - 460SJC

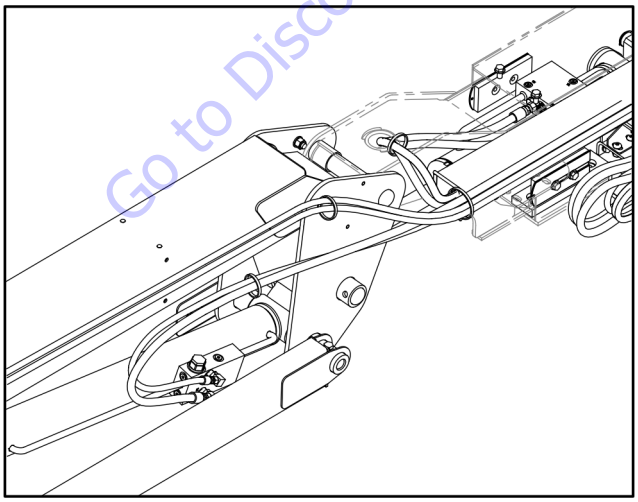
Remove the platform, platform support, rotator and jib as an assembly as follows:

NOTE: *The platform, support, rotator and jib assembly will weigh approximately 650 to 700 lb (300 to 320 kg) depending upon platform configuration. These values DO NOT reflect any optional equipment attached to the platform.*

1. Disconnect electrical cables from the platform control console.
2. Using an overhead crane or suitable lifting device, use nylon support straps to support the assembly.
3. Tag and disconnect hydraulic hoses running to the rotator.

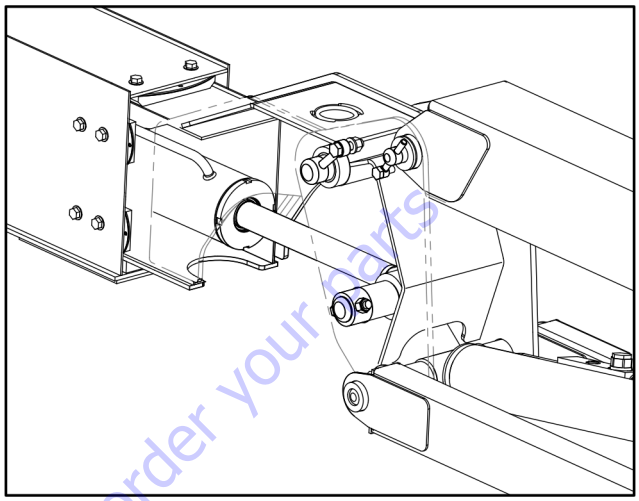


4. Tag and disconnect the hydraulic hoses running to the jib lift cylinder and level cylinder.

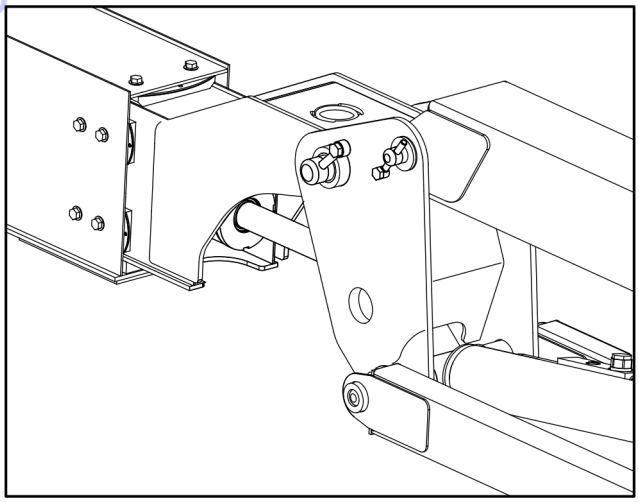


NOTE: *When removing retaining pin from rod end of the level cylinder, make sure cylinder is properly supported.*

5. Remove bolts and keeper pins that secure the retaining pins attaching the slave level cylinder to the jib. Using a suitable brass drift and hammer, remove the retaining pin form the jib.



6. Remove bolts and keeper pins that secure the retaining pin attaching the jib pivot pin to the boom. Using a suitable brass drift and hammer, remove the retaining pin from the jib and boom nose.



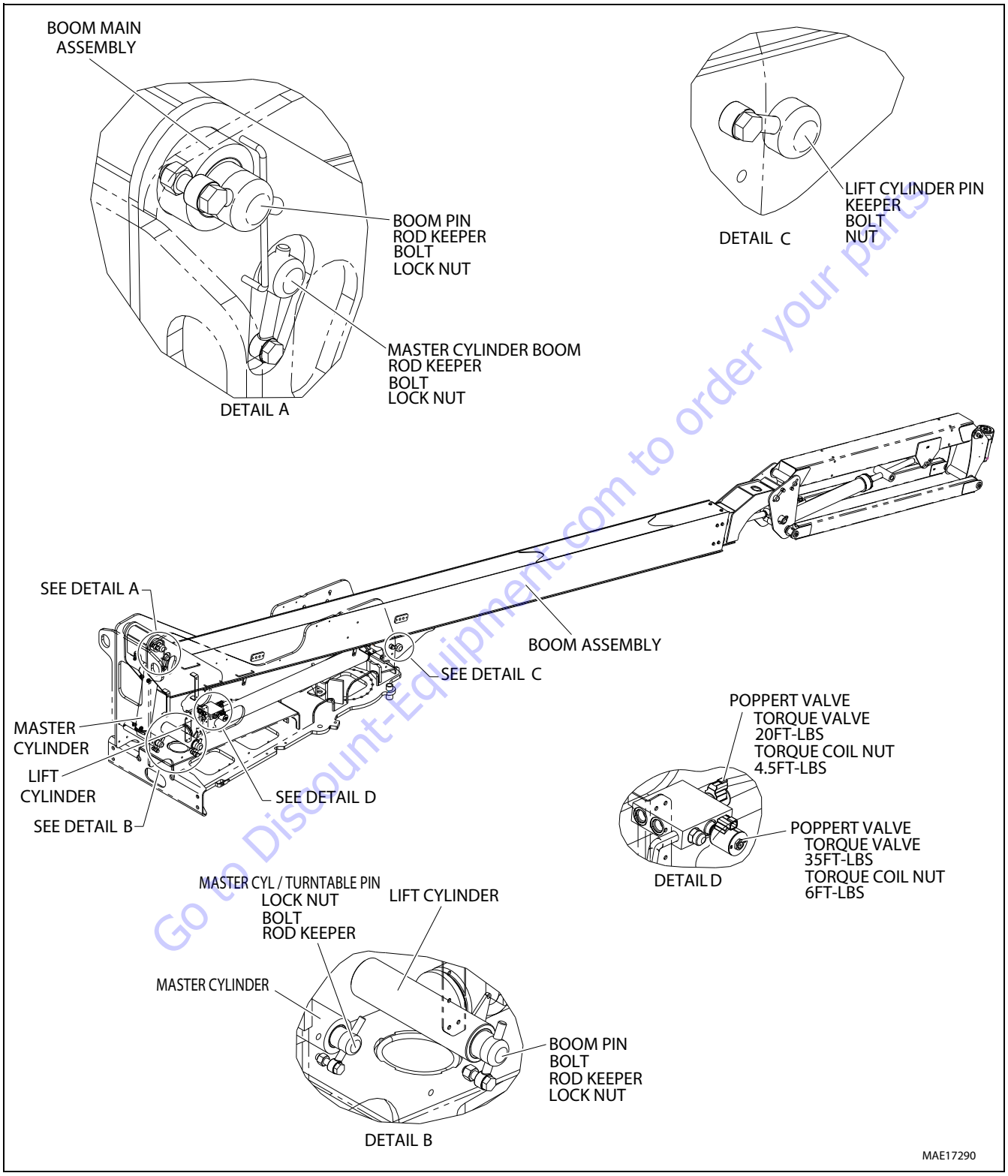


Figure 4-13. Boom Installation - 460SJC

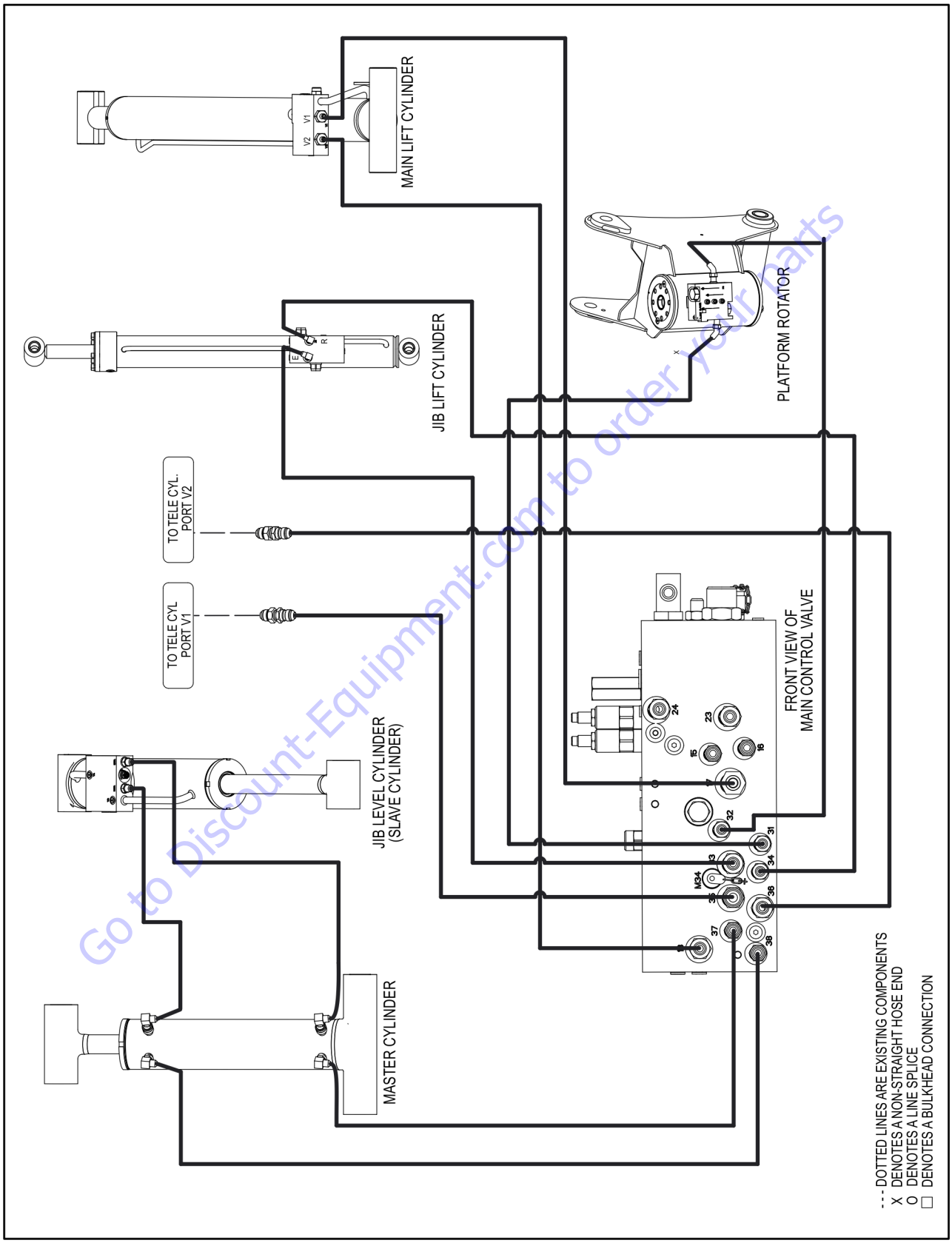


Figure 4-14. Boom Hydraulic System - 460SJC

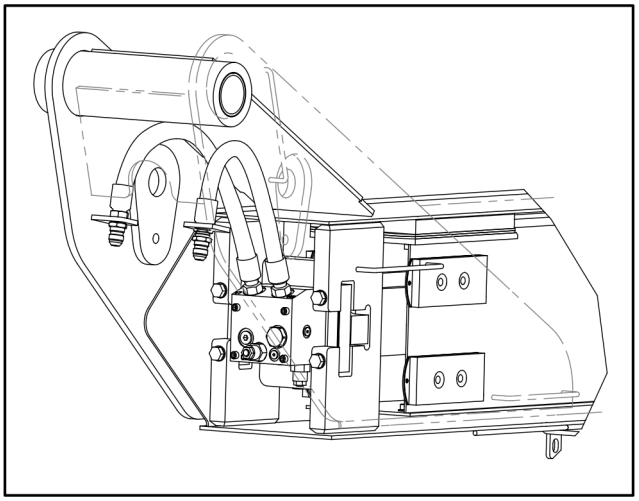
Remove boom from turntable as follows:

1. Disconnect wiring harness from ground control harness connector.

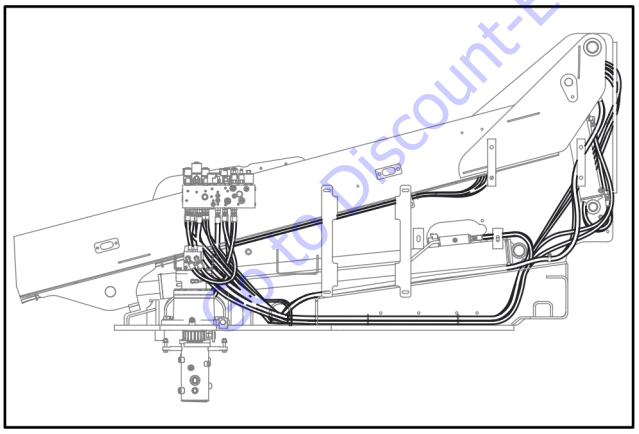
⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

2. Tag and disconnect hydraulic lines from telescope cylinder. Use a suitable container to catch escaping hydraulic fluid. Cap all hydraulic lines and ports.

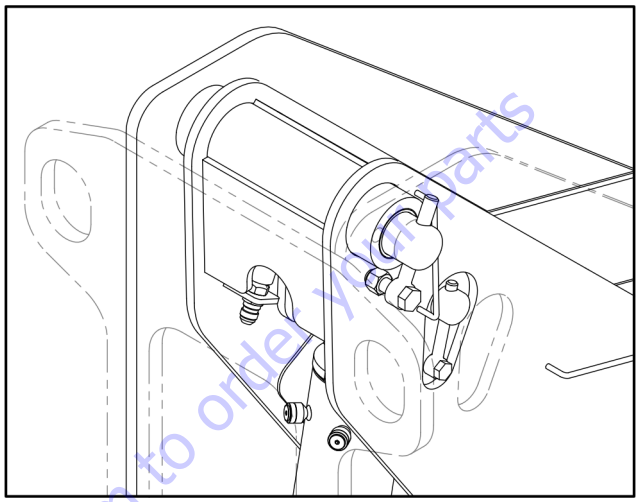


3. Tag and disconnect hydraulic lines from boom to the main control valve. Use a suitable container to catch escaping hydraulic fluid. Cap all hydraulic lines and ports.

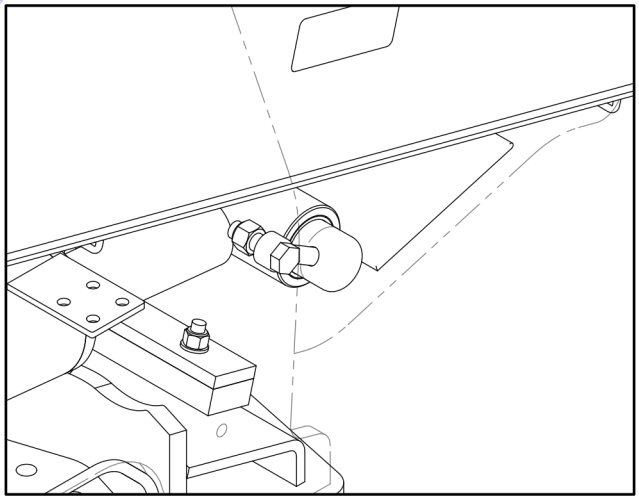


NOTE: *The 460SJC boom weighs approximately 740 kg (1630 lb). This weight does not include platform, rotator or jib.*

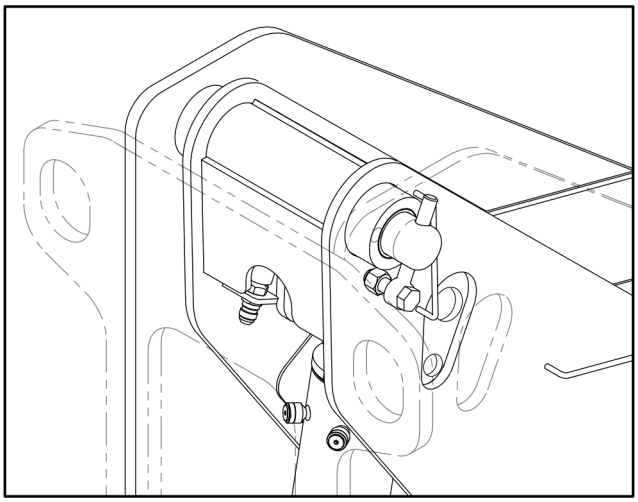
4. Using a suitable lifting device, adequately support boom weight along entire length.
5. Tag and disconnect hydraulic hoses from boom master cylinder. Cap or plug all openings. Remove bolts and keeper pins securing upper master cylinder pivot pin. Remove pivot pin.



6. Ensure lift cylinder is adequately supported. Remove bolts and keeper pins securing lift cylinder pivot pin. Using a suitable brass drift and hammer, remove pivot pin from boom.



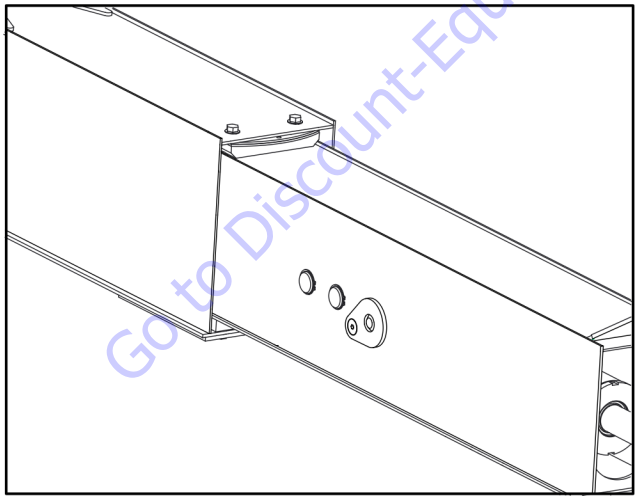
7. Remove hardware securing boom pivot pin. Using a suitable brass drift and hammer, remove pin from turntable.



8. Carefully lift boom assembly clear of turntable and lower to ground or suitable supported work surface.

Disassembly

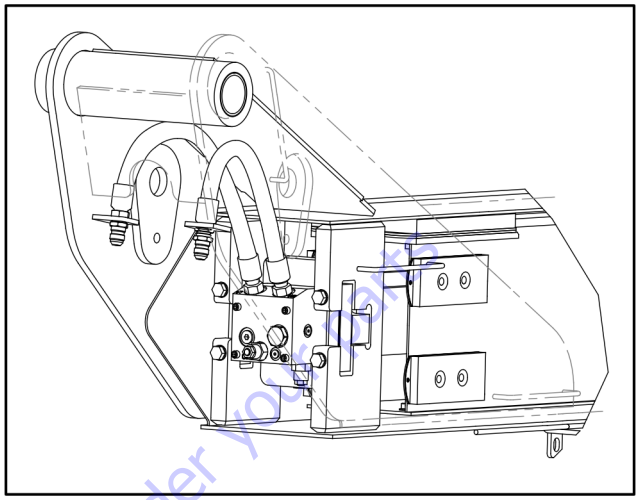
1. Using a portable power source, attach hose to telescope cylinder port block. Using all applicable safety precautions, activate hydraulic system and extend cylinder to gain access to cylinder rod retaining pin. Shut down hydraulic system.



2. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port.

3. Remove hardware securing telescope cylinder to fly boom section. Remove pin from fly.

4. Remove hardware securing telescope cylinder to base boom section.



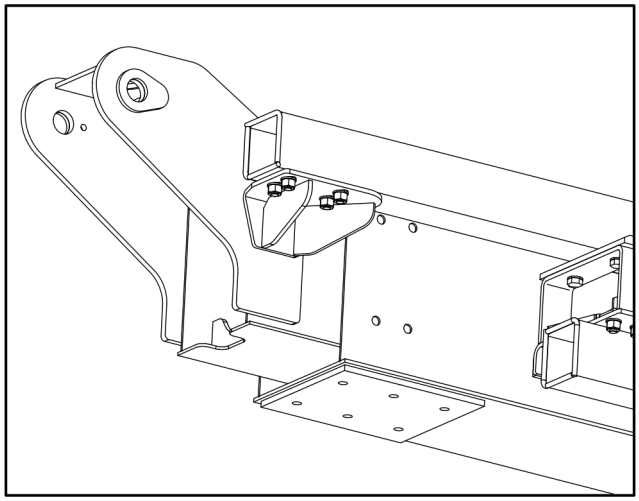
NOTE: *Telescope cylinder weighs approximately 160 kg (350 lb).*

5. Using a suitable lifting device, remove telescope cylinder from boom sections.

6. Tag all hoses and wires from front of fly boom and bottom of base boom for reassembly.

7. Remove hardware securing front wear pads on base boom section. Remove wear pads.

8. Remove hardware securing powertrack to front end of fly boom section.



9. Using a suitable lifting device, remove fly boom from boom section.

NOTE: *Fly boom section weighs approximately 135 kg (300 lb).*

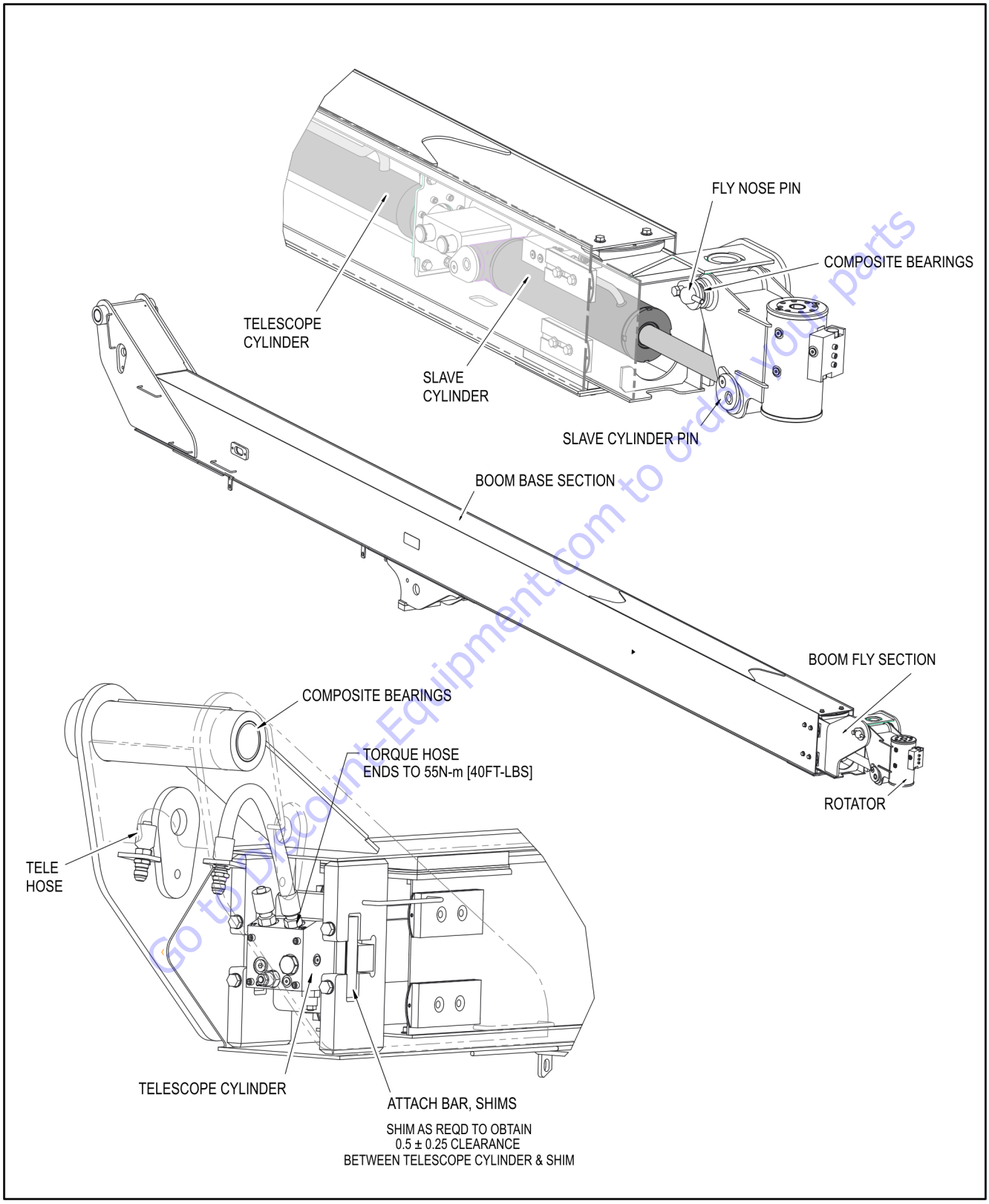
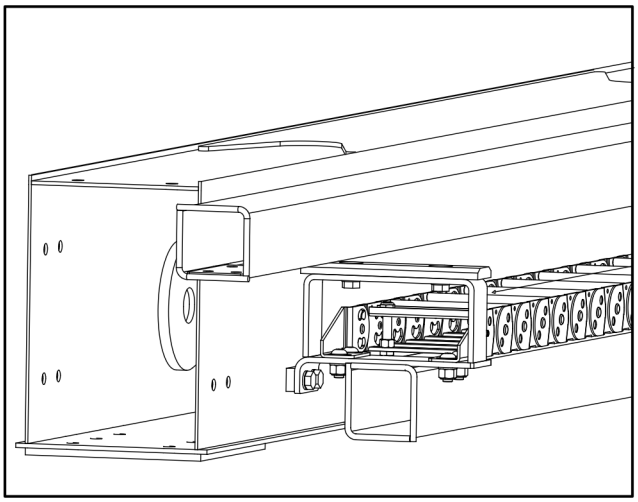


Figure 4-15. Boom Assembly

10. If necessary, remove wear pads from rear of fly boom section.

11. If necessary, remove hydraulic lines and electrical cables from powertrack.

12. If necessary, remove hardware securing powertrack to the base boom section. Remove powertrack.



Inspection

1. Inspect all boom pivot pins for wear, scoring or other damage, and for tapering or ovality. Replace pins as necessary.

2. Inspect lift cylinder pins for wear, scoring or other damage, and for tapering or ovality. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.

3. Inspect telescope cylinder rod attach pin for wear, scoring or other damage. Replace pin as necessary.

4. Inspect inner diameter of boom pivot bushings for scoring, distortion, wear or other damage. Replace bushings as necessary.

5. Inspect wear pads for wear.

6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.

7. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly

1. Install power track to the attach point on base boom section. Secure power track with attaching hardware.

2. Install hydraulic lines and electrical cables in power track as tagged during disassembly.

3. Install wear pads to the rear of fly section.

4. Using suitable lifting equipment, slide fly section into the base section until the telescope cylinder attach point aligns with holes in side of base section.

NOTE: *Fly boom section weighs approximately 135 kg (300 lb).*

5. Measure distance between telescope cylinder port block attach point on base boom section and attach point on fly boom section.

6. Connect a suitable auxiliary hydraulic power source to the telescope cylinder port block.

7. Extend telescope cylinder the distance of the two attach points.

8. Secure sling and lifting device at telescope cylinder's approximate center of gravity Lift cylinder to aft end of boom assembly.

NOTE: *Telescope cylinder weighs approximately 160 kg (350 lb).*

9. Slowly slide the telescope cylinder into boom assembly, align rod end with attach point in fly section. Insert pin and secure with retaining ring.

10. Align bolt holes at aft end of base boom section with telescope cylinder port block. Secure telescope cylinder with hardware.

11. Install wear pads at end of base boom section. Using shims, set adjustable wear pads to zero clearance. Adjust pads alternately side to side, so fly boom section is centered in base boom section.

12. Retract boom section fully. Using shims, adjust wear pads at aft end of boom section to zero clearance. Adjust pads alternately side to side, so that fly boom section is centered in base boom section.

13. Disconnect auxiliary power source from telescope cylinder.

Installation

1. Using suitable lifting equipment, position boom assembly on turntable so boom pivot holes in both boom and turntable are aligned.
2. Install boom pivot pin, ensuring location of hole in pivot pin aligns with attach point on upright.
3. Using all applicable safety precautions, operate lifting equipment to position boom lift cylinder so holes in cylinder rod end are aligned with the one in the turntable. Insert cylinder pins.
4. If necessary, gently tap pins into position with a soft headed mallet, ensure attach holes in pins are aligned with attach holes in boom structure. Secure with hardware.
5. Connect all hosing and wiring.
6. Install platform to boom assembly.
7. Connect all hosing and wiring at platform control station.
8. Using all safety precautions, operate machine systems and extend and retract boom for four or five cycles. Check for proper operation.
9. Shut down machine systems and check for leaks.

4.5 JIB - 460SJC

NOTE: *Using a suitable lifting device, support the jib.*

Removal

1. For platform and support removal see Section 4.2 - Platform.
2. Position the articulating jib boom level with ground.

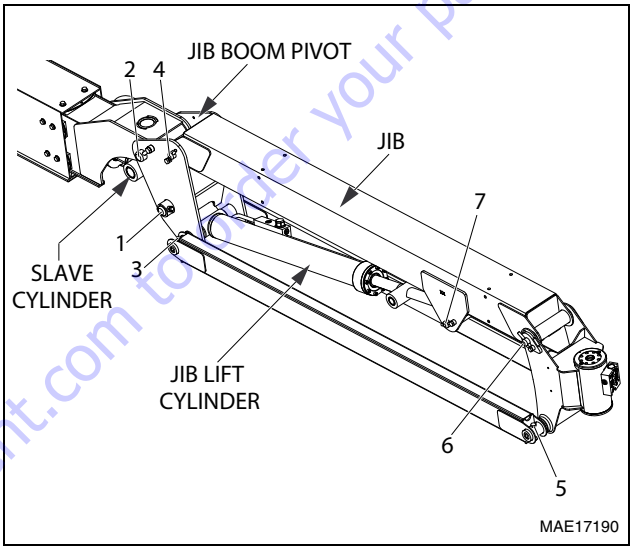
NOTICE

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

3. Tag and disconnect hydraulic lines from level cylinder and lift cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
4. Remove mounting hardware from slave leveling cylinder pin #1. Using a suitable brass drift and hammer, remove the cylinder pin from jib assembly.
5. Remove mounting hardware from jib assembly boom pivot pin #2. Using a suitable brass drift and hammer, remove the pivot pin from boom assembly.

Disassembly

1. Remove mounting hardware from articulating jib boom pivot pins #3 and #4. Using a suitable brass drift and hammer, remove the pins from articulating jib boom pivot weldment.
2. Remove mounting hardware from rotator support pins #5 and #6. Using a suitable brass drift and hammer, remove the pins from rotator support.
3. Remove mounting hardware from lift cylinder pin #7. Using a suitable brass drift and hammer, remove the cylinder pin from articulating jib boom.



Inspection

NOTE: *When inspecting pins and bearings Refer to Section 2.5 - Pins and Composite Bearing Repair Guidelines.*

1. Inspect fly boom pivot pin for wear, scoring, tapering and ovality, or other damage. Replace pins as necessary.
2. Inspect fly boom pivot attach points for scoring, tapering and ovality, or other damage. Replace pins as necessary.
3. Inspect inner diameter of fly boom pivot bearings for scoring, distortion, wear, or other damage. Replace bearings as necessary.
4. Inspect lift cylinder attach pin for wear, scoring, tapering and ovality, or other damage. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.
5. Inspect inner diameter of rotator attach point bearings for scoring, distortion, wear, or other damage.
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.

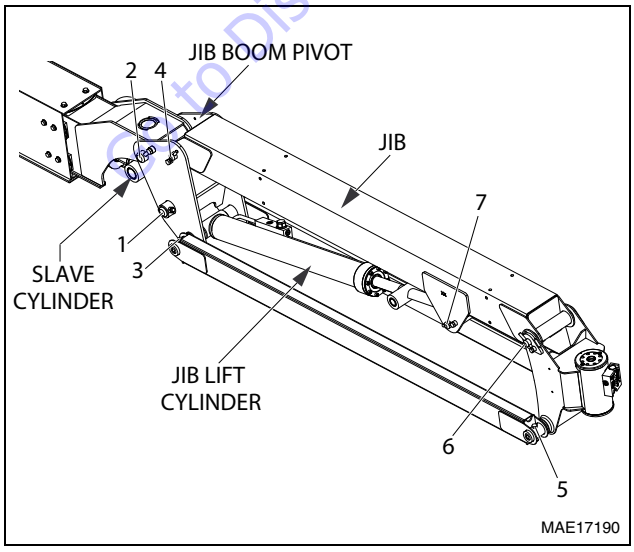
7. Inspect structural units of jib boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly

1. Align lift cylinder with attach holes in jib assembly. Using a soft head mallet, install cylinder pin #7 into jib and secure with mounting hardware.
2. Align rotator support with attach hole in jib assembly. Using a soft head mallet, install rotator support pin #6 into jib and secure with mounting hardware.
3. Align bottom tubes with attach holes in rotator support. Using a soft head mallet, install rotator support pin #5 into jib assembly and secure with mounting hardware.
4. Align jib assembly with attach hole in jib boom pivot weldment. Using a soft head mallet, install rotator support pin #4 into jib assembly and secure with mounting hardware.
5. Align bottom tubes with attach holes in jib boom pivot weldment. Using a soft head mallet, install rotator support pin #3 into jib boom pivot weldment and secure with mounting hardware.

Installation

1. Align jib boom pivot weldment with attach holes in fly boom assembly. Using a soft head mallet, install pivot pin #2 into fly boom assembly and secure with mounting hardware.
2. Align the slave leveling cylinder with attach holes in jib boom pivot weldment. Using a soft head mallet, install slave leveling cylinder pin #1 into articulating jib boom pivot weldment and secure with mounting hardware.



4.6 BOOM CLEANLINESS GUIDELINES

Following are guidelines for internal boom cleanliness for machines that are used in excessively dirty environments.

1. JLG recommends use of the JLG Hostile Environment Package if available to keep internal portions of a boom cleaner and to help prevent dirt and debris from entering the boom. This package reduces amount of contamination which can enter the boom but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.
2. JLG recommends you follow all guidelines for servicing your equipment in accordance with instructions outlined in the JLG Service & Maintenance Manual for your machine. Periodic maintenance and inspection is vital to proper operation of the machine. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.
3. Debris and foreign matter inside the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in JLG Service & Maintenance Manuals.
4. The first attempt to remove debris from inside the boom must be to utilize pressurized air to blow debris toward the nearest exiting point from the boom. Make sure all debris is removed before operating machine.
5. If pressurized air cannot dislodge debris, then water with mild solvents applied via a pressure washer can be used. Again the method is to wash the debris toward the nearest exiting point from the boom. Make sure all debris is removed, that no “puddling” of water has occurred, and boom internal components are dry prior to operating machine. Make sure you comply with all federal and local laws for disposing wash water and debris.
6. If pressurized air or washing does not remove debris, disassemble boom in accordance to instructions outlined in the JLG Service & Maintenance Manual to remove debris.

4.7 BOOM SHIMMING PROCEDURE

NOTE: *When installing wear pads, wear pad bolt lengths may need to be adjusted as shim thicknesses are adjusted. Bolt lengths should be flush or up to one thread below surface of insert.*

1. Measure and take note of the inside width and inside height of the base boom opening for reference later in this procedure.

2. Install side wear pads on fly boom and shim as required to match the corresponding dimension recorded in Step 1 within +0/-1.2 mm. Divide shims as evenly as possible between sides of the boom. The number of shims installed at position #1 must match position #2, and position #3 must match position #4 as shown below. Take note to how many shims are installed in each position.

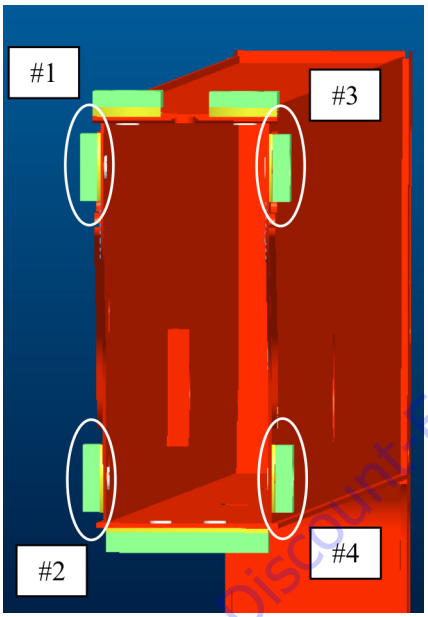


Figure 4-16. Fly Boom Wear Pads

3. Install top wear pads and shims on fly boom.

4. Install bottom wear pads on fly boom and shim as required to obtain the total base boom dimension within +0/-1.2 mm of the corresponding dimension from Step 1.

5. Slide fly boom into base boom, leaving 1 to 2 meters exposed.

6. Install bottom wear pads and shims in end of base boom.

7. Instal side pads and shims in base boom. Distribute shims to each side to match distribution noted in Step 2. Positions #5/6 must match positions #1/2. Positions #7/8 must match positions #3/4 (See Figure 4-16. and Figure 4-17.). Verify no more shims will fit on either side.

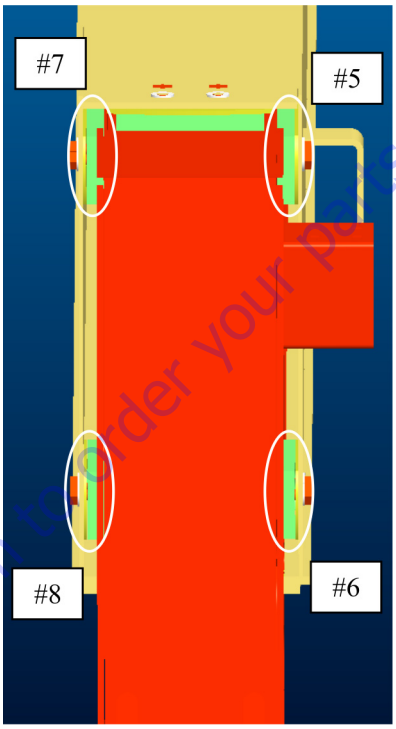


Figure 4-17. Base Boom Wear Pads

NOTE: *Do not use a wedge to install more shims than will fit with use of a pry bar. This may result in boom being shimmed too tight. Pry bars should only be used to finish installing a shim that can be installed by hand more than half of its length.*

8. Install top wear pads and shims in base boom leaving a gap of 0mm to 1.2mm between top of fly boom and inside of base boom.

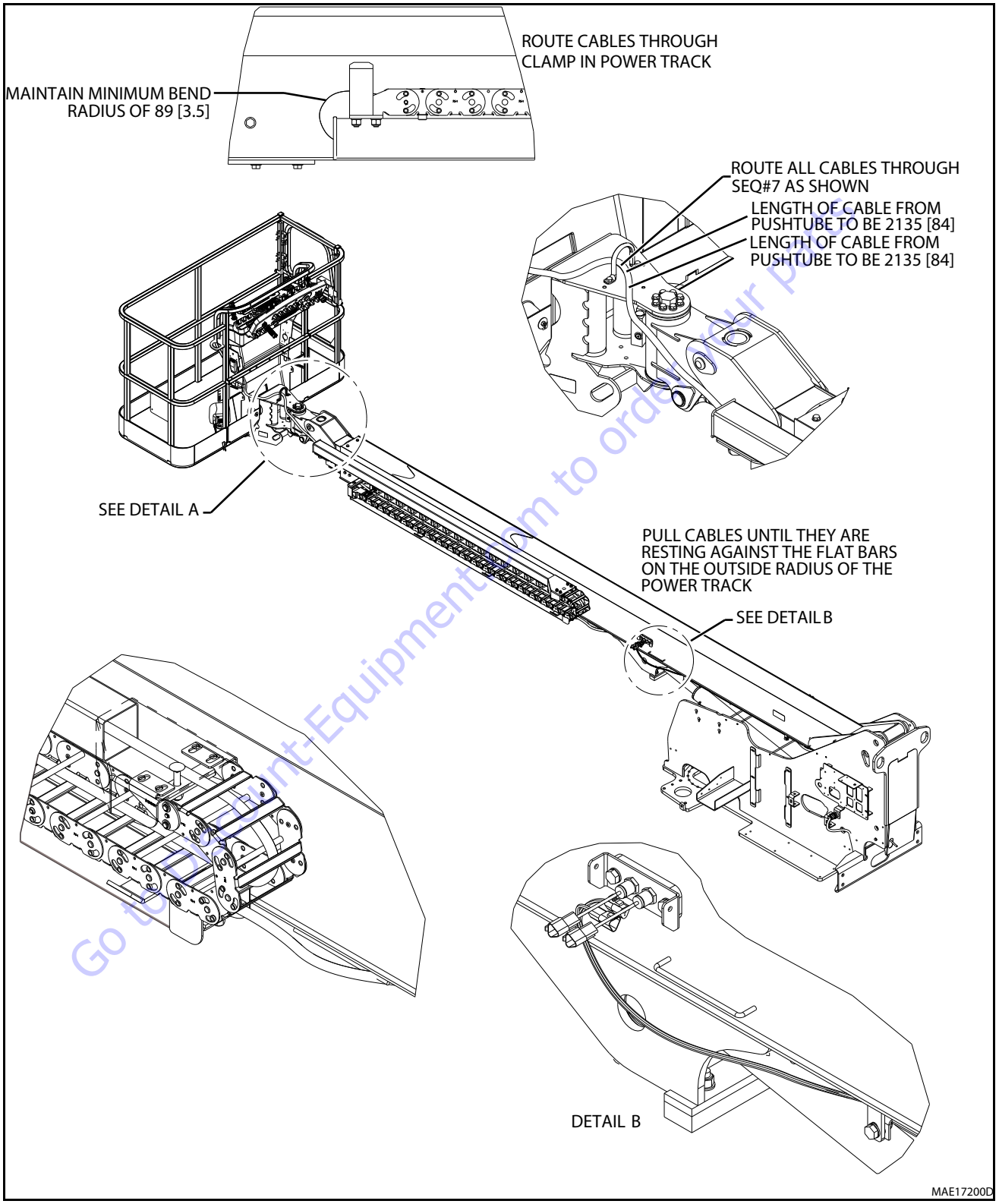


Figure 4-18. Cables and Clamps Installation - 400SC (Sheet 1 of 2)

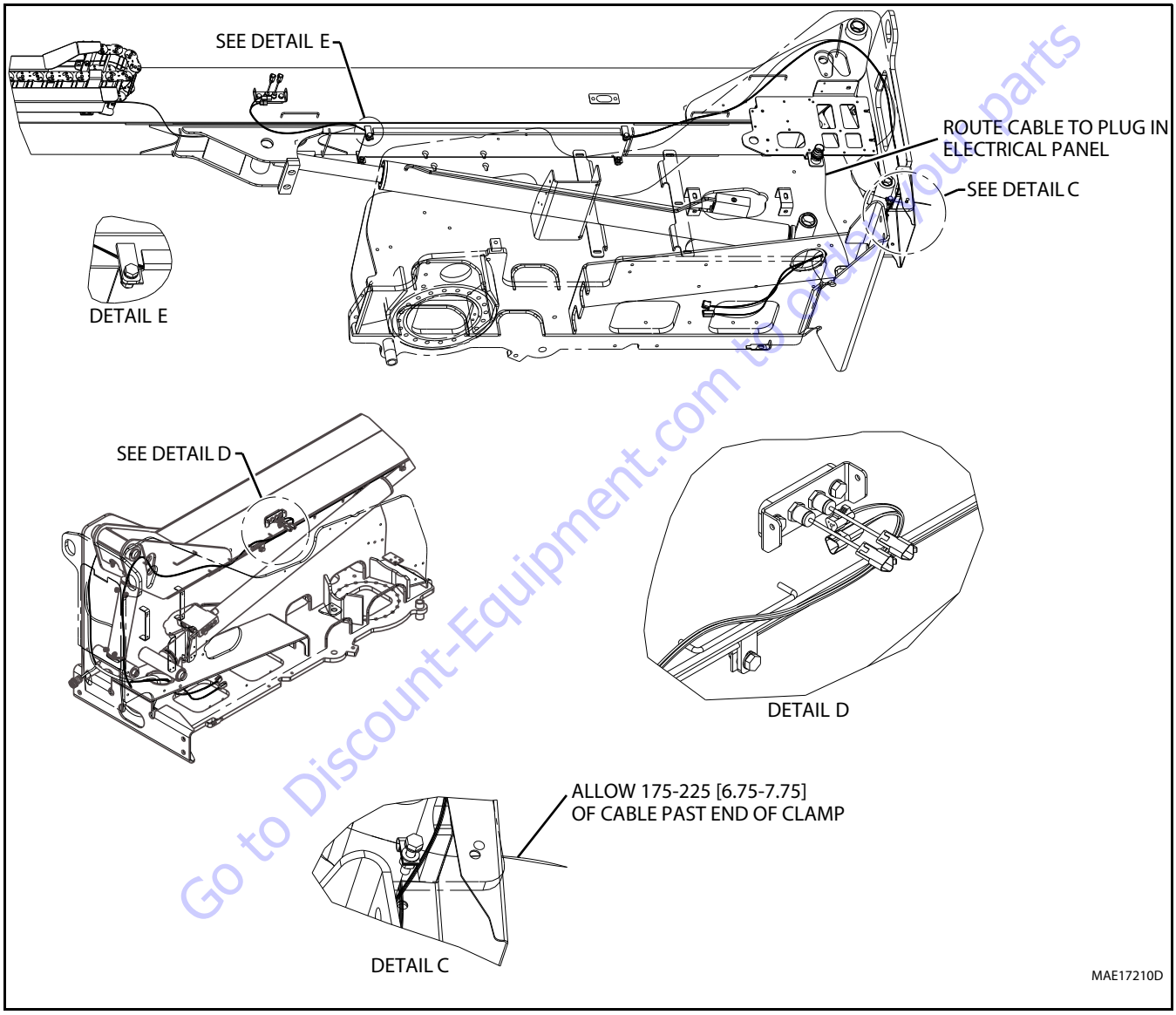


Figure 4-19. Cables and Clamps Installation - 400SC (Sheet 2 of 2)

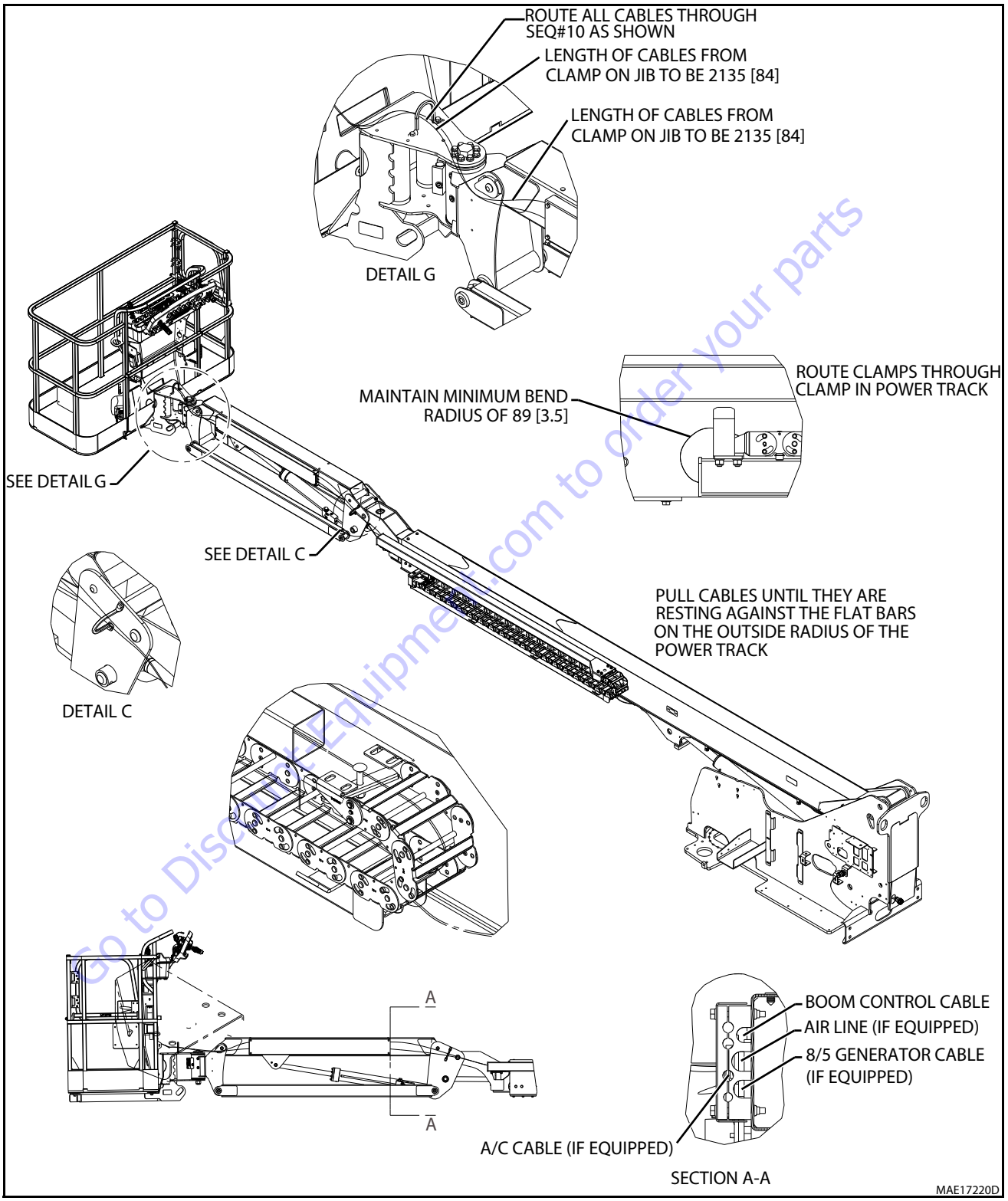


Figure 4-20. Cables and Clamps Installation - 460SJC (Sheet 1 of 2)

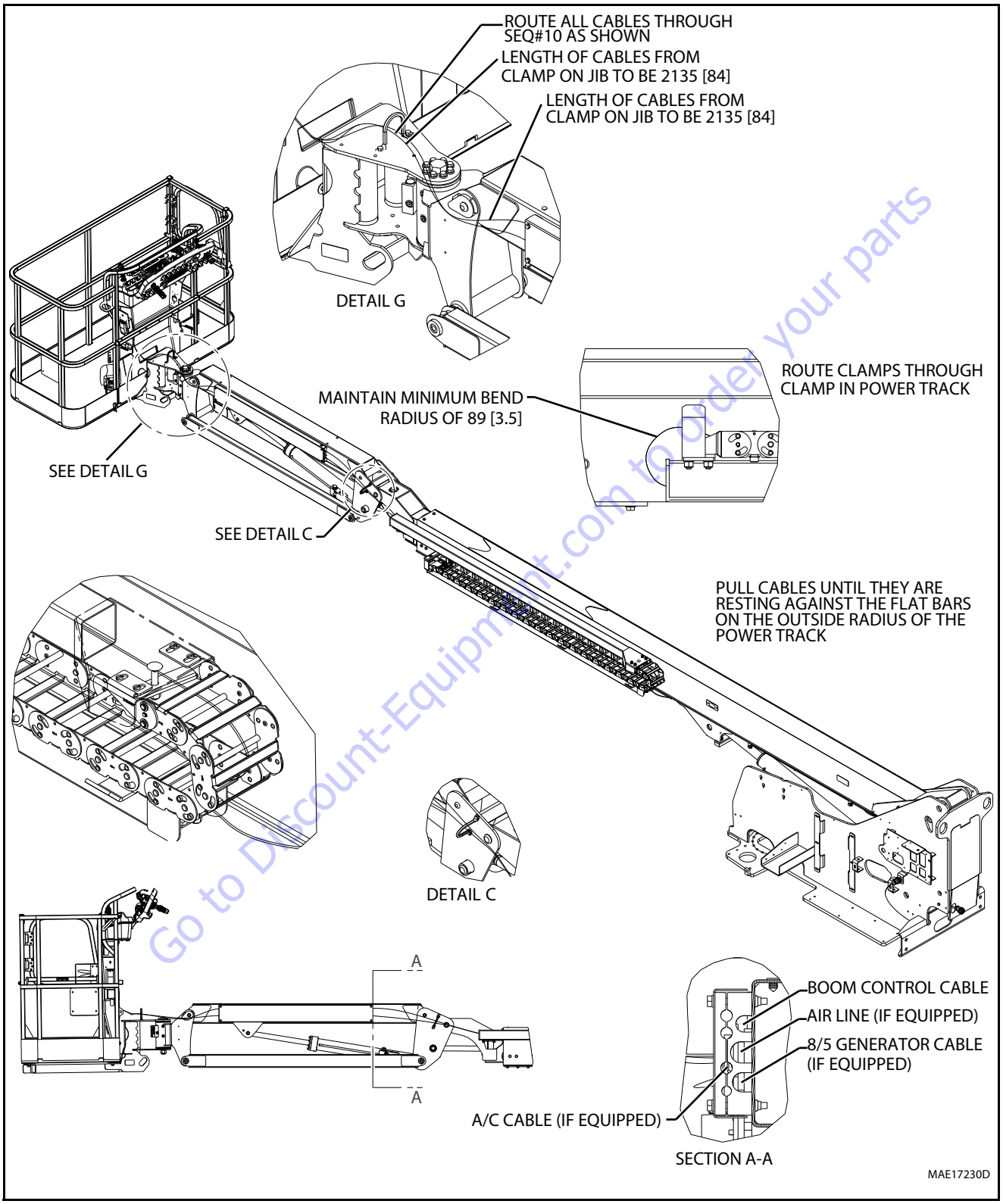


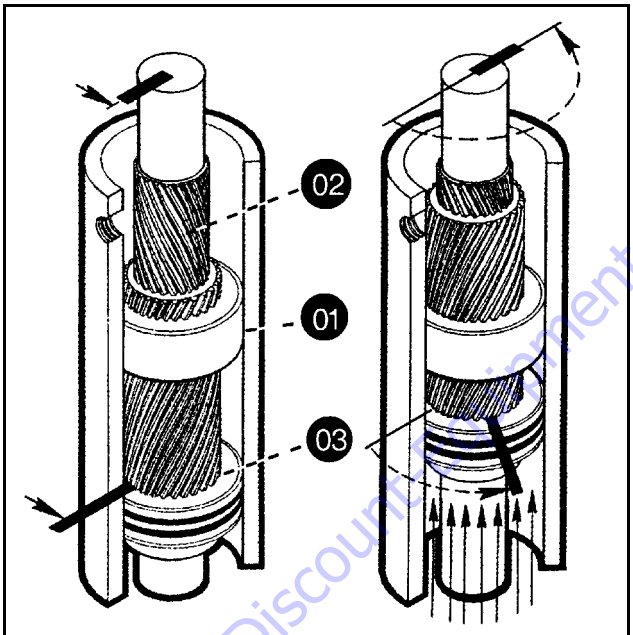
Figure 4-21. Cables and Clamps Installation - 460SJC (Sheet 2 of 2)

4.8 ROTARY ACTUATOR

Theory of Operation

The L20 Series rotary actuator converts linear piston motion to shaft rotation. Each actuator is composed of a housing with integrated gear teeth (01) and only two moving parts: the central shaft with integrated bearing tube and mounting flange (02), and the annular piston sleeve (03). Helical spline teeth machined on the shaft engage matching splines on inside diameter of piston. Outside diameter of piston carries a second set of splines, of opposite hand, which engage with matching splines in the housing.

As hydraulic pressure is applied, piston is displaced axially in the housing - similar to a hydraulic cylinder - while splines cause shaft to rotate. When control valve is closed, oil is trapped inside actuator, preventing piston movement and locking shaft in position.



Bars indicate starting positions of piston and shaft. Arrows indicate rotation direction. Housing with integral ring gear remains stationary.

Shaft glands, bearings, and end cap are not shown for clarity.

As fluid pressure is applied, piston is displaced axially while helical gearing causes piston and shaft to rotate simultaneously.

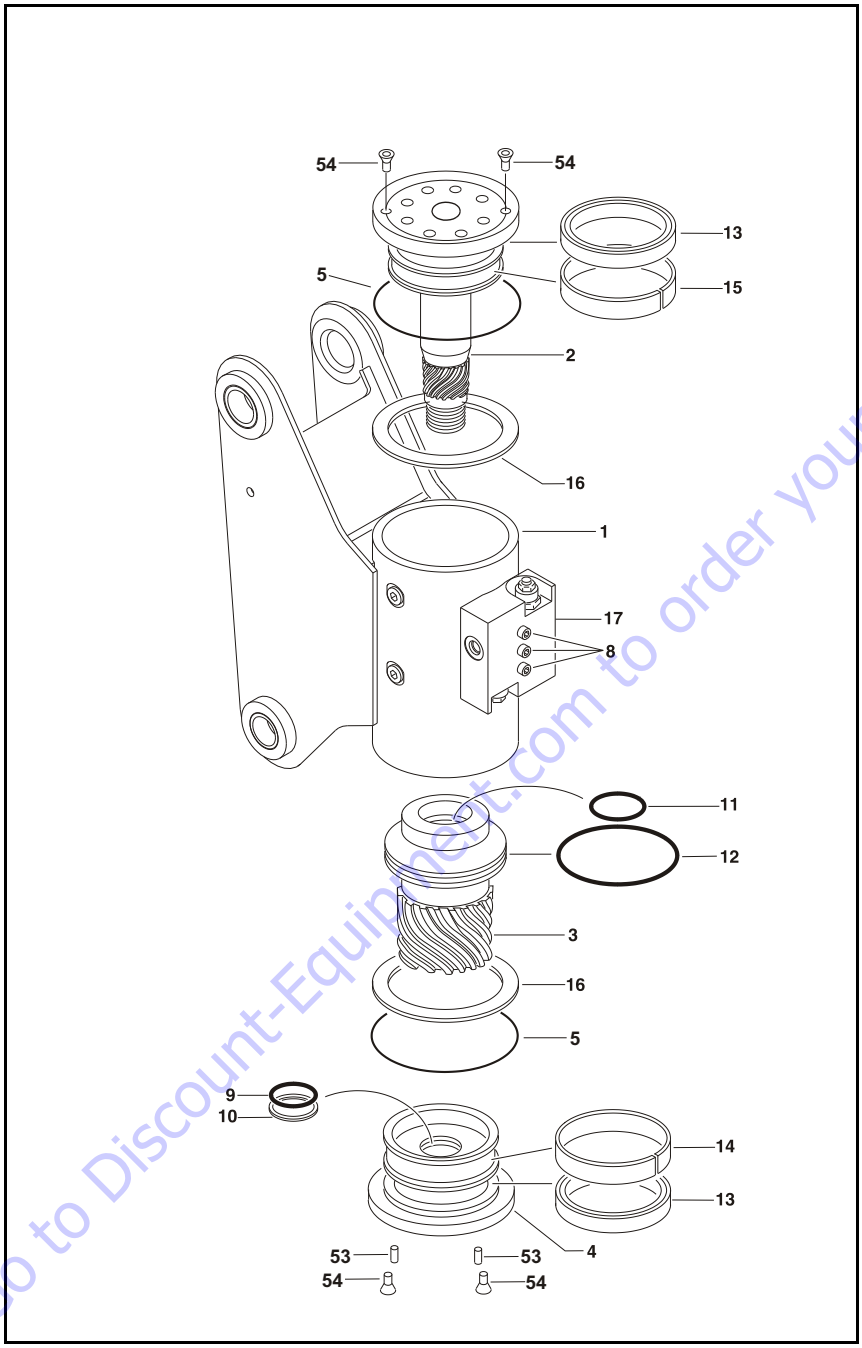
Double helix design compounds rotation: shaft rotation is about twice of piston.

Shaft is supported radially by large upper radial bearing and lower radial bearing. Axially, shaft is separated from housing by upper and lower thrust washers. End cap is adjusted for axial clearance and locked in position by set screws or pins.

Required Tools

Basic tools required for assembly and disassembly of the actuator and their intended functions are as follows:

1. Flashlight - helps examine timing marks, component failure, and overall condition.
2. Felt Marker - match mark timing marks and outline troubled areas.
3. Allen wrench - removal of port plugs and set screws.
4. Box knife - removal of seals.
5. Seal tool - assembly and disassembly of seals and wear guides.
6. Pry bar - end cap removal and manual rotation of shaft.
7. Rubber mallet - removal and installation of shaft and piston sleeve assembly.
8. Nylon drift - installation of piston sleeve
9. End cap dowel pins - removal and installation of end cap (sold with Helac seal kit).

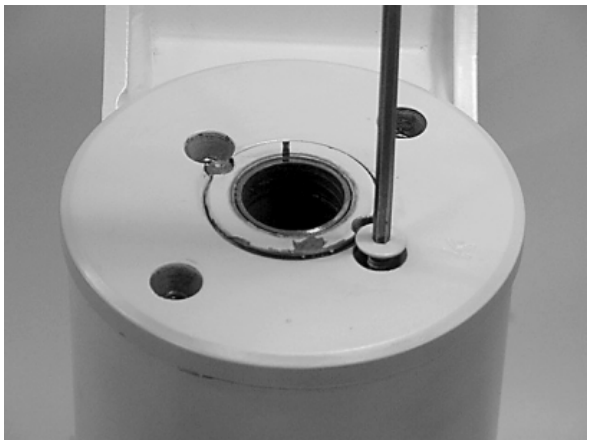


1. Housing
2. Shaft
3. Piston Sleeve
4. End Cap
5. Exclusion Seal
8. Bolt
9. Cap Seal
10. Cap Ring
11. Rod Seal
12. Piston Seal
13. Bearing Packing
14. Cap Bearing
15. Shaft Bearing
16. Thrust Washer
17. Counterbalance Valve
53. Lock Pin
54. Countersunk Screw

Figure 4-22. Rotary Actuator - Exploded View

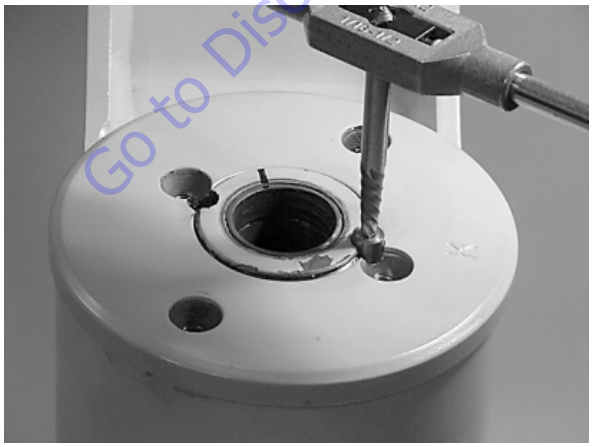
Disassembly

1. Remove capscrews (54) over end cap lock pins (53).



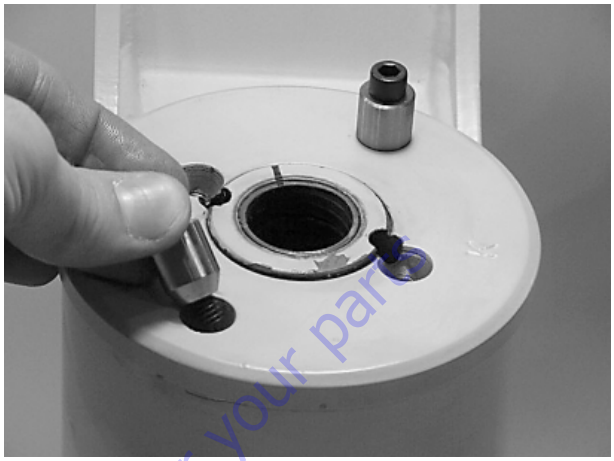
2. Using a 3.18mm (1/8") drill bit, drill hole in center of each lock pin to a depth of approximately 4.76mm (3/16").

3. Remove lock pins using an "Easy Out" (#2 shown).



If pin will not come out with "Easy Out", use 5/16" drill bit to a depth of 12.7mm (1/2") and drill out entire pin.

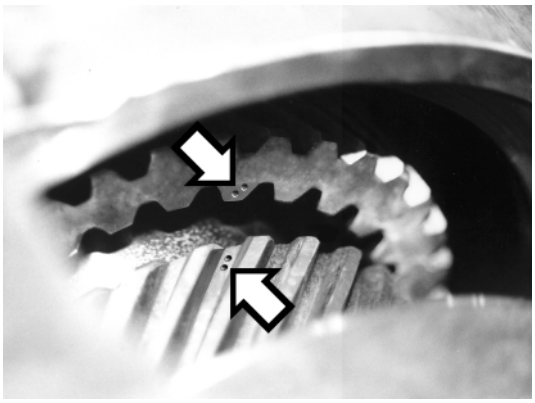
4. Install end cap (4) removal tools provided with Helac seal kit.



5. Using a metal bar or similar, unscrew end cap (4) by turning it counterclockwise.

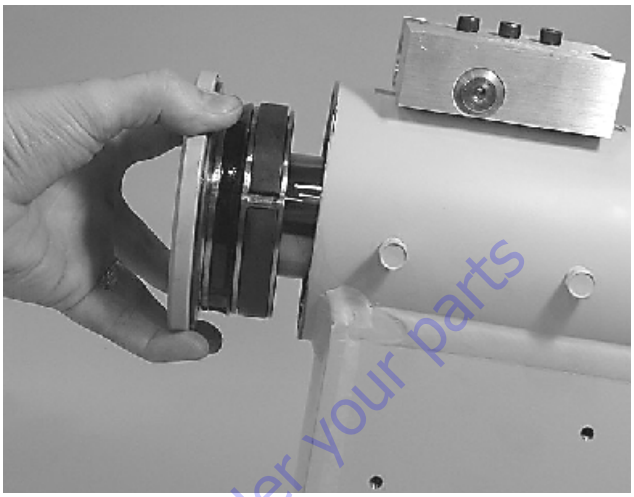
6. Remove end cap (4) and set aside.

7. Actuator has timing marks for proper engagement.



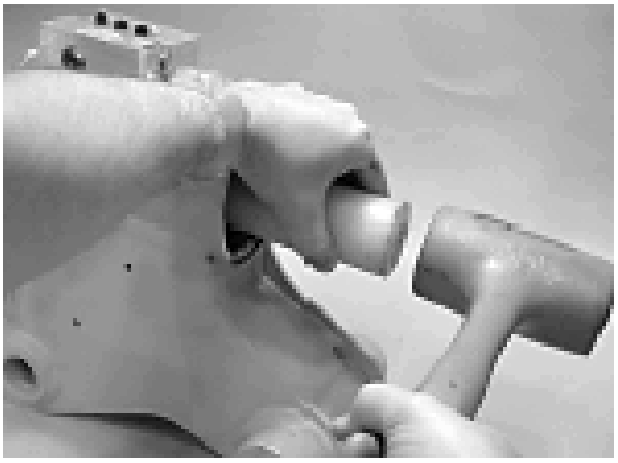
8. Use a felt marker to clearly indicate timing marks between shaft and piston before removing shaft, (2). This simplifies timing during assembly.

9. Remove shaft (2). It may be necessary to strike threaded end of shaft with a rubber mallet.



10. Mark housing (1) ring gear in relation to piston O.D. gear before removing piston sleeve (3). There are timing marks on housing ring gear (1), piston (3), and shaft (2).

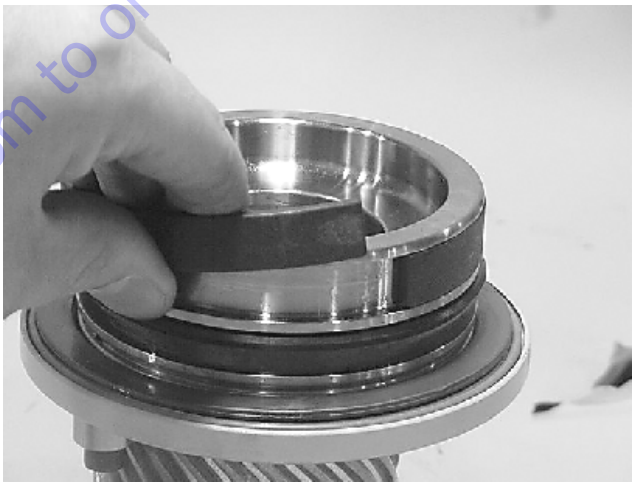
11. Use a rubber mallet and plastic mandrel to prevent damage when removing piston sleeve (3).



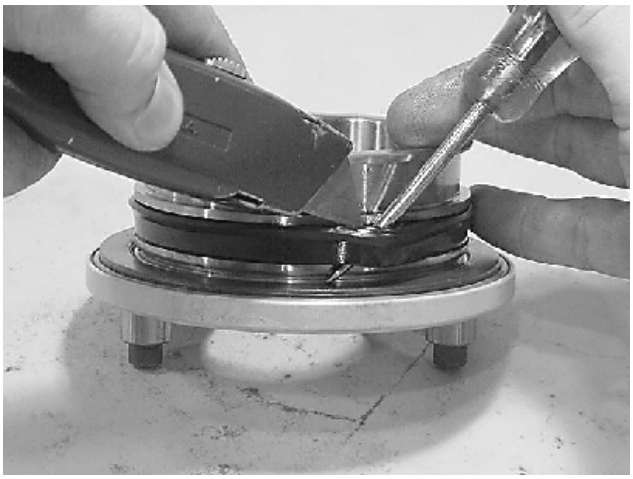
12. Mark piston and housing with a marker where piston gear teeth come out of engagement with housing gear teeth as shown.

13. Remove O-ring (9) and backup ring (10) from end cap (4) and set aside.

14. Remove wear guides (14) from end cap (4) and shaft (2).



15. To remove main pressure seals (13), it is easiest to cut them using a sharp razor blade being careful not to damage the seal groove.



16. Remove thrust washers (16), from end cap (4) and shaft (2).

17. Remove exclusion seal (5) from groove in end cap (4) and shaft (2).

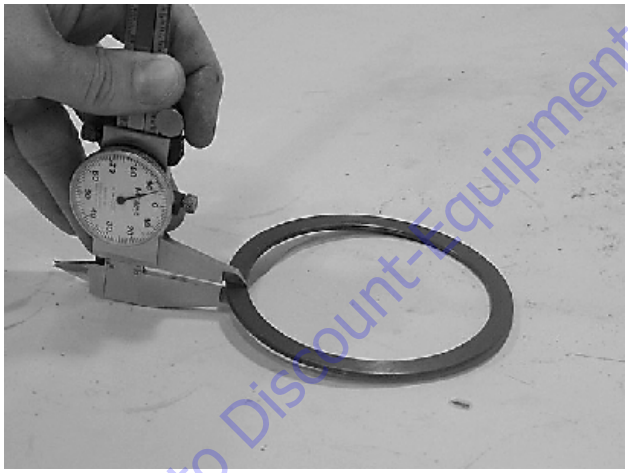
18. Remove piston O.D. seal (12).

19. Remove piston I.D. seal (11).

Inspection

1. Clean parts in a solvent tank and dry with compressed air before inspecting. Inspect seal grooves, bearing grooves, thrust surfaces, rod surface, housing bore, and gear teeth for surface finish abnormalities.

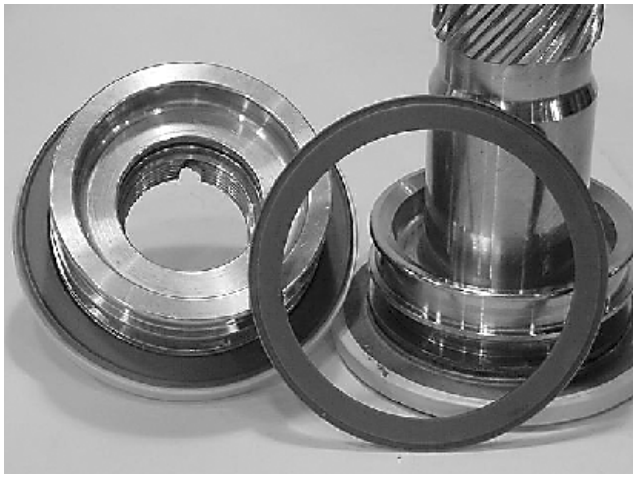
2. Inspect thrust washers (16) for rough or worn edges and surfaces. Measure thickness to make sure it is not less than 2.34 mm (0.092 in).



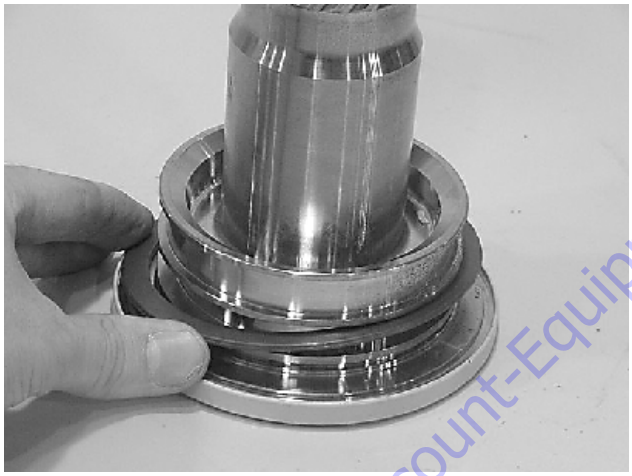
3. Inspect wear guide condition. Measure thickness not less than 3.12 mm (0.123 in).

Assembly

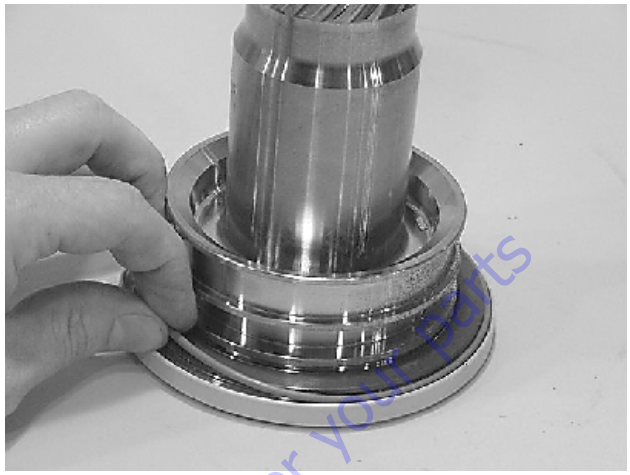
1. Gather all components and tools to one location.



2. Install thrust washer (16) on shaft (2) and end cap (4).



3. Install exclusion seal (5) in groove on shaft (2) and end cap (4) around outside edge of thrust washer (16).



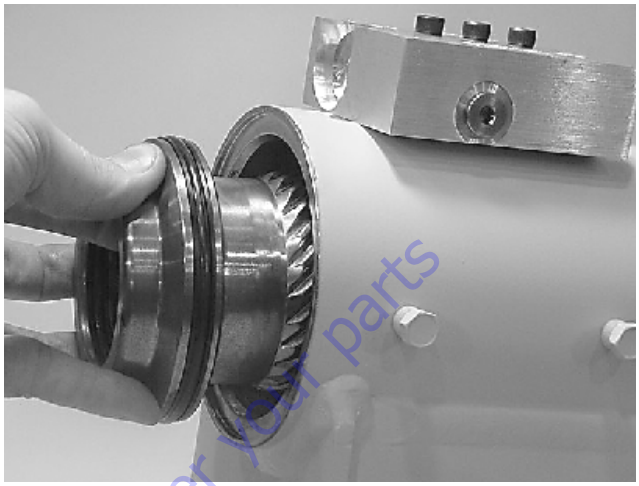
4. Use seal tool in a circular motion to install main pressure seal (13) on shaft (2) and end cap (4).

5. Install wear guide (14) on end cap (4) and shaft (2).

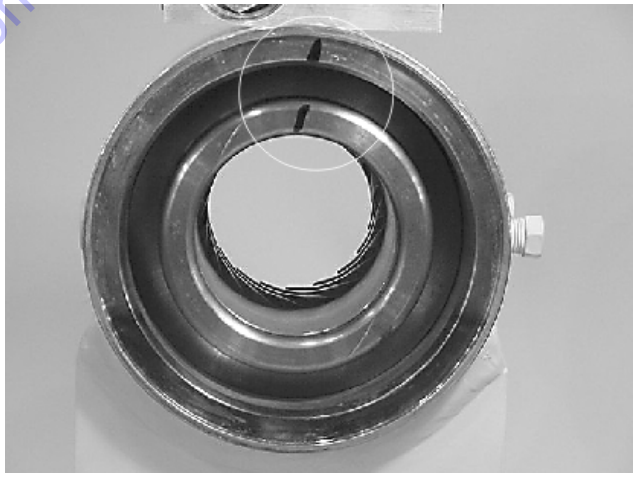
6. Install inner T-seal (11) in piston (3) using a circular motion.
7. Install outer T-seal (12) by stretching it around groove in a circular motion. Each T-seal has 2 backup rings (see drawing for orientation).

8. Beginning with inner seal (11), insert one end of backup ring in lower groove and feed the rest in using a circular motion. Make sure wedged ends overlap correctly.
9. Repeat for outer seal (12).

10. Insert piston (3) in housing (1) until outer piston seal (12) is touching inside housing bore.

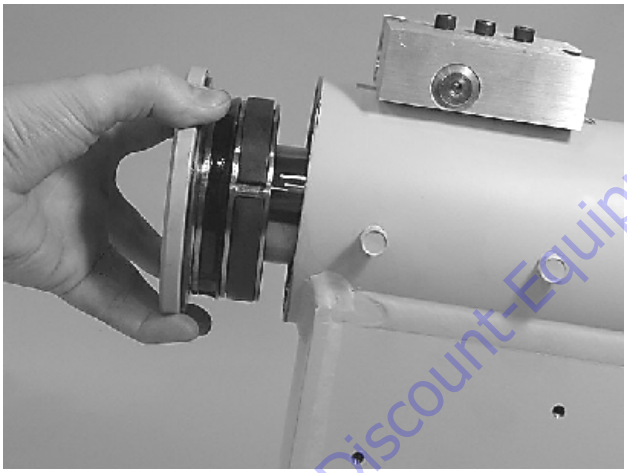


11. Looking from angle shown, rotate piston (3) until marks on piston and housing (1) line up as shown.
12. Using a rubber mallet, tap piston into housing to point where gear teeth meet.

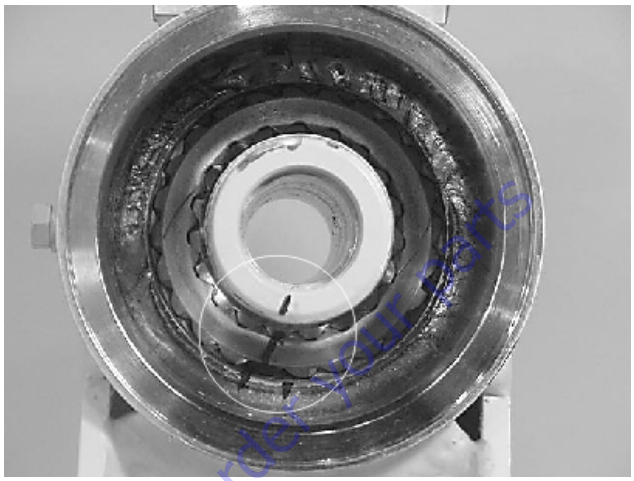


13. Look from opposite end of housing (1) to see if timing marks line up. When they do, tap piston (3) in until gear teeth mesh together. Tap piston into housing until it bottoms out.

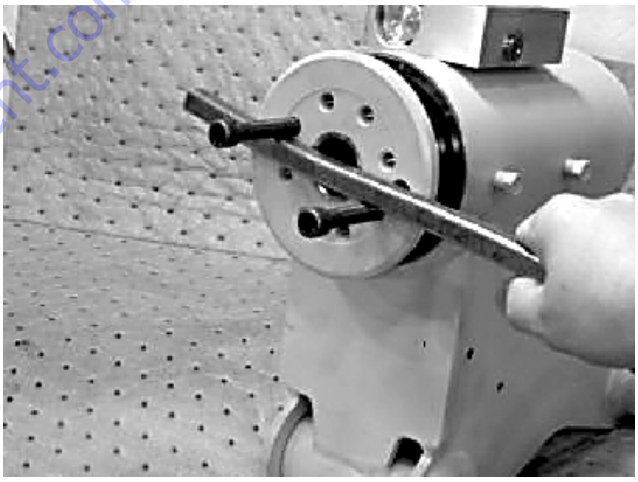
14. Install shaft (2) into piston (3). Do not damage seals. Do not engage piston gear teeth yet.



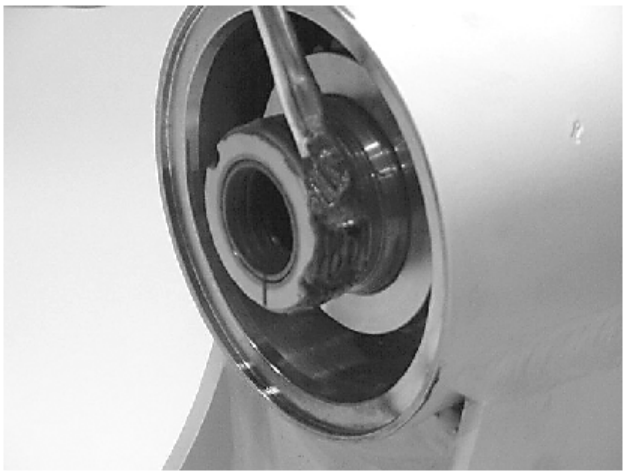
15. Looking from view shown, use existing timing marks to line up gear teeth on shaft (2) with gear teeth on inside of piston (3). Now tap flange end of shaft with a rubber mallet until gear teeth engage.



16. Install 2 bolts in threaded holes in flange. Using a bar, rotate shaft clockwise until wear guides are seated inside housing bore.

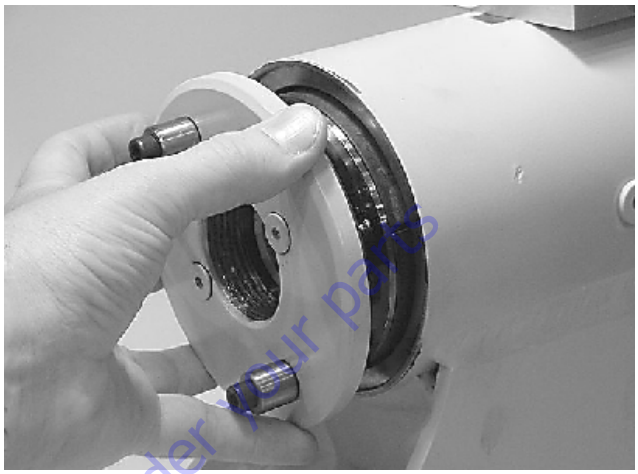


17. Coat threads on end of shaft with anti-seize grease to prevent galling.

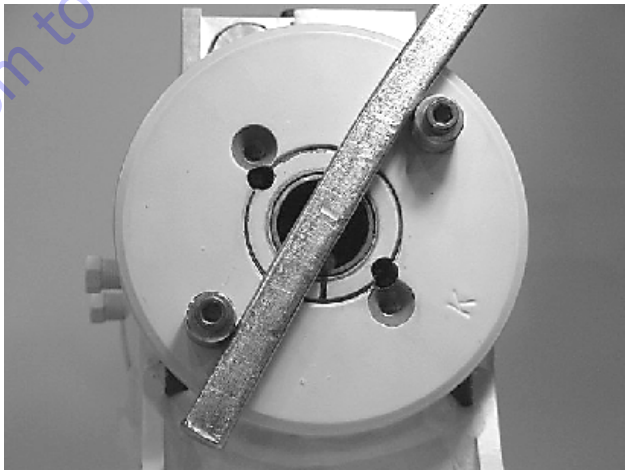


18. Install 0-ring (9) and backup ring (10) in inner seal groove on end cap (4).

19. Thread end cap (4) on shaft (2) end. Make sure wear guide stays in place on end cap as it is threaded in housing (1).

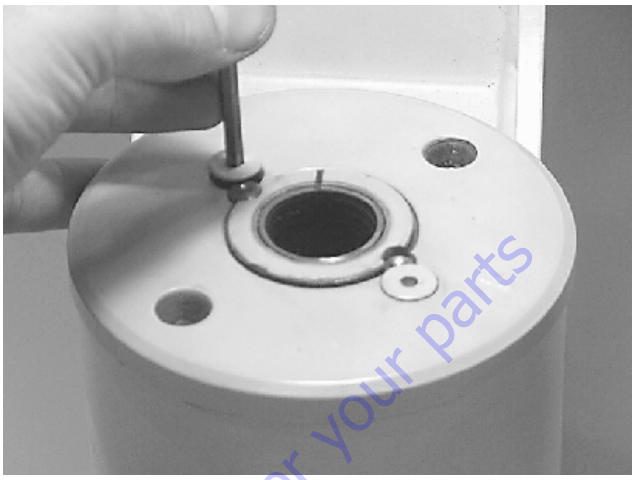


20. Tighten end cap (4) and align holes for lock pins.



21. Place lock pins (53) provided in Helac seal kit in holes with dimple side up. Using a punch, tap lock pins to bottom of hole.

22. Insert set screws (54) over lock pins. Tighten to 2.825 Nm (25 in-lb).



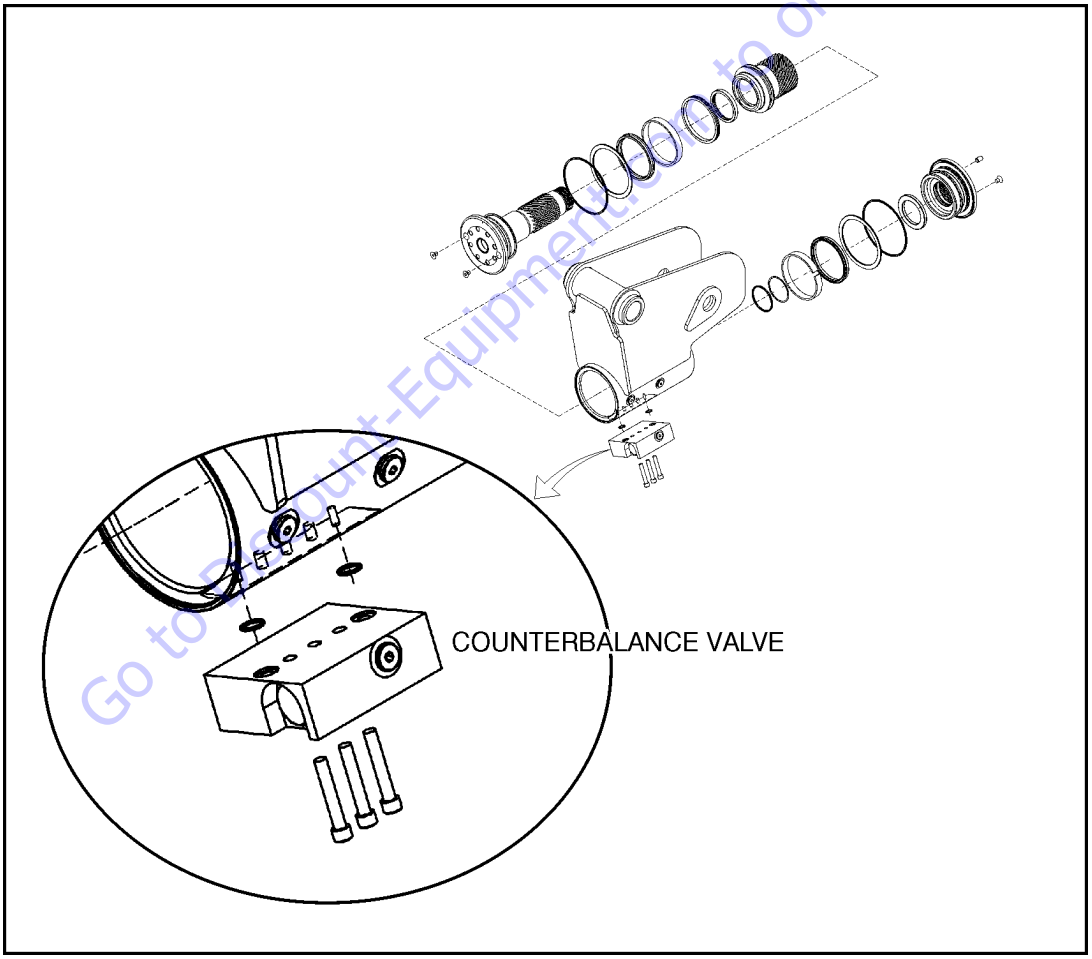


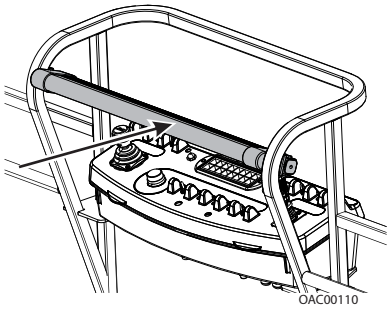
Figure 4-23. Rotator Counterbalance Valve

4.9 SKYGUARD

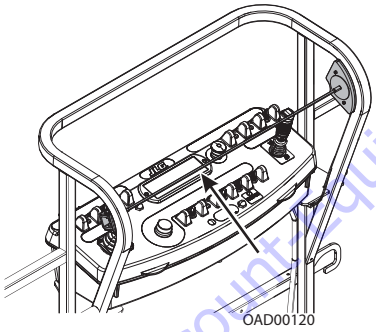
Operation

SkyGuard provides enhanced control panel protection. When the SkyGuard sensor is activated, functions in use at the time of actuation will reverse or cutout. The SkyGuard Function Table provides more details on these functions.

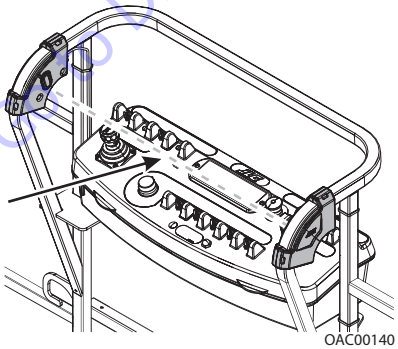
Consult the following illustrations to determine which type of SkyGuard the machine is equipped with. Regardless of the type, SkyGuard function according to the SkyGuard Function Table does not change.



SkyGuard



SkyGuard SkyLine™



SkyGuard SkyEye™

⚠ WARNING

THE MACHINE OPERATOR IS REQUIRED TO PERFORM A DAILY FUNCTION TEST TO ENSURE PROPER OPERATION OF THE SKYGUARD SYSTEM.

Function Test

SKYGUARD ONLY

Perform this function test if **SkyGuard only** is selected in machine setup (refer to Table 6-2).

From the Platform Control Console in an area free from obstructions:

1. Operate the telescope out function, then activate SkyGuard sensor.
2. Once sensor has been activated, ensure telescope out function stops then telescope in function operates for a short duration. Additionally, verify Soft Touch/SkyGuard indicator light flashes and horn sounds. If machine is equipped with SkyGuard beacon, ensure it flashes when sensor activates.
3. With SkyGuard sensor still engaged, press and hold yellow Soft Touch/SkyGuard override button. Operate a function to verify operation can be resumed.
4. Disengage SkyGuard sensor, release controls, and recycle footswitch. Ensure normal operation available.

In Ground Mode:

Operation is allowed regardless of SkyGuard activation.

SOFT TOUCH ONLY

If **Soft Touch only** is selected in machine setup (refer to Table 6-2), machine will treat the Soft Touch/SkyGuard override switch as if it is a Soft Touch switch.

SKYGUARD NOT SELECTED IN MACHINE SETUP

If the SkyGuard system is installed on the machine, but no option is selected in the machine setup (refer to Table 6-2), SkyGuard sensor status will be ignored. No function cutout or reversal will be implemented.

Diagnostics & Troubleshooting

If SkyGuard does not function when the sensor is engaged, first verify the configuration under the
MACHINE SETUP: SKYGUARD OPTION menu using the handheld Analyzer. Ensure the selected configuration matches the actual system installed on the machine. If not, select the correct configuration, then verify operation.

Additionally, use the handheld analyzer to navigate to the DIAGNOSTICS: FEATURES → SKYGUARD INPUTS menu to determine additional SkyGuard fault information.

Engage the SkyGuard sensor and observe the Analyzer to determine if the switch/relay closes.

If the status of the switch/relay remains OPEN while the SkyGuard sensor is actively engaged, it is possible the sensor has failed and should be replaced immediately.

If the status of the switch/relay remains CLOSED while the SkyGuard sensor is actively engaged, a power or ground wire may not be making good contact or may be loose or broken. Additionally, there is a low probability that both relays may have failed.

If the switch/relay status is in disagreement, then one may have failed or is not installed correctly. In this case, the machine will be inoperable.

FAULT CODES

Refer to Table 6-13 for more fault code information

- **0039 -** SkyGuard switch activation fault
- **2563 -** SkyGuard switch disagreement fault

Table 4-1. SkyGuard Function Table

Drive Forward	Drive Reverse	Steer	Swing	Boom Lift Up	Boom Lift Down	Boom Tele Out	Boom Tele In	Jib Lift	Basket Level	Basket Rotate
C	C	C	R	R	R	R	C	C	C	C
R = Indicates Reversal is Activated										
C = Indicates Cutout is Activated										

4.10 PLATFORM ROTATE BLEED PROCEDURE

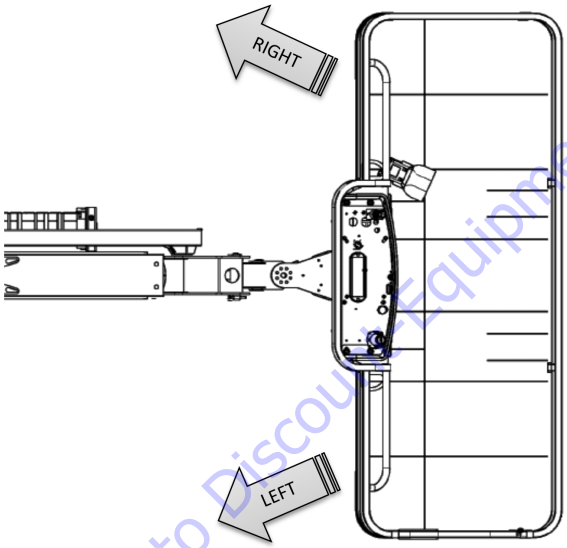
NOTE: *This procedure will have to be performed any time a component is removed or replaced in the platform rotate hydraulic circuit.*

General Notes & Precautions

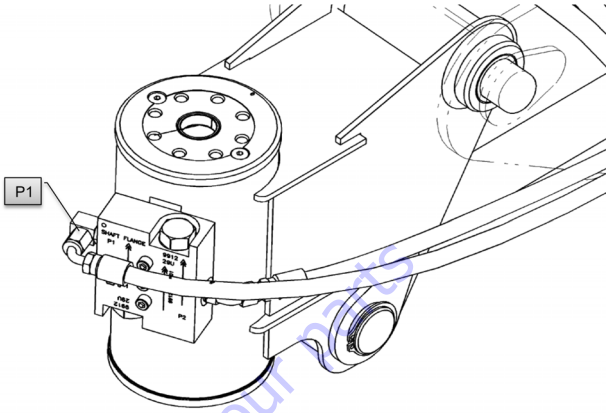
- Wear appropriate eye protection.
- Engine must be turned off when loosening & tightening hydraulic connections.
- Ensure persons and objects are clear of the platform area prior to starting the engine and activating platform rotate function.
- Place appropriate pan and absorbent mats under platform rotator to collect hydraulic fluid.

Procedure

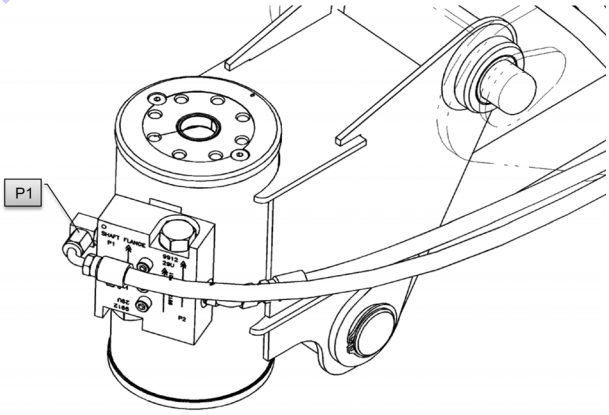
1. Activate platform rotate right until end of stroke and hold for 5 seconds.



2. Activate platform rotate left until end of stroke and hold for 5 seconds.
3. Loosen hydraulic hose end at port P1 of platform rotator 1 turn (use existing paint mark as a reference).



4. Activate platform rotate right for approximately 10 seconds (the platform will rotate slowly).
5. Activate platform rotate left until end of stroke.
6. Repeat steps 4 & 5 until air is removed.
7. Tighten hydraulic hose end at port P1 of platform rotator to 14 ft. lbs. (19 Nm).

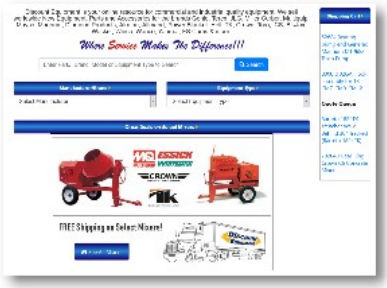


8. Activate platform rotate right until end of stroke and hold for 5 seconds.
9. Loosen hydraulic hose end at port P2 of platform rotator.

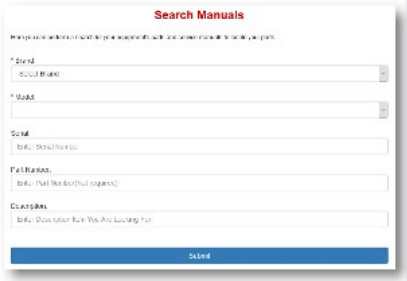
PARTS FINDER

Search Website by Part Number

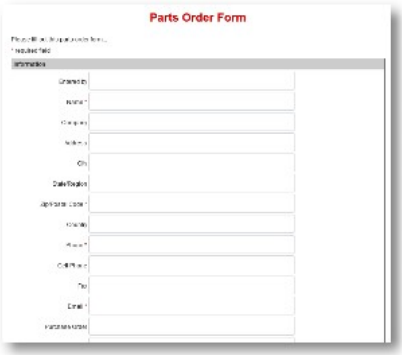
Discount Equipment



Search Manual Library For Parts Manual & Lookup Part Numbers – Purchase or Request Quote



Can't Find Part or Manual? Request Help by Manufacturer, Model & Description



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SECTION 5. HYDRAULICS AND HYDRAULIC SCHEMATICS

5.1 O-RING LUBRICATION

All fittings with O-rings must be lubricated with hydraulic oil before assembly using one of the following four methods:

- Cup and Brush
- Dip
- Spray

Cup and Brush

Tools needed:

- Small container for hydraulic oil
- Small paint brush

1. Hold fitting in one hand and dip brush into container with other hand. Remove excess hydraulic oil from brush so an even film of oil is applied to O-ring.

2. Hold fitting over hydraulic oil container and brush an even film of oil around entire O-ring in fitting. Make sure O-ring is completely saturated.

3. Turn over fitting and repeat previous step to O-ring on other side of fitting. Make sure entire O-ring is coated with hydraulic oil.

Dip Method

NOTE: *This method works best with Face Seal O-rings, but will work for all O-ring fitting types.*

Tools needed:

- Small leak proof container
- Sponge cut to fit inside container
- Small amount of hydraulic oil to saturate sponge.

1. Place sponge inside container and add hydraulic oil to sponge until fully saturated.
2. Dip fitting into sponge using firm pressure.

NOTE: *After lifting fitting, a small droplet should form and drip from bottom of fitting. This indicates an even coating of oil.*

NOTE: *O-ring boss-type fittings require more pressure to immerse more of fitting into saturated sponge. This also causes more oil to be dispersed from sponge.*

Spray Method

This method requires a pump or trigger spray bottle.

1. Fill spray bottle with hydraulic oil.
2. Hold fitting over a suitable catch can.
3. Spray entire O-ring surface with a medium coat of oil.

Brush-on Method

This method requires a sealed bottle brush.

1. Fill bottle with hydraulic oil.
2. Using slight pressure to body of spray bottle, invert bottle so brush end faces down.
3. Brush an even coat of hydraulic oil on entire O-ring.

5.2 HYDRAULIC CONNECTION ASSEMBLY AND TORQUE SPECIFICATION

Tapered Thread Types

NPTF = national tapered fuel (Dry Seal) per SAE J476/J512

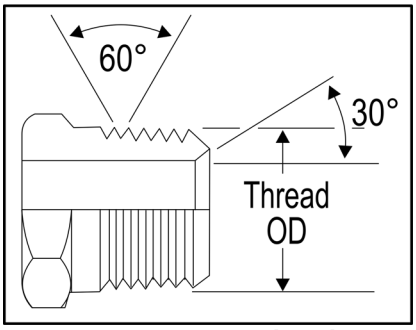


Figure 5-1. NPTF thread

BSPT = British standard pipe tapered per ISO7-1

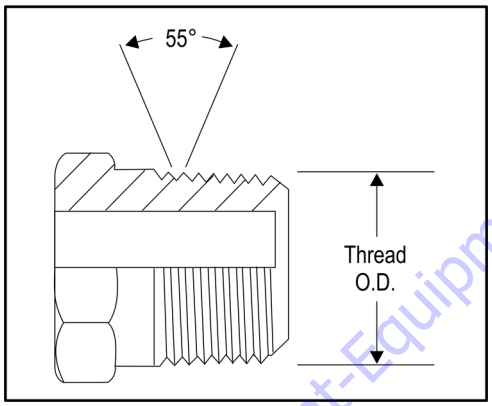


Figure 5-2. BSPT thread

Straight Thread Types, Tube and Hose Connections

JIC = 37° flare per SAE J514

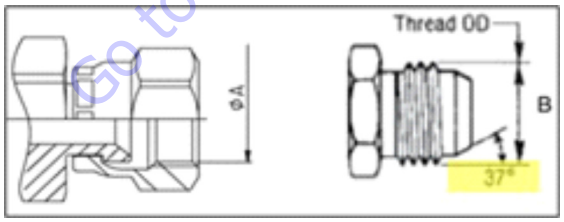


Figure 5-3. JIC Thread

SAE = 45° flare per SAE J512

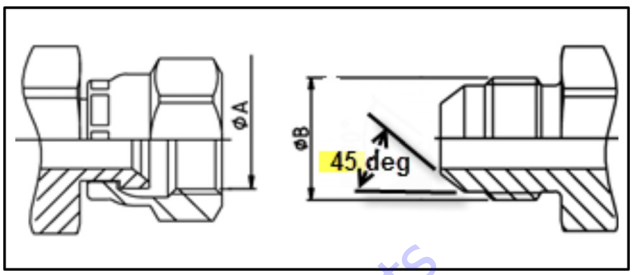


Figure 5-4. SAE Thread

ORFS = o-ring face seal per SAE J1453

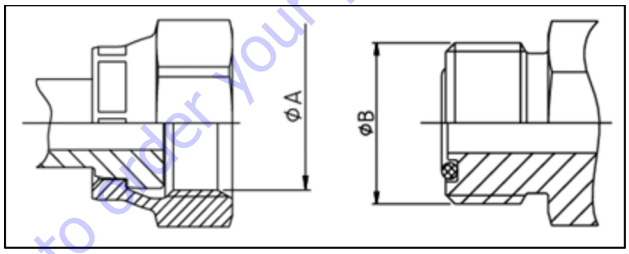


Figure 5-5. ORFS Thread

MBTL = metric flareless bite type fitting, pressure rating L (medium) per ISO 8434, DIN 2353

MBTS = metric flareless bite type fitting, pressure rating S (high) per ISO 8434, DIN 2353

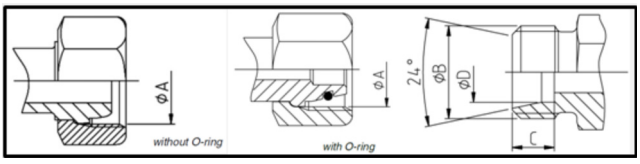


Figure 5-6. MTBL-MBTS Thread

BH = bulkhead connection – JIC, ORFS, MBTL, or MBTS types

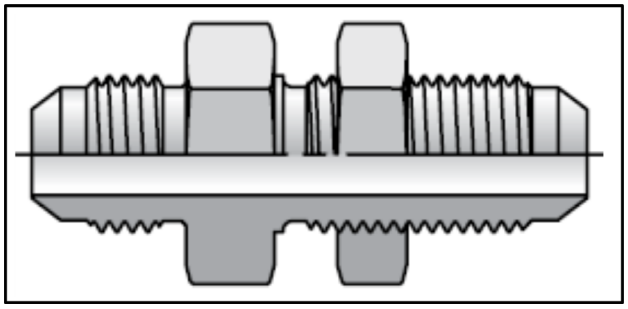
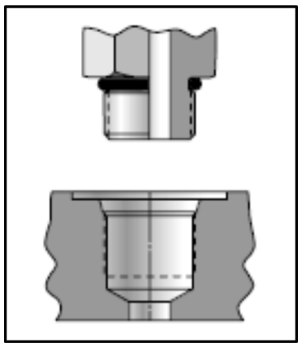


Figure 5-7. Bulkhead Thread

Straight Thread Types, Port Connections

ORB = o-ring boss per SAE J1926, ISO 11926

MPP = metric pipe parallel o-ring boss per SAE J2244, ISO 6149, DIN 3852



MFF = metric flat face port per ISO 9974-1

BSPP = British standard parallel pipe per ISO 1179-1, DIN 3852-2

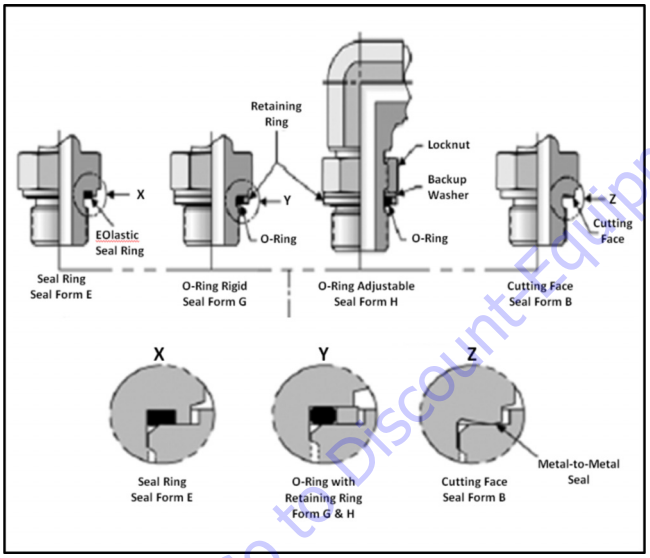


Figure 5-8. MFF-BSPP Thread

Flange Connection Types

FL61 = code 61 flange per SAE J518, ISO 6162

FL62 = code 62 flange per SAE J518, ISO 6162

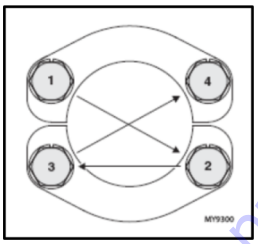


Figure 5-9. ORB-MPP Thread

Tightening Methods

Torque = Application of a twisting force to the applicable connection by use of a precise measurement instrument (i.e. torque wrench).

Finger Tight = The point where the connector will no longer thread onto the mating part when tightened by hand or fingers. Finger Tight is relative to user strength and will have some variance. The average torque applied by this method is 3 ft. lbs. (4 Nm). Also referred to as 'Hand Tight.'

TFFT = Turns From Finger Tight; Application of a preload to a connection by first tightening the connection by hand (fingers) and applying an additional rotation counted by a defined number of turns by use of a tool.

FFWR = Flats From Wrench Resistance; Application of a preload to a connection by tightening to the point of initial wrench resistance and turning the nut a described number of 'flats'. A 'flat' is one side of the hexagonal tube nut and equates to 1/6 of a turn. Also referred to as the 'Flats Method.'

Assembly And Torque Specifications

Prior to selecting the appropriate torque from the tables within this section, it is necessary to properly identify the connector being installed. Refer to the Figures and Tables in this section.

GENERAL TUBE TYPE FITTING ASSEMBLY INSTRUCTIONS

1. Take precautions to ensure that fittings and mating components are not damaged during storage, handling or assembly. Nicks and scratches in sealing surfaces can create a path for leaks which could lead to component contamination and/or failure.
2. When making a connection to tubing, compression or flare, inspect the tube in the area of the fitting attachment to ensure that the tube has not been damaged.
3. The assembly process is one of the leading causes for contamination in air and hydraulic systems. Contamination can prevent proper tightening of fittings and adapters from occurring.
   a. Avoid using dirty or oily rags when handling fittings.
   b. If fittings are disassembled, they should be cleaned and inspected for damage. Replace fittings as necessary before re-installing.
   c. Sealing compounds should be applied where specified; however, care should be taken not to introduce sealant into the system.
   d. Avoid applying sealant to the area of the threads where the sealant will be forced into the system. This is generally the first two threads of a fitting.
   e. Sealant should only be applied to the male threads.
   f. Straight thread fittings do not require sealants. O-rings or washers are provided for sealing.
   g. When replacing or installing an o-ring, care is to be taken while transferring the o-ring over the threads as it may become nicked or torn. When replacing an o-ring on a fitting, the use of a thread protector is recommended.
   h. When installing fittings with o-rings, lubrication shall be used to prevent scuffing or tearing of the o-ring. See o-ring Installation (Replacement) in this section.
4. Take care to identify the material of parts to apply the correct torque values.
   a. Verify the material designation in the table headings.
   b. If specifications are given only for steel fittings and components, the values for alternate materials shall be as follows: Aluminum and Brass- reduce steel values by 35%; Stainless Steel- Use the upper limit for steel.
5. To achieve the specified torque, the torque wrench is to be held perpendicular to the axis of rotation.

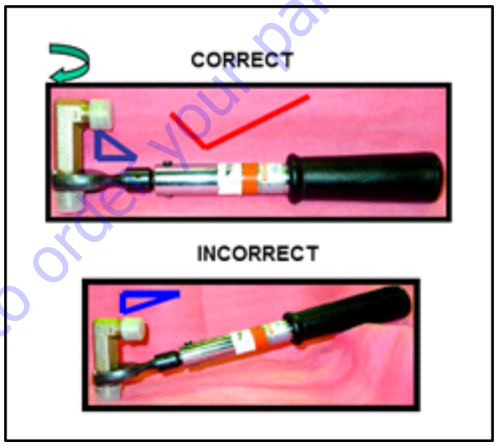


Figure 5-10. Torque Wrench Angle

6. Refer to the appropriate section in this manual for more specific instructions and procedures for each type of fitting connection.

Assembly Instructions for American Standard Pipe Thread Tapered (NPTF) Connections.

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as loctite 567, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

OVER TIGHTENING MAY CAUSE DEFORMATION OF THE PIPE FITTING AND DAMAGE TO THE JOINING FITTING, FLANGE OR COMPONENT MAY OCCUR.

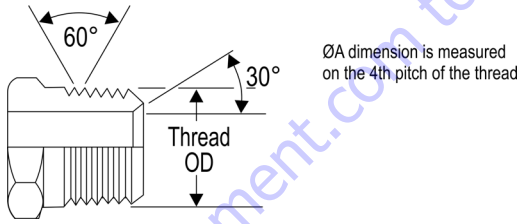
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

5. Rotate male fitting the number of turns per Table 5-1, NPTF Pipe Thread. See FFWR and TFFT Methods for TFFT procedure requirements.

NOTE: *TFFT values provided in Table 5-1, NPTF Pipe Thread are applicable for the following material configurations:*

- STEEL fittings with STEEL mating components
- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-1. NPTF Pipe Thread



TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
Material	Dash Size	Thread Size	ØA*		
		(UNF)	(in)	(mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH **STEEL, ALUMINUM, OR BRASS** MATING COMPONENTS	2	1/8-27	0.40	10.24	2 to 3
	4	1/4-18	0.54	13.61	2 to 3
	6	3/8-18	0.67	17.05	2 to 3
	8	1/2-14	0.84	21.22	2 to 3
	12	3/4-14	1.05	26.56	2 to 3
	16	1-11 1/2	1.31	33.22	1.5 to 2.5
	20	1 1/4-11 1/2	1.65	41.98	1.5 to 2.5
	24	1 1/2-11 1/2	1.89	48.05	1.5 to 2.5
	32	2-11 1/2	2.37	60.09	1.5 to 2.5

* ØA thread dimension for reference only.

** See FFWR and TFFT Methods subsection for TFFT procedure requirements.

Assembly Instructions for British Standard Pipe Thread Tapered (BSPT) Connections

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply a suitable thread sealant, such as loctite 567, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

⚠ CAUTION

OVER TIGHTENING MAY CAUSE DEFORMATION OF THE PIPE FITTING AND DAMAGE TO THE JOINING FITTING, FLANGE OR COMPONENT MAY OCCUR.

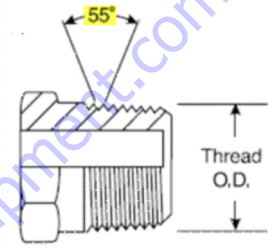
NEVER BACK OFF (LOOSEN) PIPE THREADED CONNECTORS TO ACHIEVE ALIGNMENT. MEET THE MINIMUM REQUIRED TURNS AND USE THE LAST TURN FOR ALIGNMENT.

5. Rotate male fitting the number of turns per Table 5-2, BSPT Pipe Thread. See FFWR and TFFT Methods for TFFT procedure requirements.

NOTE: *TFFT values provided in Table 5-2, BSPT Pipe Thread are applicable for the following material configurations:*

- STEEL fittings with STEEL mating components
- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-2. BSPT Pipe Thread



TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
MATERIAL	Dash Size	Thread Size (BSPT)	ØA* (in)	ØA* (mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH **STEEL, ALUMINUM, OR BRASS** MATING COMPONENTS	2	1/8-28	0.38	9.73	2 to 3
	4	1/4-19	0.52	13.16	2 to 3
	6	3/8-19	0.66	16.66	2 to 3
	8	1/2-14	0.83	20.96	2 to 3
	12	3/4-14	1.04	26.44	2 to 3
	16	1-11	1.31	33.25	1.5 to 2.5
	20	1 1/4-11	1.65	41.91	1.5 to 2.5
	24	1 1/2-11	1.88	47.80	1.5 to 2.5
	32	2-11	2.35	59.61	1.5 to 2.5

* ØA thread dimension for reference only.

** See Appendix B for TFFT procedure requirements.

Assembly Instructions for 37° (JIC) Flare Fittings

1. Inspect the flare for obvious visual squareness and concentricity issues with the tube OD. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

DO NOT FORCE A MISALIGNED OR SHORT HOSE/TUBE INTO ALIGNMENT. IT PUTS UNDESIRABLE STRAIN ONTO THE JOINT EVENTUALLY LEADING TO LEAKAGE.

2. Align tube to fitting and start threads by hand.

⚠ CAUTION

THE TORQUE METHOD SHOULD NOT BE USED ON LUBRICATED OR OILY FITTINGS. NO LUBRICATION OR SEALANT IS REQUIRED. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

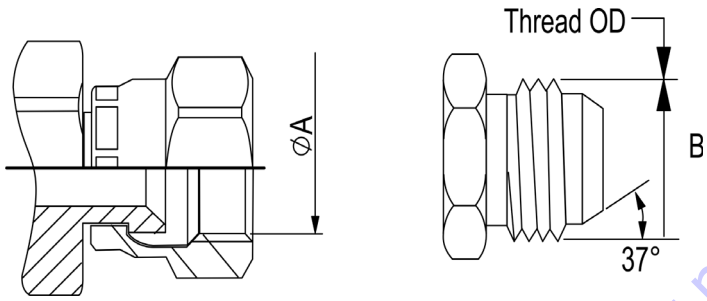
3. Torque assembly to value listed in Table 5-3, 37° Flare (JIC)Thread - Steel or Table 5-4, 37° Flare (JIC)Thread - Aluminum/Brass while using the Double Wrench Method per Double Wrench Method. Refer to FFWR and TFFT Methods for procedure requirements if using the FFWR method.

NOTE: *Torque values provided in Table Table 5-3, 37° Flare (JIC)Thread - Steel and Table 5-4, 37° Flare (JIC)Thread - Aluminum/Brass are segregated based on the material configuration of the connection.*

ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

Table 5-3. 37° Flare (JIC)Thread - Steel

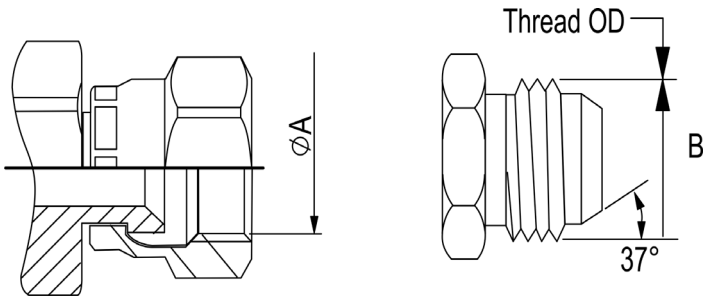


Type/Fitting Identification							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	6	7	7	8	9	10	--
	3	3/8-24	0.34	8.60	0.37	9.50	8	9	10	11	12	14	--
	4	7/16-20	0.39	10.00	0.44	11.10	13	14	14	18	19	19	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	14	15	15	19	20	21	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	22	23	24	30	31	33	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	42	44	46	57	60	63	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	60	63	66	81	85	89	1 to 1-1/2
	12	1 1/16-12	0.97	24.60	1.06	27.00	84	88	92	114	120	125	1 to 1-1/2
	14	1 3/16-12	1.11	28.30	1.19	30.10	100	105	110	136	142	149	1 to 1-1/2
	16	1 5/16-12	1.23	31.30	1.31	33.30	118	124	130	160	168	176	3/4 to 1
	20	1 5/8-12	1.54	39.20	1.63	41.30	168	176	185	228	239	251	3/4 to 1
	24	1 7/8-12	1.80	45.60	1.87	47.60	195	205	215	264	278	291	3/4 to 1
	32	2 1/2-12	2.42	61.50	2.50	63.50	265	278	292	359	377	395	3/4 to 1

* ØA and ØB thread dimensions for reference only.

** See Appendix B for FFWR procedure requirements.

Table 5-4. 37° Flare (JIC)Thread - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	4	4	5	5	6	7	--
	3	3/8-24	0.34	8.60	0.37	9.50	5	6	7	7	8	9	--
	4	7/16-20	0.39	10.00	0.44	11.10	8	9	9	11	12	13	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	9	10	10	12	13	14	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	14	15	16	19	20	21	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	27	29	30	37	39	41	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	39	41	43	53	56	58	1 to 1-1/2
	12	11/16-12	0.97	24.60	1.06	27.00	55	57	60	74	78	81	1 to 1-1/2
	14	13/16-12	1.11	28.30	1.19	30.10	65	68	72	88	93	97	1 to 1-1/2
	16	15/16-12	1.23	31.30	1.31	33.30	77	81	84	104	109	114	3/4 to 1
	20	15/8-12	1.54	39.20	1.63	41.30	109	115	120	148	155	163	3/4 to 1
	24	17/8-12	1.80	45.60	1.87	47.60	127	133	139	172	180	189	3/4 to 1
	32	21/2-12	2.42	61.50	2.50	63.50	172	181	189	234	245	257	3/4 to 1

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

Assembly Instructions for 45° SAE Flare Fittings

1. Inspect the flare for obvious visual squareness and concentricity issues with the tube OD. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

DO NOT FORCE A MISALIGNED OR SHORT HOSE/TUBE INTO ALIGNMENT. IT PUTS UNDESIRABLE STRAIN ONTO THE JOINT EVENTUALLY LEADING TO LEAKAGE.

2. Align tube to fitting.
3. Tighten fitting by hand until hand tight.

⚠ CAUTION

THE TORQUE METHOD SHOULD NOT BE USED ON LUBRICATED OR OILY FITTINGS. NO LUBRICATION OR SEALANT IS REQUIRED. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

Torque fitting to value listed in Table 5-5, 45° Flare (SAE) - Steel and Table 5-6, 45° Flare (SAE) - Aluminum/Brass while using the Double Wrench Method outlined in this section. Refer to FFWR and TFFT Methods for procedure requirements if using the TFFT method.

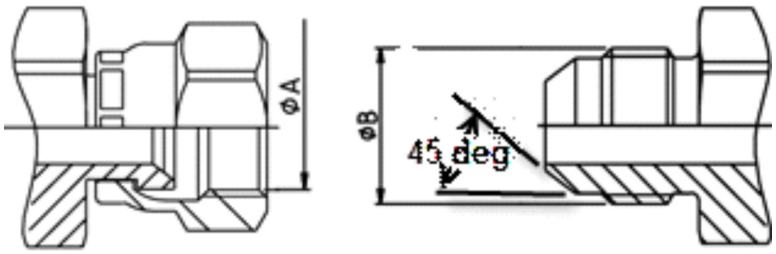
NOTE: *Torque values provided in Table 5-5, 45° Flare (SAE) - Steel and Table 5-6, 45° Flare (SAE) - Aluminum/Brass are segregated based on the material configuration of the connection.*

ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS

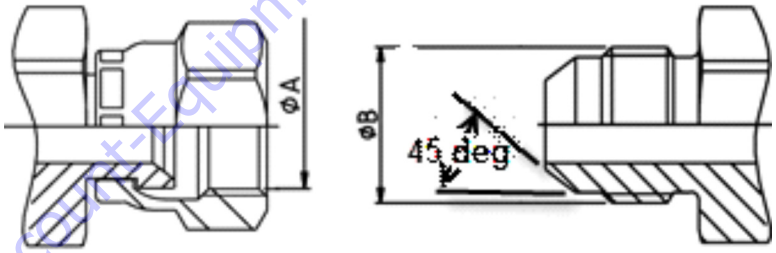
mating components.

Table 5-5. 45° Flare (SAE) - Steel



TYPE/FITTING IDENTIFICATION							Torque					
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]		
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	13	14	14	18	19	19
	6	5/8-18	0.56	14.30	0.63	15.90	22	23	24	30	31	33
	8	3/4-16	0.69	17.50	0.75	19.10	42	44	46	57	60	62
	10	7/8-14	0.81	20.60	0.87	22.20	60	63	66	81	85	89
	12	11/16-14	0.98	25.00	1.06	27.00	84	88	92	114	119	125
* ØA and ØB thread dimensions for reference only.												
** See FFWR and TFFT Methodsfor FFWR procedure requirements.												

Table 5-6. 45° Flare (SAE) - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque					
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]		
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	8	9	9	11	12	12
	6	5/8-18	0.56	14.30	0.63	15.90	14	15	15	19	20	20
	8	3/4-16	0.69	17.50	0.75	19.10	27	29	30	37	39	41
	10	7/8-14	0.81	20.60	0.87	22.20	39	41	43	53	56	58
	12	11/16-14	0.98	25.00	1.06	27.00	55	58	61	75	79	83
* ØA and ØB thread dimensions for reference only.												
** See FFWR and TFFT Methods for TFFT procedure requirements.												

Assembly Instructions for O-ring Face Seal (ORFS) Fittings

1. Ensure proper o-ring is installed. If o-ring is missing install per O-ring Installation (Replacement).
2. Ensure surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary replace fitting or adapter.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the o-ring with Hydraulic Oil.
4. Place the tube assembly against the fitting body so that the flat face comes in contact with the o-ring. Hand thread the nut onto the fitting body.
5. Torque nut to value listed in Table 5-7, O-ring Face Seal (ORFS) - Steel or Table 5-8, O-ring Face Seal (ORFS) - Aluminum/Brass while using the Double Wrench Method. Refer to FFWR and TFFT Methods for procedure requirements if using the FFWR method.

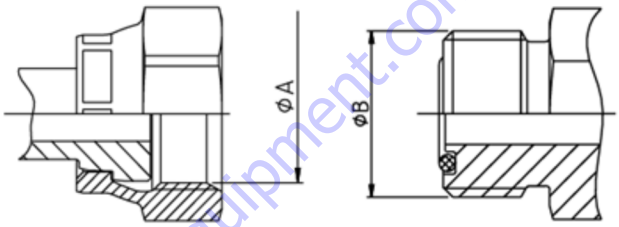
NOTE: *Torque values provided in Table 5-7, O-ring Face Seal (ORFS) - Steel and Table 5-8, O-ring Face Seal (ORFS) - Aluminum/Brass are segregated based on the material configuration of the connection.*

ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or

BRASS mating components

Table 5-7. O-ring Face Seal (ORFS) - Steel

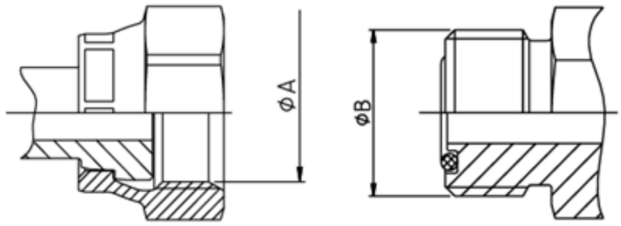


TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**	
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	18	19	20	25	26	27	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	30	32	33	40	43	45	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	40	42	44	55	57	60	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	60	63	66	81	85	89	1/4 to 1/2	1/2 to 3/4
	12	13/16-12	1.11	28.20	1.19	30.10	85	90	94	115	122	127	1/4 to 1/2	1/2 to 3/4
	16	17/16-12	1.34	34.15	1.44	36.50	110	116	121	149	157	164	1/4 to 1/2	1/2 to 3/4
	20	111/16-12	1.59	40.50	1.69	42.90	150	158	165	203	214	224	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	230	242	253	312	328	343	1/4 to 1/2	1/2 to 3/4
	32	21/2-12	2.43	61.67	2.50	63.50	375	394	413	508	534	560	1/4 to 1/2	1/2 to 3/4

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methodsfor FFWR procedure requirements.

Table 5-8. O-ring Face Seal (ORFS) - Aluminum/Brass



TYPE/FITTING IDENTIFICATION							Torque						Flats from Wrench Resistance (F.F.W.R)**	
MATERIAL	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[N-m]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	12	13	13	16	18	18	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	20	21	22	27	28	30	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	26	28	29	35	38	39	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	39	41	43	53	56	58	1/4 to 1/2	1/2 to 3/4
	12	13/16-12	1.11	28.20	1.19	30.10	55	58	61	75	79	83	1/4 to 1/2	1/2 to 3/4
	16	17/16-12	1.34	34.15	1.44	36.50	72	76	79	98	103	107	1/4 to 1/2	1/2 to 3/4
	20	111/16-12	1.59	40.50	1.69	42.90	98	103	108	133	140	146	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	12	13	13	16	18	18	1/4 to 1/2	1/2 to 3/4
	32	2 1/2-12	2.43	61.67	2.50	63.50	20	21	22	27	28	30	1/4 to 1/2	1/2 to 3/4

* ØA and ØB thread dimensions for reference only.

** See FFWR and TFFT Methods for FFWR procedure requirements.

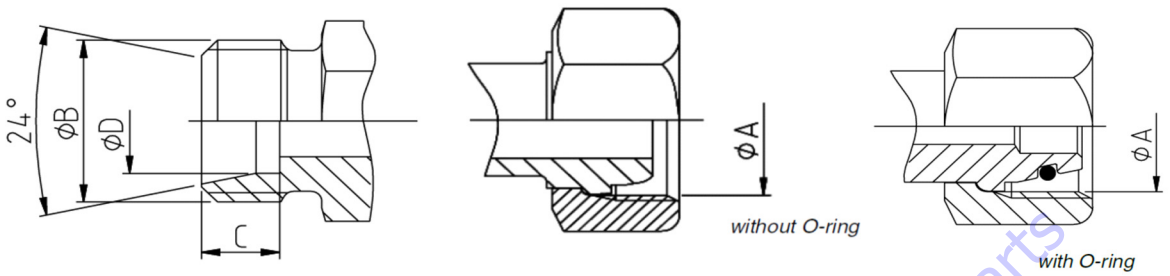
Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS)

⚠ CAUTION

A NON-SQUARE TUBE END CAN CAUSE IMPROPERLY SEATED FITTINGS AND LEAKAGE.

1. Inspect the components to ensure free of contamination, external damage, rust, splits, dirt, foreign matter, or burrs. Ensure tube end is visibly square. If necessary replace fitting or tube.
2. Lubricate thread and cone of fitting body or hardened pre-assembly tool, as well as the progressive ring and nut threads.
3. Slip nut and progressive ring over tube, assuring that they are in the proper orientation.
4. Push the tube end into the coupling body.
5. Slide collet into position and tighten until finger tight. Mark nut and tube in the finger-tight position. Tighten nut to the number of flats listed in Table 5-9, DIN 24°Cone (MBTL & MBTS) while using the Double Wrench Method. The tube must not turn with the nut.

Table 5-9. DIN 24°Cone (MBTL & MBTS)



TYPE/FITTING IDENTIFICATION								DIN 24° CONE FLARELESS BITE FITTING (With or Without o-ring)						
MATERIAL	TYPE	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Nom	Max	Torque [N-m] Min	Nom	Max	Flats from Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
STEEL FITTINGS WITH STEEL MATING COMPONENTS	DIN 24° CONE FLARELESS BITE (MBTL) FITTING	6	M12x1.5	10.50	12.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristics of the connection. Refer to the specific procedure in this Service Manual.						1.5 to 1.75
		8	M14x1.5	12.50	14.00	7.00	8.20							1.5 to 1.75
		10	M16x1.5	14.50	16.00	7.00	10.20							1.5 to 1.75
		12	M18x1.5	16.50	18.00	7.00	12.20							1.5 to 1.75
		15	M22x1.5	20.50	22.00	7.00	15.20							1.5 to 1.75
		18	M26x1.5	24.50	26.00	7.50	18.20							1.5 to 1.75
		22	M30x2	27.90	30.00	7.50	22.20							1.5 to 1.75
		28	M36x2	33.90	36.00	7.50	28.20							1.5 to 1.75
		35	M45x2	42.90	45.00	10.50	35.30							1.5 to 1.75
		42	M52x2	49.90	52.00	11.00	42.30							1.5 to 1.75
	TYPE	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Nom	Max	Torque [N-m] Min	Nom	Max	Flats from Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
	DIN 24° CONE FLARELESS BITE (MBTS) FITTING	6	M14x1.5	12.50	14.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristics of the connection. Refer to the specific procedure in this Service Manual.						1.5 to 1.75
		8	M16x1.5	14.50	16.00	7.00	8.20							1.5 to 1.75
		10	M18x1.5	16.50	18.00	7.50	10.20							1.5 to 1.75
		12	M20x1.5	18.50	20.00	7.50	12.20							1.5 to 1.75
		14	M22x1.5	20.50	22.00	8.00	14.20							1.5 to 1.75
		16	M24x1.5	22.50	24.00	8.50	16.20							1.5 to 1.75
		20	M30x2	27.90	30.00	10.50	20.20							1.5 to 1.75
		25	M36x2	33.90	36.00	12.00	25.20							1.5 to 1.75
		30	M42x2	39.90	42.00	13.50	30.20							1.5 to 1.75
		38	M52x2	49.90	52.00	16.00	38.30							1.5 to 1.75

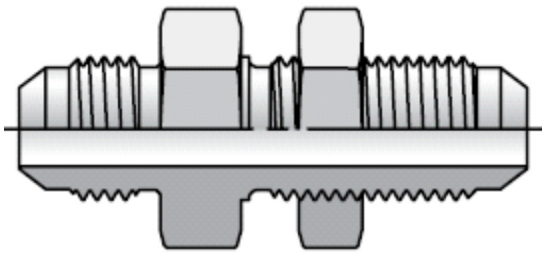
* ØA, ØB, C, & ØD thread dimensions for reference only.

** See Appendix B for FFWR procedure requirements.

Assembly Instructions for Bulkhead (BH) Fittings

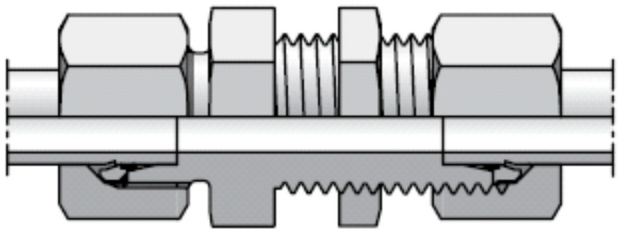
1. Ensure threads and surface are free of rust, weld and brazing splatter, splits, burrs or other foreign material. If necessary replace fitting or adapter.
2. Remove the locknut from the bulkhead assembly.
3. Insert the bulkhead side of the fitting into the panel or bulkhead bracket opening.
4. Hand thread the locknut onto the bulkhead end of the fitting body.
5. Torque nut onto fitting per Table 5-10 and Table 5-11 while using the Double Wrench Method.

Table 5-10. Bulkhead Fittings (BH) - INCH



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT for Bulkhead Connectors					
MATERIAL	TYPE	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[N-m]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	O-RING FACE SEAL (ORFS) BULKHEAD FITTING	4	9/16-18	15	16	17	20	22	23
		6	11/16-16	25	27	28	34	37	38
		8	13/16-16	55	58	61	75	79	83
		10	1-14	85	90	94	115	122	127
		12	13/16-12	135	142	149	183	193	202
		14	15/16-12	170	179	187	230	243	254
		16	17/16-12	200	210	220	271	285	298
		20	111/16-12	245	258	270	332	350	366
		24	2-12	270	284	297	366	385	403
	TYPE	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[N-m]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
	37° FLARE (JIC) BULKHEAD FITTING	3	3/8-24	8	9	9	11	12	12
		4	7/16-20	13	14	14	18	19	19
		5	1/2-20	20	21	22	27	28	30
		6	9/16-18	25	27	28	34	37	38
		8	3/4-16	50	53	55	68	72	75
		10	7/8-14	85	90	94	115	122	127
		12	11/16-12	135	142	149	183	193	202
		14	13/16-12	170	179	187	230	243	254
		16	15/16-12	200	210	220	271	285	298
		20	15/8-12	245	258	270	332	350	366
		24	17/8-12	270	284	297	366	385	403
		32	21/2-12	310	326	341	420	442	462

Table 5-11. Bulkhead Fittings (BH) - METRIC



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT for Bulkhead Connectors					
MATERIAL	TYPE	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[N-m]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	DIN 24° CONE FLARELESS BITE (MBTL) BULKHEAD FITTING	6	M12x1.5	14	15	16	19	20	22
		8	M14x1.5	17	18	19	23	24	26
		10	M16x1.5	22	23	24	30	31	33
		12	M18x1.5	35	37	39	47	50	53
		15	M22x1.5	44	47	50	60	64	68
		18	M26x1.5	70	75	80	95	102	108
		22	M30x2	115	120	125	156	163	169
		28	M36x2	150	157	164	203	213	222
		35	M45x2	155	162	169	210	220	229
		42	M52x2	220	230	240	298	312	325
	DIN 24° CONE FLARELESS BITE (MBTS) BULKHEAD FITTING	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[N-m]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
		6	M14x1.5	17	15	16	23	20	22
		8	M16x1.5	22	18	19	30	24	26
		10	M18x1.5	35	23	24	47	31	33
		12	M20x1.5	40	35	37	54	47	50
		14	M22x1.5	44	47	50	60	64	68
		16	M24x1.5	70	75	80	95	102	108
		20	M30x2	115	120	125	156	163	169
		25	M36x2	150	157	164	203	213	222
		30	M42x2	155	162	169	210	220	229
		38	M52x2	220	230	240	298	312	325

Assembly Instructions for O-ring Boss (ORB) Fittings

1. Inspect components to ensure that male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Ensure proper o-ring is installed. If o-ring is missing install per O-ring Installation (Replacement).

⚠ CAUTION

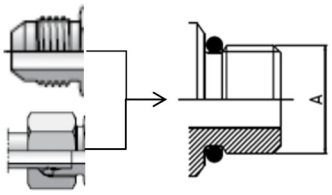
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the o-ring with Hydraulic Oil.
4. For Non-Adjustable and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-12 through Table 5-17 while using the Double Wrench Method.
   a. The table headings identify the straight thread o-ring port and the type on the other side of the fitting. The torque will be applied to the straight thread o-ring port.
   b. Torque values provided in Table 5-12 through Table 5-17 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-12. O-ring Boss (ORB) - Table 1 of 6



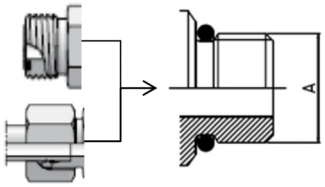
TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(94)	10	10	11
	3	3/8-24	0.37	9.52	(155)	(163)	(171)	18	18	19
	4	7/16-20	0.44	11.11	22	23	24	29	31	33
	5	1/2-20	0.50	12.70	23	25	26	32	34	35
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(55)	(58)	(61)	6	7	7
	3	3/8-24	0.37	9.52	(101)	(106)	(111)	11	12	13
	4	7/16-20	0.44	11.11	14	15	16	19	20	22
	5	1/2-20	0.50	12.70	15	16	17	20	22	23
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-13. O-ring Boss (ORB) - Table 2 of 6



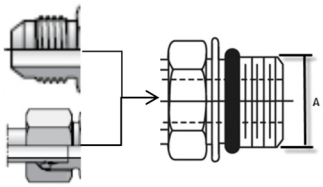
TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	26	27	28	35	37	38
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	17	18	18	23	24	24
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-14. O-ring Boss (ORB) - Table 3 of 6



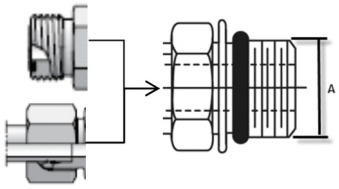
TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(60)	(63)	(66)	7	7	7
	3	3/8-24	0.37	9.52	(100)	(105)	(110)	11	12	12
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	21	22	23	28	30	31
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(39)	(41)	(43)	4	5	5
	3	3/8-24	0.37	9.52	(65)	(69)	(72)	7	8	8
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	15	19	20	20
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-15. O-ring Boss (ORB) - Table 4 of 6



TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560

TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

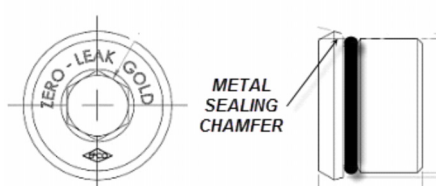
Table 5-16. O-ring Boss (ORB) - Table 5 of 6

TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(30)	(32)	(33)	3	4	4
	3	3/8-24	0.37	9.52	(55)	(58)	(61)	6	7	7
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	16	19	20	22
	6	9/16-18	0.56	14.28	34	36	38	46	49	52
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(20)	(21)	(21)	2	2	2
	3	3/8-24	0.37	9.52	(36)	(38)	(40)	4	4	5
	4	7/16-20	0.44	11.11	6	7	7	8	9	9
	5	1/2-20	0.50	12.70	9	10	10	12	14	14
	6	9/16-18	0.56	14.28	22	24	25	30	33	34
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Table 5-17. O-ring Boss (ORB) - Table 6 of 6



TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						

TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
MATERIAL	Dash Size	Thread Size	ØA*		Torque					
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 not typically specified on JLG applications. Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						

* ØA Thread OD dimension for reference only.

**Removal Torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

Assembly Instructions for Adjustable Port End Metric (MFF) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter or burrs.
2. If o-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

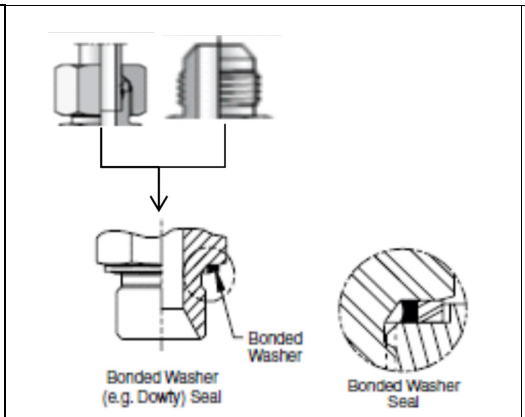
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

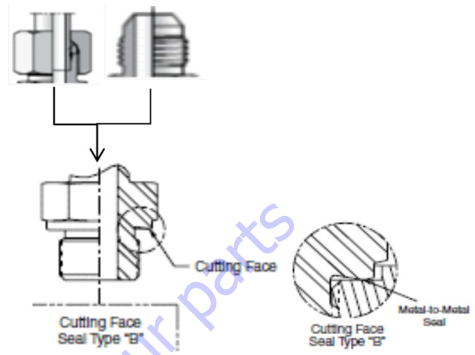
3. Pre-lubricate the o-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-18, Table 5-19, Table 5-20, Table 5-21, Table 5-22, or Table 5-23 while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values provided in Table 5-18, Table 5-19, Table 5-20, Table 5-21, Table 5-22, and Table 5-23 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counterbore of the port.

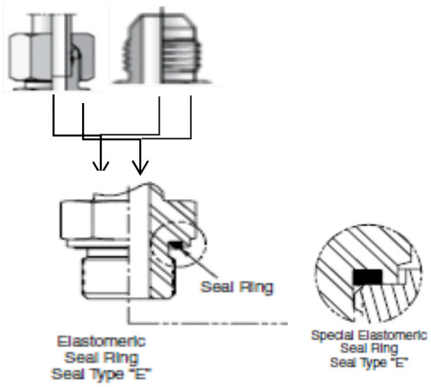
Table 5-18. Metric Flat Face Port (MFF) - L Series - Table 1 of 3

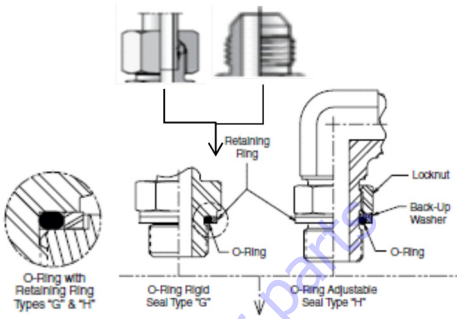




TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	7	8	8	9	11	11	13	14	14	18	19	19
	M12x1.5	8	15	16	17	20	22	23	22	23	24	30	31	33
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	33	35	36	45	47	49	48	51	53	65	69	72
	M18x1.5	15	41	43	45	55	58	61	59	62	65	80	84	88
	M22x1.5	18	48	51	53	65	69	72	103	108	113	140	146	153
	M27x2	22	66	70	73	90	95	99	140	147	154	190	199	209
	M33x2	28	111	117	122	150	159	165	251	264	276	340	358	374
	M42x2	35	177	186	195	240	252	264	369	388	406	500	526	550
	M48x2	42	214	225	235	290	305	319	465	489	512	630	663	694
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	4	5	5	5	7	7	8	9	9	11	12	12
	M12x1.5	8	10	11	11	14	15	15	14	15	16	19	20	22
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	21	22	23	28	30	31	31	33	34	42	45	46
	M18x1.5	15	27	28	29	37	38	39	38	40	42	52	54	57
	M22x1.5	18	31	33	34	42	45	46	67	70	73	91	95	99
	M27x2	22	43	45	47	58	61	64	91	96	100	123	130	136
	M33x2	28	72	76	79	98	103	107	163	171	179	221	232	243
	M42x2	35	115	121	127	156	164	172	240	252	264	325	342	358
	M48x2	42	139	146	153	188	198	207	302	318	332	409	431	450

Table 5-19. Metric Flat Face Port (MFF) - L Series - Table 2 of 3





TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	15	18	19	20
	M12x1.5	8	18	19	20	25	26	27	18	19	20	25	26	28
	M14x1.5	10	33	35	36	45	47	49	30	31	32	40	42	44
	M16x1.5	12	41	43	45	55	58	61	41	43	45	55	58	61
	M18x1.5	15	52	55	57	70	75	77	52	54	57	70	74	77
	M22x1.5	18	92	97	101	125	132	137	66	70	73	90	95	99
	M27x2	22	133	140	146	180	190	198	133	139	146	180	189	198
	M33x2	28	229	241	252	310	327	342	229	240	252	310	326	341
	M42x2	35	332	349	365	450	473	495	332	348	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12
	M12x1.5	8	12	13	13	16	18	18	12	13	13	16	18	18
	M14x1.5	10	21	22	23	28	30	31	19	20	21	26	27	29
	M16x1.5	12	27	28	29	37	38	39	26	28	29	36	38	39
	M18x1.5	15	34	36	37	46	49	50	34	35	37	46	48	50
	M22x1.5	18	60	63	66	81	85	89	43	45	47	59	61	64
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

Table 5-20. Metric Flat Face Port (MFF) - L Series - Table 3 of 3

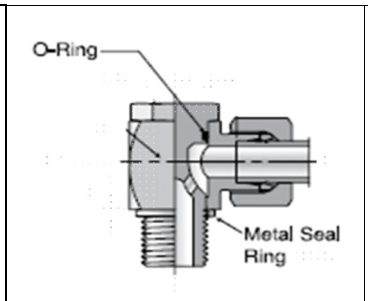
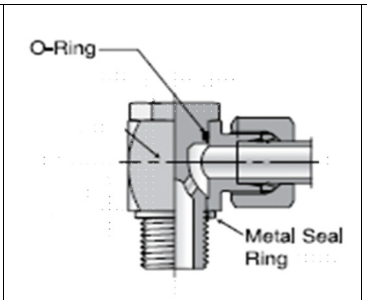
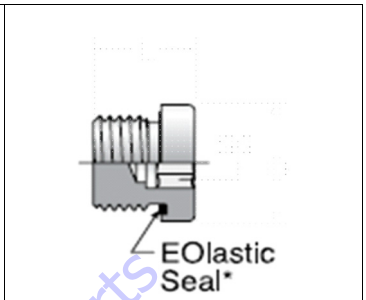
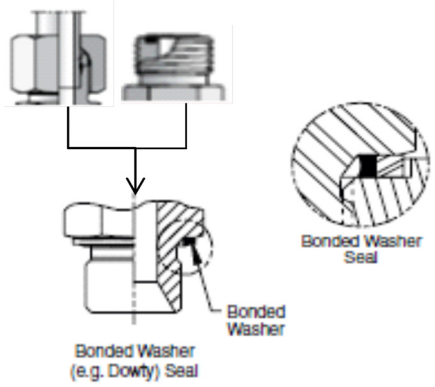
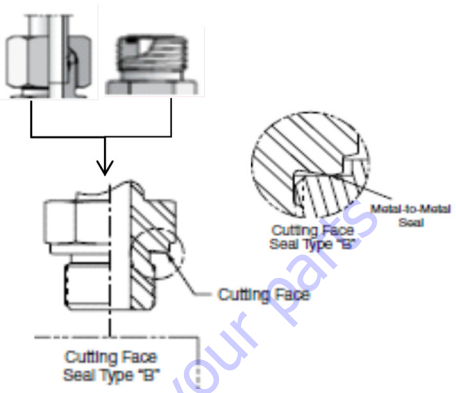
																				
TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with L series DIN (MBTL) opposite end						HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS								
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque								
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]				
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max		
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	14	18	19	19	9	10	10	12	14	14		
	M12x1.5	8	26	28	29	35	38	39	33	35	36	45	47	49	18	19	20	25	26	27		
	M14x1.5	10	37	39	41	50	53	56	41	43	45	55	58	61	26	28	29	35	38	39		
	M16x1.5	12	44	46	48	60	62	65	59	62	65	80	84	88	41	43	45	55	58	61		
	M18x1.5	15	59	62	65	80	84	88	74	78	81	100	106	110	48	51	53	65	69	72		
	M22x1.5	18	89	94	98	120	127	133	103	108	113	140	146	153	66	70	73	90	95	99		
	M27x2	22	96	101	106	130	137	144	236	248	260	320	336	353	100	105	110	135	142	149		
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	166	175	183	225	237	248		
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	266	280	293	360	380	397		
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	266	280	293	360	380	397		
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque								
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]				
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max		
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9		
	M12x1.5	8	17	18	19	23	24	26	21	22	23	28	30	31	12	13	13	16	18	18		
	M14x1.5	10	24	26	27	33	35	37	27	28	29	37	38	39	17	18	19	23	24	26		
	M16x1.5	12	29	30	31	39	41	42	38	40	42	52	54	57	27	28	29	37	38	39		
	M18x1.5	15	38	40	42	52	54	57	48	51	53	65	69	72	31	33	34	42	45	46		
	M22x1.5	18	58	61	64	79	83	87	67	70	73	91	95	99	43	45	47	58	61	64		
	M27x2	22	62	66	69	84	89	94	153	161	169	207	218	229	65	69	72	88	94	98		
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	108	114	119	146	155	161		
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	173	182	190	235	247	258		
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	173	182	190	235	247	258		

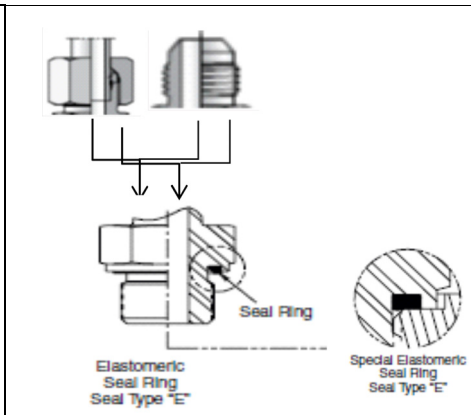
Table 5-21. Metric Flat Face Port (MFF) - S Series - Table 1 of 3

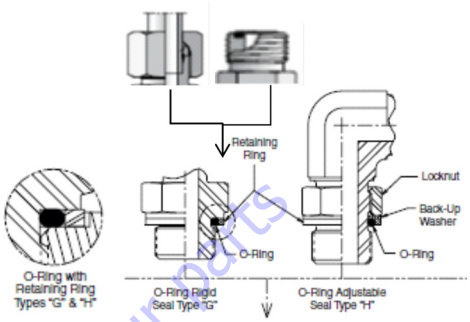




TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	15	16	17	20	22	23	26	28	29	35	38	39
	M14x1.5	8	26	28	29	35	38	39	41	43	45	55	58	61
	M16x1.5	10	33	35	36	45	47	49	52	55	57	70	75	77
	M18x1.5	12	41	43	45	55	58	61	81	85	89	110	115	121
	M20x1.5	14	41	43	45	55	58	61	111	117	122	150	159	165
	M22x1.5	16	48	51	53	65	69	72	125	132	138	170	179	187
	M27x2	20	66	70	73	89	95	99	199	209	219	270	283	297
	M33x2	25	111	117	122	150	159	165	302	317	332	410	430	450
	M42x2	30	177	186	195	240	252	264	398	418	438	540	567	594
	M48x2	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	10	11	11	14	15	15	17	18	19	23	24	26
	M14x1.5	8	17	18	19	23	24	26	27	28	29	37	38	39
	M16x1.5	10	21	22	23	28	30	31	34	36	37	46	49	50
	M18x1.5	12	27	28	29	37	38	39	53	56	58	72	76	79
	M20x1.5	14	27	28	29	37	38	39	72	76	79	98	103	107
	M22x1.5	16	31	33	34	42	45	46	81	86	90	110	117	122
	M27x2	20	43	45	47	58	61	64	129	136	142	175	184	193
	M33x2	25	72	76	79	98	103	107	196	206	216	266	279	293
	M42x2	30	115	121	127	156	164	172	259	272	285	351	369	386
	M48x2	38	139	146	153	188	198	207	335	352	369	454	477	500

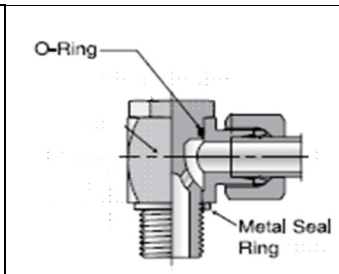
Table 5-22. Metric Flat Face Port (MFF) - S Series - Table 2 of 3

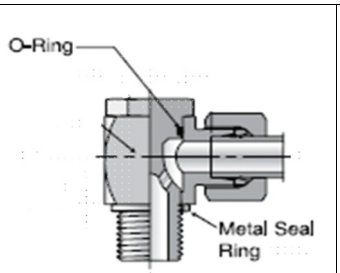


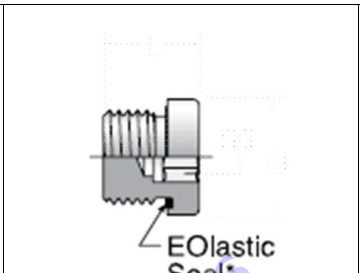


TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	26	28	29	35	38	39
	M12x1.5	8	33	35	36	45	47	49	41	43	45	55	58	61
	M14x1.5	10	52	55	57	70	75	77	52	55	57	70	75	77
	M16x1.5	12	66	70	73	90	95	99	66	70	73	90	95	99
	M18x1.5	15	92	97	101	125	132	137	92	97	101	125	132	137
	M22x1.5	18	100	105	110	135	142	149	100	105	110	135	142	149
	M27x2	22	133	140	146	180	190	198	133	140	146	180	190	198
	M33x2	28	229	241	252	310	327	342	229	241	252	310	327	342
	M42x2	35	332	349	365	450	473	495	332	349	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	17	18	19	23	24	26
	M12x1.5	8	21	23	23	29	31	32	27	28	29	37	38	39
	M14x1.5	10	34	36	37	46	49	50	34	36	37	46	49	50
	M16x1.5	12	43	45	47	58	61	64	43	45	47	58	61	64
	M18x1.5	15	60	63	66	81	85	89	60	63	66	81	85	89
	M22x1.5	18	65	69	72	88	94	98	65	69	72	88	94	98
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

Table 5-23. Metric Flat Face Port (MFF) - S Series - Table 3 of 3







TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with S series DIN (MBTS) opposite end						HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	33	35	36	45	47	49	--	--	--	--	--	--
	M12x1.5	8	37	39	41	50	53	56	41	43	45	55	58	61	--	--	--	--	--	--
	M14x1.5	10	44	46	48	60	62	65	59	62	65	80	84	88	--	--	--	--	--	--
	M16x1.5	12	59	62	65	80	84	88	74	78	81	100	106	110	--	--	--	--	--	--
	M18x1.5	15	81	85	89	110	115	121	92	97	101	125	132	137	59	62	65	80	84	88
	M22x1.5	18	89	94	98	120	127	133	100	105	110	135	142	149	--	--	--	--	--	--
	M27x2	22	100	105	110	135	142	149	236	248	260	320	336	353	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	--	--	--	--	--	--
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	21	22	23	28	30	31	--	--	--	--	--	--
	M12x1.5	8	24	26	27	33	35	37	27	28	29	37	38	39	--	--	--	--	--	--
	M14x1.5	10	29	30	31	39	41	42	38	40	42	52	54	57	--	--	--	--	--	--
	M16x1.5	12	38	40	42	52	54	57	48	51	53	65	69	72	--	--	--	--	--	--
	M18x1.5	15	53	56	58	72	76	79	60	63	66	81	85	89	38	40	42	52	54	57
	M22x1.5	18	58	61	64	79	83	87	65	69	72	88	94	98	--	--	--	--	--	--
	M27x2	22	65	69	72	88	94	98	153	161	169	207	218	229	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	--	--	--	--	--	--

Assembly Instructions for Metric ISO 6149 (MPP) Port Assembly Stud Ends

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter or burrs.
2. If o-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

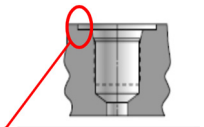
CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the o-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-24 while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values provided in Table 5-24 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

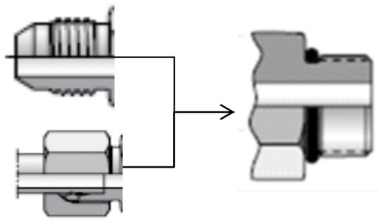
- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

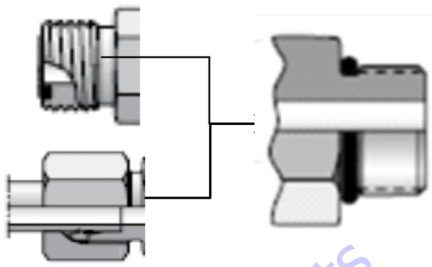
7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-24. Metric Pipe Parallel O-ring Boss (MPP)



Note: Metric O-ring only style (ISO 6149) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB),**but is not interchangeable.**





TYPE/FITTING IDENTIFICATION			STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	6	7	7	8	9	9	8	9	9	10	12	12
	M10x1	6	11	12	12	15	16	16	15	16	17	20	22	23
	M12x1.5	8	18	19	20	25	26	27	26	28	29	35	38	39
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	30	32	33	40	43	45	41	43	45	55	58	61
	M18x1.5	15	33	35	36	45	47	49	52	55	57	70	75	77
	M20x1.5	--	--	--	--	--	--	--	59	62	65	80	84	88
	M22x1.5	18	44	46	48	60	62	65	74	78	81	100	106	110
	M27x2	22	74	78	81	100	106	110	125	132	138	170	179	187
	M30x2	--	95	100	105	130	136	142	175	184	193	237	249	262
	M33x2	25	120	126	132	160	171	179	230	242	253	310	328	343
	M38x2	--	135	142	149	183	193	202	235	247	259	319	335	351
	M42x2	30	155	163	171	210	221	232	245	258	270	330	350	366
	M48x2	38	190	200	209	260	271	283	310	326	341	420	442	462
	M60x2	50	230	242	253	315	328	343	370	389	407	500	527	552
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	4	5	5	5	7	7	5	6	6	7	8	8
	M10x1	6	7	8	8	9	11	11	10	11	11	14	15	15
	M12x1.5	8	12	13	13	16	18	18	17	18	19	23	24	26
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	20	21	21	27	28	28	27	28	29	37	38	39
	M18x1.5	15	21	22	23	28	30	31	34	36	37	46	49	50
	M20x1.5	--	--	--	--	--	--	--	30	40	42	41	54	57
	M22x1.5	18	29	30	31	39	41	42	48	51	53	65	69	72
	M27x2	22	48	51	53	65	69	72	81	86	90	110	117	122
	M30x2	--	62	65	68	84	88	92	114	120	125	155	163	169
	M33x2	25	78	82	86	106	111	117	150	157	164	203	213	222
	M38x2	--	88	93	97	119	126	132	153	161	168	207	218	228
	M42x2	30	101	106	111	137	144	150	159	168	176	216	228	239
	M48x2	38	124	130	136	168	176	184	202	212	222	274	287	301
	M60x2	50	150	157	164	203	213	222	241	253	265	327	343	359

Assembly instructions for Adjustable Port End (BSPP) Fittings

1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter or burrs.
2. If o-ring is not pre-installed, install proper size, taking care not to damage it. See O-ring Installation (Replacement) for instructions.

⚠ CAUTION

CARE TO BE TAKEN WHEN LUBRICATING O-RING. AVOID ADDING OIL TO THE THREADED CONNECTION OF THE FITTING. THE LUBRICATION WOULD CAUSE INCREASED CLAMPING FORCE AND CAUSE FITTING DAMAGE.

3. Pre-lubricate the o-ring with Hydraulic Oil.
4. For Non-Adjustable Fittings and Plugs, thread the fitting by hand until contact.
5. For Adjustable fittings, refer to Adjustable Stud End Assembly for proper assembly.
6. Torque the fitting or nut to value listed in Table 5-25, Table 5-26, Table 5-27, Table 5-28, Table 5-29, or Table 5-30 while using the Double Wrench Method.
   a. The table headings identify the BSPP port and the type on the other side of the fitting. The torque will be applied to the BSPP port.
   b. Torque values provided in Table 5-25, Table 5-26, Table 5-27, Table 5-28, Table 5-29, and Table 5-30 are segregated based on the material configuration of the connection. 'ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

- STEEL fittings with ALUMINUM or BRASS mating components
- ALUMINUM or BRASS fittings with STEEL mating components
- ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counterbore of the port.

Table 5-25. British Standard Parallel Pipe Port (BSPP) - L Series - Table 1 of 3

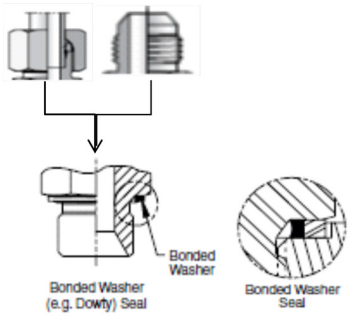
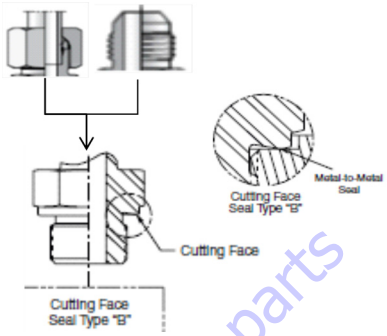
														
TYPE/FITTING IDENTIFICATION			FORM A**(SEALING WASHER) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM B** (CUTTING FACE) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	7	8	8	9	11	11	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	33	35	36	45	47	49	52	55	57	70	75	77
	G 1/2A	15	48	51	53	65	69	72	103	108	113	140	146	153
	G 1/2A	18	48	51	53	65	69	72	74	78	81	100	106	110
	G 3/4A	22	66	70	73	90	95	99	133	140	146	180	190	198
	G 1A	28	111	117	122	150	159	165	243	255	267	330	346	362
	G 1-1/4A	35	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	42	214	225	235	290	305	319	465	489	512	630	663	694
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	4	5	5	5	7	7	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	21	22	23	28	30	31	34	36	37	46	49	50
	G 1/2A	15	31	33	34	42	45	46	67	70	73	91	95	99
	G 1/2A	18	31	33	34	42	45	46	48	51	53	65	69	72
	G 3/4A	22	42	45	47	57	61	64	86	91	95	117	123	129
	G 1A	28	72	76	79	98	103	107	158	166	174	214	225	236
	G 1-1/4A	35	115	121	127	156	164	172	259	272	285	351	369	386
	G 1-1/2A	42	139	146	153	188	198	207	302	318	333	409	431	451
* Typical for JLG Straight Male Stud Fittings														
** Non typical for JLG Straight Male Stud Fittings, reference only.														
*** Typical for JLG Adjustable Fittings														

Table 5-26. British Standard Parallel Pipe Port (BSPP) - L Series - Table 2 of 3

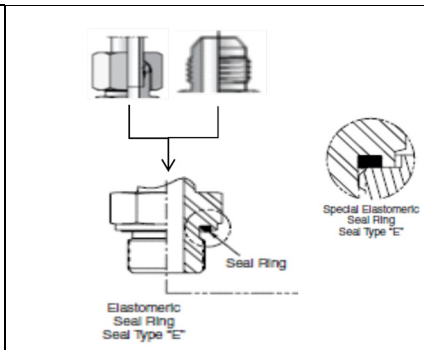
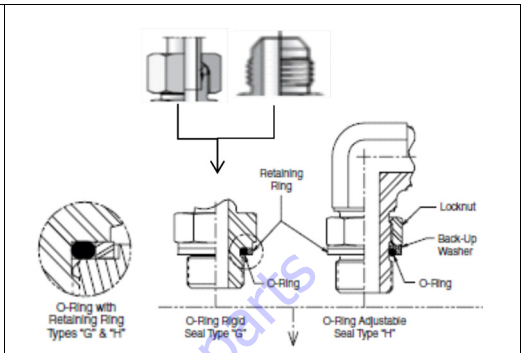
														
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with 37° (JIC) or L series DIN (MBTL) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	52	55	57	70	75	77	52	55	57	70	75	77
	G 1/2A	15	66	70	73	90	95	99	66	70	73	90	95	99
	G 1/2A	18	66	70	73	90	95	99	66	70	73	90	95	99
	G 3/4A	22	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	28	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	35	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	42	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	34	36	37	46	49	50	34	36	37	46	49	50
	G 1/2A	15	43	45	47	58	61	64	43	45	47	58	61	64
	G 1/2A	18	43	45	47	58	61	64	43	45	47	58	61	64
	G 3/4A	22	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	28	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	35	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	42	259	272	285	351	369	386	259	272	285	351	369	386
* Typical for JLG Straight Male Stud Fittings														
** Non typical for JLG Straight Male Stud Fittings, reference only.														
*** Typical for JLG Adjustable Fittings														

Table 5-27. British Standard Parallel Pipe Port (BSPP) - L Series - Table 3 of 3

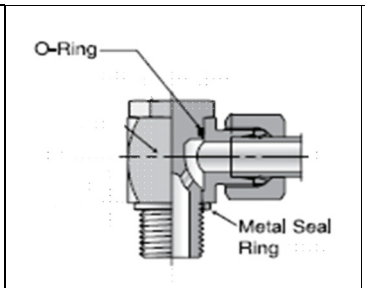
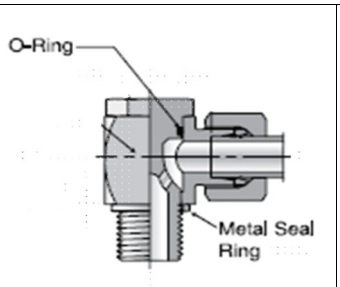
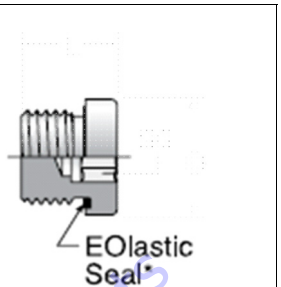
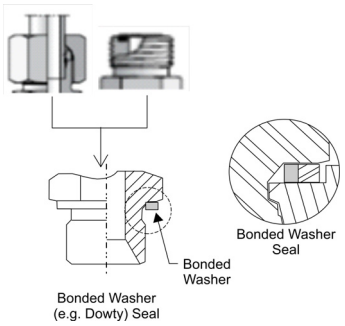
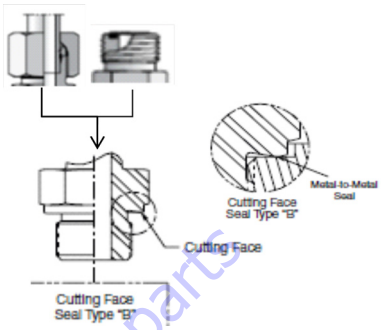
																				
TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with L series DIN (MBTL) opposite end						HIGH PRESSURE BANJO FITTINGS with L series DIN (MBTL) opposite end						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19	10	11	11	13	15	15
	G 1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 1/4A	10	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77	44	46	48	60	62	65
	G 1/2A	15	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 1/2A	18	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 3/4A	22	92	97	101	125	132	137	170	179	187	230	243	254	103	108	113	140	146	153
	G 1A	28	--	--	--	--	--	--	236	248	260	320	336	353	148	156	163	200	212	221
	G 1-1/4A	35	--	--	--	--	--	--	398	418	438	540	567	594	295	313.5	332	400	425	450
	G 1-1/2A	42	--	--	--	--	--	--	516	542	568	700	735	770	332	349	365	450	473	495
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	G 1/4A	8	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 1/4A	10	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50	29	30	31	39	41	42
	G 1/2A	15	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 1/2A	18	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 3/4A	22	60	63	66	81	85	89	111	117	122	150	159	165	67	70	73	91	95	99
	G 1A	28	--	--	--	--	--	--	153	161	169	207	218	229	96	101	106	130	137	144
	G 1-1/4A	35	--	--	--	--	--	--	259	272	285	351	369	386	216	227	237	293	308	321
	G 1-1/2A	42	--	--	--	--	--	--	335	352	369	454	477	500	216	227	237	293	308	321
* Typical for JLG Straight Male Stud Fittings																				
** Non typical for JLG Straight Male Stud Fittings, reference only.																				
*** Typical for JLG Adjustable Fittings																				

Table 5-28. British Standard Parallel Pipe Port (BSPP) - S Series - Table 1 of 3





TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end						FORM B** (CUTTING FACE) STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	26	28	29	35	38	39	41	43	45	55	58	61
	G 1/4A	8	26	28	29	35	38	39	41	43	45	55	58	61
	G 3/8A	10	33	35	36	45	47	49	66	70	73	90	95	99
	G 3/8A	12	33	35	36	45	47	49	66	70	73	90	95	99
	G 1/2A	14	48	51	53	65	69	72	111	117	122	150	159	165
	G 1/2A	16	48	51	53	65	69	72	96	101	106	130	137	144
	G 3/4A	20	66	70	73	90	95	99	199	209	219	270	283	297
	G 1A	25	111	117	122	150	159	165	251	264	276	340	358	374
	G 1-1/4A	30	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	38	214	225	235	290	305	319	516	542	568	700	735	770
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	17	18	19	23	24	26	27	28	29	37	38	39
	G 1/4A	8	17	18	19	23	24	26	27	28	29	37	38	39
	G 3/8A	10	21	22	23	28	30	31	43	45	47	58	61	64
	G 3/8A	12	21	22	23	28	30	31	43	45	47	58	61	64
	G 1/2A	14	31	33	34	42	45	46	72	76	79	98	103	107
	G 1/2A	16	31	33	34	42	45	46	62	66	69	84	89	94
	G 3/4A	20	43	45	47	58	61	64	129	136	142	175	184	193
	G 1A	25	72	76	79	98	103	107	163	171	179	221	232	243
	G 1-1/4A	30	115	121	127	156	164	172	259	272	285	351	369	386
	G 1-1/2A	38	139	146	153	188	198	207	335	352	369	454	477	500

* Typical for JLG Straight Male Stud Fittings

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Table 5-29. British Standard Parallel Pipe Port (BSPP) - S Series - Table 2 of 3

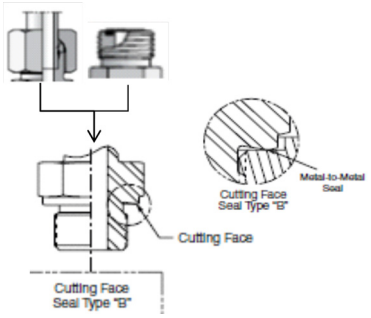
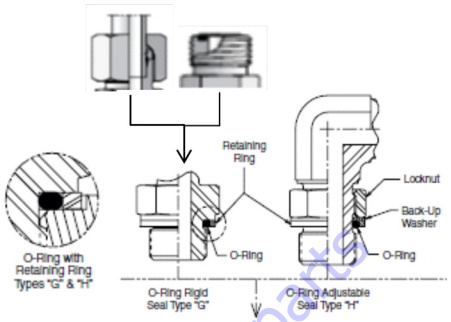
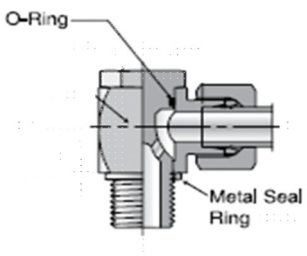
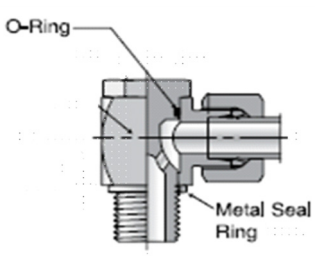
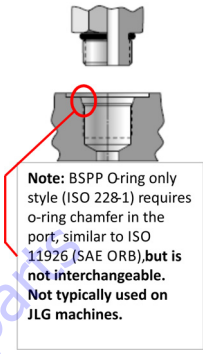
														
TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS with (ORFS) or S series DIN (MBTS) opposite end						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS with (ORFS) or S series DIN (MBTS) opposite end					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	41	43	45	55	58	61	26	28	29	35	38	39
	G 1/4A	8	41	43	45	55	58	61	26	28	29	35	38	39
	G 3/8A	10	59	62	65	80	84	88	52	55	57	70	75	77
	G 3/8A	12	59	62	65	80	84	88	52	55	57	70	75	77
	G 1/2A	14	85	90	94	115	122	127	66	70	73	90	95	99
	G 1/2A	16	85	90	94	115	122	127	66	70	73	90	95	99
	G 3/4A	20	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	25	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	30	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	38	398	418	438	540	567	594	398	418	438	540	567	594
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	27	28	29	37	38	39	17	18	19	23	24	26
	G 1/4A	8	27	28	29	37	38	39	17	18	19	23	24	26
	G 3/8A	10	38	40	42	52	54	57	34	36	37	46	49	50
	G 3/8A	12	38	40	42	52	54	57	34	36	37	46	49	50
	G 1/2A	14	55	58	61	75	79	83	43	45	47	58	61	64
	G 1/2A	16	55	58	61	75	79	83	43	45	47	58	61	64
	G 3/4A	20	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	25	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	30	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	38	259	272	285	351	369	386	259	272	285	351	369	386
* Typical for JLG Straight Male Stud Fittings														
** Non typical for JLG Straight Male Stud Fittings, reference only.														
*** Typical for JLG Adjustable Fittings														

Table 5-30. British Standard Parallel Pipe Port (BSPP) - S Series - Table 3 of 3

TYPE/FITTING IDENTIFICATION			BANJO FITTINGS with S series DIN (MBTS) opposite end						HIGH PRESSURE BANJO FITTINGS with S series DIN (MBTS) opposite end						JIS/BSPP O-RING ONLY					
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	30	32	33	40	43	45	33	35	36	45	47	49	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G 1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49						
	G 3/8A	10	48	51	53	65	69	72	52	55	57	70	75	77						
	G 3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77						
	G 1/2A	14	66	70	73	90	95	99	89	94	98	120	127	133						
	G 1/2A	16	66	70	73	90	95	99	89	94	98	120	127	133						
	G 3/4A	20	92	97	101	125	132	137	170	179	187	230	243	254						
	G 1A	25	--	--	--	--	--	--	236	248	260	320	336	353						
	G 1-1/4A	30	--	--	--	--	--	--	398	418	438	540	567	594						
	G 1-1/2A	38	--	--	--	--	--	--	516	542	568	700	735	770						
MATERIAL	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]			[Ft-Lb]			[N-m]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	20	21	21	27	28	28	22	22	23	30	30	31	Fitting type not typically specified on JLG applications. Refer to the specific procedure in this Service Manual.					
	G 1/4A	8	20	21	21	27	28	28	22	22	23	30	30	31						
	G 3/8A	10	31	33	34	42	45	46	34	36	37	46	49	50						
	G 3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50						
	G 1/2A	14	43	45	47	58	61	64	58	61	64	79	83	87						
	G 1/2A	16	43	45	47	58	61	64	58	61	64	79	83	87						
	G 3/4A	20	60	63	66	81	85	89	111	117	122	150	159	165						
	G 1A	25	--	--	--	--	--	--	153	161	169	207	218	229						
	G 1-1/4A	30	--	--	--	--	--	--	259	272	285	351	369	386						
	G 1-1/2A	38	--	--	--	--	--	--	335	352	368	454	477	499						

* Typical for JLG Straight Male Stud Fittings

** Non typical for JLG Straight Male Stud Fittings, reference only.

*** Typical for JLG Adjustable Fittings

Assembly Instructions for Flange Connections: (FL61 and FL62)

1. Make sure sealing surfaces are free of rust, splits, scratches, dirt, foreign matter or burrs.
2. Install o-ring as per “O-ring Installation (Replacement)” .
3. Pre-lubricate the o-ring with Hydraulic Oil.
4. Position flange and clamp halves.
5. Place lock washers on bolt and bolt through clamp halves.
6. Tighten all bolts by hand.
7. Torque bolts in diagonal sequence in two or more increments to the torque listed on Table 5-31and Table 5-32.