CALIFORNIA

Proposition 65 Warning

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

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

ANY PICTURES CONTAINED WITHIN THIS OPERATOR'S MANUAL THAT DEPICT SITUATIONS WITH SHIELDS, GUARDS, RAILS, OR LIDS REMOVED ARE FOR DEMONSTRATION PURPOSES ONLY. HAGIE MANUFACTURING COMPANY STRONGLY URGES THE OPERATOR TO KEEP ALL SHIELDS AND SAFETY DEVICES IN PLACE AT ALL TIMES.

I. SAFETY/DECALS

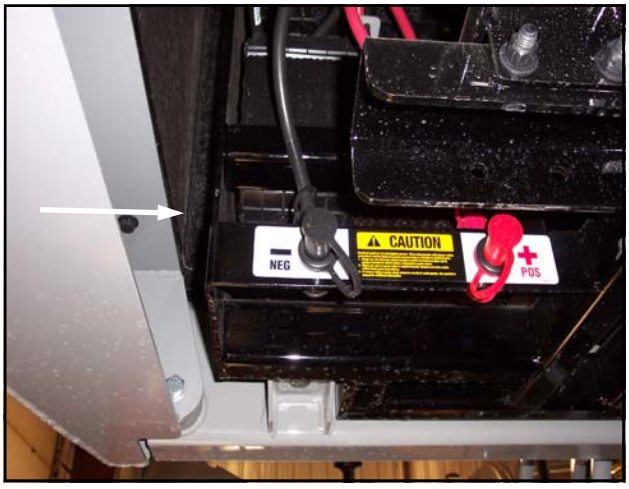
WARNING DECALS

Decals warning you of avoidable danger are located on various parts of the sprayer. They are there for your personal safety and protection. DO NOT remove them. They will fracture upon attempted removal and therefore must be replaced.

Following are locations of important safety decals. Replace them if they are torn or missing. All warning decals and other instructional Hagie decals or machine striping may be purchased through the Hagie Customer Support Department. To replace decals, be sure that the installation area is clean and dry; decide on exact position before you remove the backing paper.

DECAL LOCATION

650107



Rear of mainframe above booster terminals.

650165

Right side cab post.

III. SPECIFICATIONS

ELECTRICAL SYSTEM

General Electrical System

Battery	Dual 12V, negative ground
Alternator	130 AMP, voltage regulated
Starter	12V with solenoid

Circuit Breakers/Fuses (See Model STS 10 Parts Manual.)

Lights

Front of cab	2 Trapezoidal head lights and 4 flood lights
Transom mount	2 Trapezoidal head lights
Boom cradle (forward)	2 Trapezoidal flood lights (1 each)
Boom cradle (rearward)	2 Trapezoidal flood lights (1 each)

CAB AND INSTRUMENTS

Cab

General cab	Tilt steering Windshield wiper/washer Dual side mirrors Dome light Tinted glass Training seat
Temperature control	Full-range
A/C charge type	R-134a
Fresh air filtration	Paper and charcoal filter
Seat	Air ride

Instruments

Message center	Hour meter Fuel Water temperature Battery voltage Engine oil pressure Ground speed Engine RPM Tread adjustment assist
Stereo	AM/FM/WB with CD

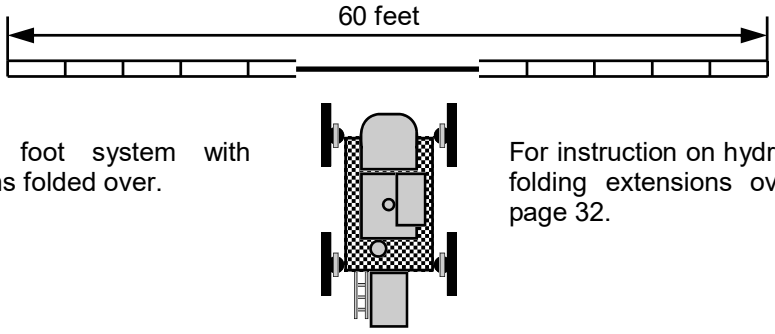
IV. OPERATING INFORMATION

SPRAY BOOMS

Hydraulically folding the extensions of the 60/80/90 foot boom system and adjusting spray valves essentially turns it into a 60 foot boom (see pages 32 & 37). Manually folding the outer extensions of the 60/80/90 foot system, adjusting spray valves and recalibrating spray monitor essentially turns it into an 80 foot boom (see pages 34 & 54).

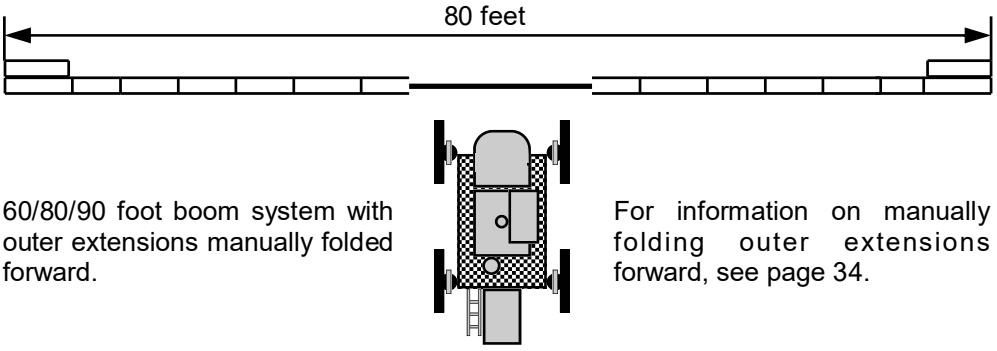
The spray booms are controlled by an electro-hydraulic system. This system consists of operator manipulated switches located in the sprayer's cab and hydraulic cylinders attached to the booms. It provides control of lift (page 29), level (page 30), horizontal fold (page 31) and vertical fold (page 32).

All STS 10 spray booms are equipped with a hydraulic breakaway circuit. When folded out as an 80 or 90 foot spray boom, a one-way hydraulic circuit on the outer boom section provides outer boom breakaway functions. The outer breakaway is self-resetting and will return to normal operating position after it has cleared the hazard.



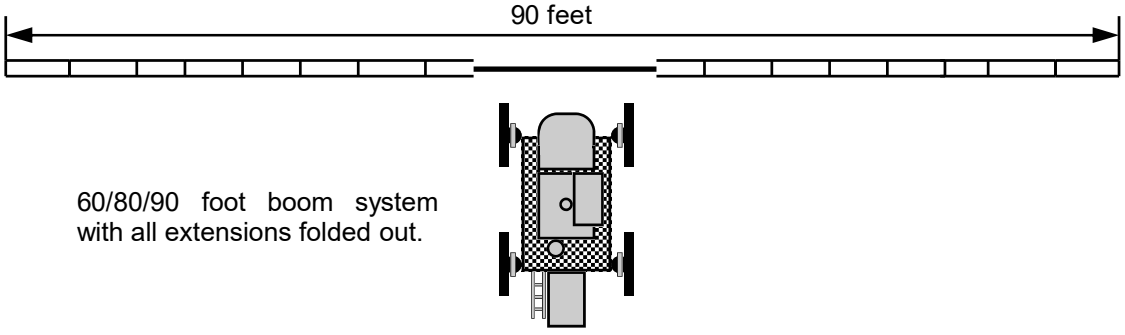
60/80/90 foot system with extensions folded over.

For instruction on hydraulically folding extensions over, see page 32.



60/80/90 foot boom system with outer extensions manually folded forward.

For information on manually folding outer extensions forward, see page 34.



60/80/90 foot boom system with all extensions folded out.

FIG 4.42

FIG 4.43A

FIG 4.43B

Main Solution Switch

Main spray power can be controlled from a switch mounted on the hydrostatic control lever (fig. 4.42). This controls the panel of boom solution valve switches . The switch must be on to supply the switches with voltage. This way you can turn all of the boom solution valves "ON" or "OFF" all at once in a hands-free execution such as turning the main solution switch "OFF" as you arrive at the end rows of a field and turn it back "ON" as you enter the field again. This switch supplies the power to the boom solution valve switches that you turn off to disconnect the power.

When the main spray power is "ON" a "GREEN" indicator light mounted on the right side of the message center will light up (fig. 4.43A), also a white light mounted above boom lights on transom assembly (fig.4.43B), will come on. When the light is not lit, the main solution switch is "OFF."

IV. OPERATING INFORMATION

FIG 4.66

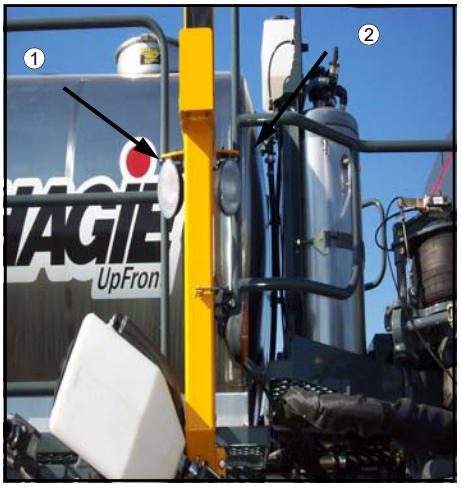


FIG 4.67

Work Lights

Additional work lights are located on each boom cradle (fig. 4.67, items 1 & 2), one on each side facing forward and one on each side facing backward. Use these lights when operating in a field after dark. Turn them on by pressing the rocker switch (fig. 4.66). To turn them off, press rocker switch down. Turn them off when entering a public roadway.

The ignition key does have to be on in order to operate the work lights, but extended use without the engine operating to charge the battery is not recommended.

VII. SERVICE AND MAINTENANCE

PAGE NO	Service Point	CLEAN	CHANGE	CHECK	GREASE	DRAIN
62	ENGINE OIL		A	DAILY		
64	RADIATOR COOLANT LEVEL			DAILY		
64	COOLANT CONCENTRATION		AS REQ	500 HRS*		
68	RADIATOR GRILLE SCREEN	DAILY				
74	ENGINE DRIVE BELT		AS REQ	DAILY		
74	A/C COMPRESSOR BELT		AS REQ	250 HRS		
66	A/C COMPRESSOR		B			
70	FUEL FILTER (WATER SEPARATOR)		500 HRS*			DAILY
70	IN-LINE FUEL STRAINER		AS REQ			
67	AIR INTAKE FILTER	NOT REC	C			
67	FILTER MINDER®		D	DAILY		
62	HYDRAULIC RESERVOIR OIL LEVEL		500HRS**	DAILY		
68	HYDRAULIC CHARGE and SUCTION FILTER (1 in tank)		E			
69	SOLUTION LINE STRAINER	AS REQ		DAILY		
63	TORQUE HUB® OIL LEVEL		F	DAILY		
79	WET TANK					DAILY
71	FRONT LEG STRG ZERKS (4 PLACES – 2 EACH)				50 HRS	
71	REAR LEG BRG ZERKS (2 PLACES – 1 EACH)				500 HRS*	
76	TREAD ADJUSTMENT BEARING TORQUE		AS REQ	50 HRS		
72	BATTERIES	100 HRS	AS REQ	DAILY		
75	LUG NUT TORQUE			G		
80	TIRE PRESSURE			50 HRS		
70	FRESH AIR CAB FILTER	50 HRS	AS REQ			
70	CHARCOAL CAB FILTER		AS REQ			
70	RECIRCULATION FILTER		AS REQ			
79	SPRAY NOZZLE DIAPHRAGMS & SPRAY TIPS			500HRS**		

*OR YEARLY, WHICHEVER COMES FIRST; OR AS REQUIRED
**OR AT THE BEGINNING OF THE SEASON, WHICHEVER COMES FIRST; OR AS REQUIRED
NOTE A: SEE ENGINE MANUFACTURER'S HAND BOOK
NOTE B: CHARGE AS REQ; USE PROPER EQUIPMENT
NOTE C: FOLLOW FILTER MINDER READINGS
NOTE D: RESET EACH TIME YOU SERVICE AIR FILTER
NOTE E: 1ST 50 HRS, THEN 250 HRS THEREAFTER
NOTE F: 1ST 50 HRS, THEN 100 HRS THEN YEARLY
NOTE G: IMMEDIATELY, THEN 50 HRS THEREAFTER

VII. SERVICE AND MAINTENANCE

FIG 7.15

FIG 7.16

Radiator Screen

In order to maintain maximum air flow through the engine cooling system's radiator, oil cooler, and air conditioning condenser, the cooling air intake grille (fig. 7.15) must be inspected often and periodically cleaned.

NOTE:

Failure to keep cooling systems clean can cause over heating and damage to the hydrostatic system and/or engine.

Compressed air will dislodge most large trash or loose dirt after the hood has been opened for service. Blow out the screen away from the machine. Water from a pressurized hose may also be used, or if necessary the screen may be soaked with soapy water and scrubbed with a brush.

NOTE:

When cleaning cooling fins of the radiator, oil cooler, or A/C condenser with compressed air or water, be careful not to damage cooling fins which may impair cooling capabilities.

Hydraulic Filter

Remove and install a new 10 Micron rated suction filter (fig. 7.16) at the end of the first 50 hours of use; subsequently, replace the filter every 250 hours, or once a year, whichever comes first.

TOE-IN ADJUSTMENT

FIG 7.40

To adjust the toe-in of the front tires follow these instructions for both front steering cylinders carefully:

1. Loosen jam nut (fig. 7.41, item 3).
2. Move left and right tires evenly until difference in dimension “A” and “B” (fig. 7.42) are within specified range. At least one wheel must be parallel with the frame.
3. Screw swivel assembly in or out on steering cylinder until the swivel joint lines up with steering plate.
4. Insert bolt through swivel joint and steering plate, and tighten jam nut.

FIG 7.41

NOTE:

Dimension “A” should be ½" to ¾" less than dimension “B.” For more information regarding toe-in, see page 77.

FIG 7.42

IX. TROUBLE SHOOTING

C. HYDROSTATIC SYSTEM

⚠ CAUTION

DO NOT GO NEAR LEAKS. High pressure oil easily punctures skin causing injury, gangrene, or death. If injured, seek emergency medical help. Immediate surgery is required to remove oil. Do not use finger or skin to check for leaks. Lower load or relieve hydraulic pressure before loosening fittings.

PROBLEM	POSSIBLE CAUSE	SUGGESTED REMEDY
Machine won't move in either direction	Engine speed too low	Set engine at operating RPM before trying to move machine
	Oil level in reservoir low	Fill reservoir to proper level w/ approved oil; see section on Service and Maintenance
	Clogged filter	Replace filter
	Hydrostatic pump not turning	Check drive coupling
	Faulty hydrostatic pump	Replace pump
	Air leak in suction line	Inspect and tighten all fittings on suction line
	Low charge pressure	See section under charge pressure
	Cruise is set to low	Adjust knob for cruise
Machine will move in only one direction	Faulty high pressure relief valve	Switch relief valves from side to side; If problem reverses, replace multi-function valve (Call Hagie Customer Support and refer to parts manual)
	Cruise set to low	

System log

The system log is automatically added to your application. You will find it in the application manager, under the node *Logs*. Its default name is *System log*, but you can change it to whatever you want.

System events

These are the events stored in the system log.

Event	Information stored
Application changed	Application name and version. Firmware version. IQANdesign or IQANrun license number.
Machine id changed	New machine id. IQANrun license number.
System started	
Channel alarms/errors	Channel name, module/pin connection and status.
Module alarms/errors	Module name and status.
CAN bus alarms/errors	CAN bus name and status.
Clock changed	Date and time before change.
Login/Logout	User name and access level. IQANrun license number.
External log item	Information added by an IQANrun user or a script. IQANrun license number.
Log cleared	IQANrun license number.
Settings changed	IQANrun license number.

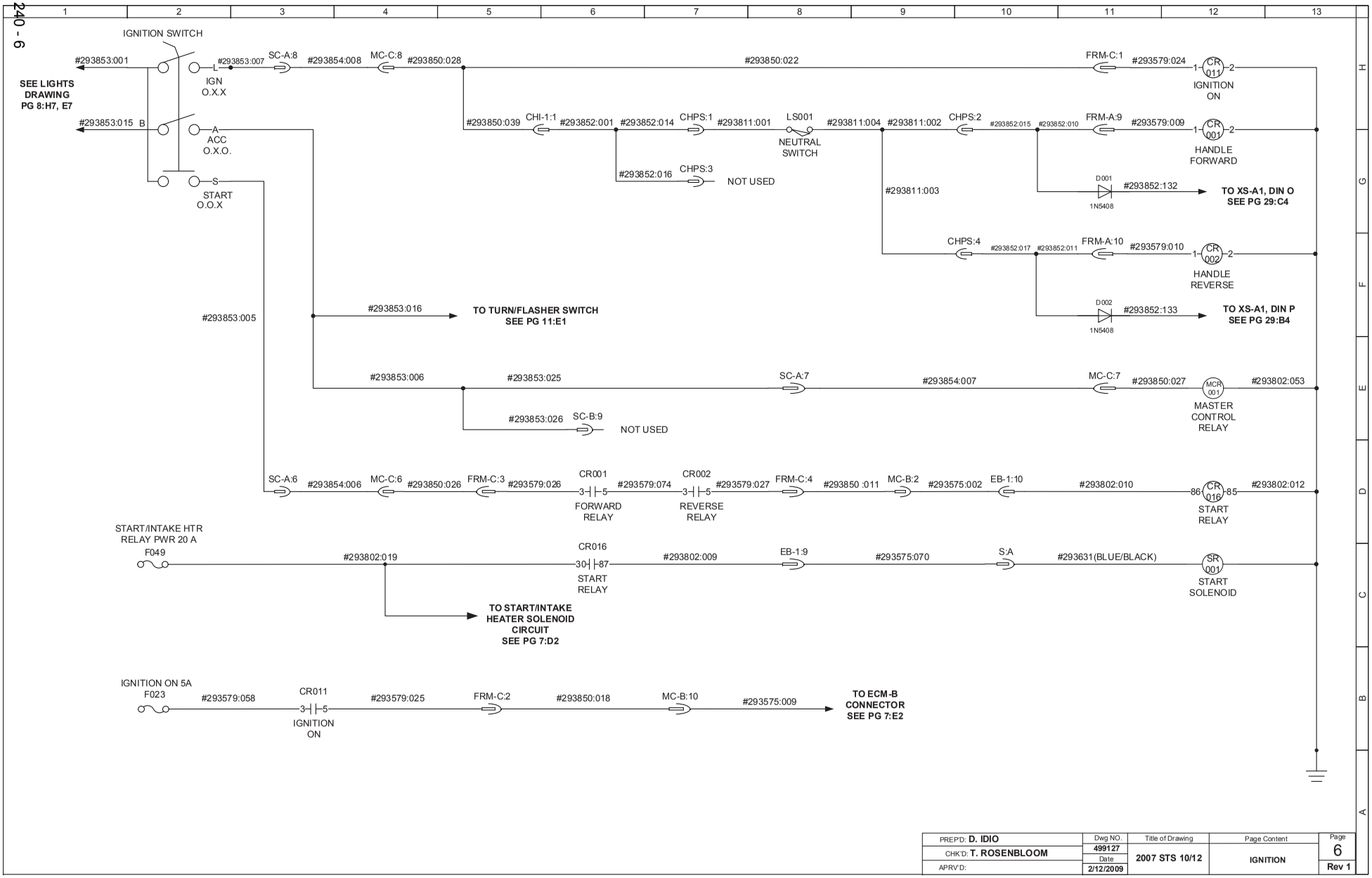
NOTE

Some events are not stored until the system is restarted.

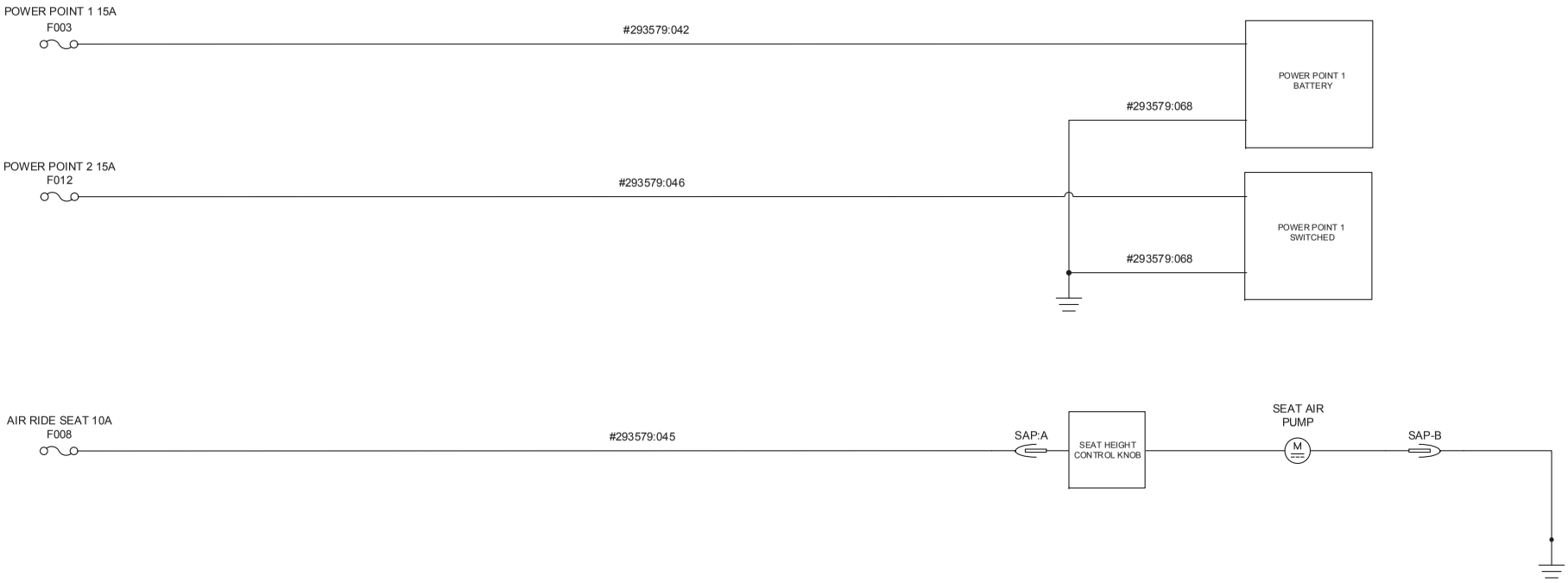
Properties

These are the properties for the system log.

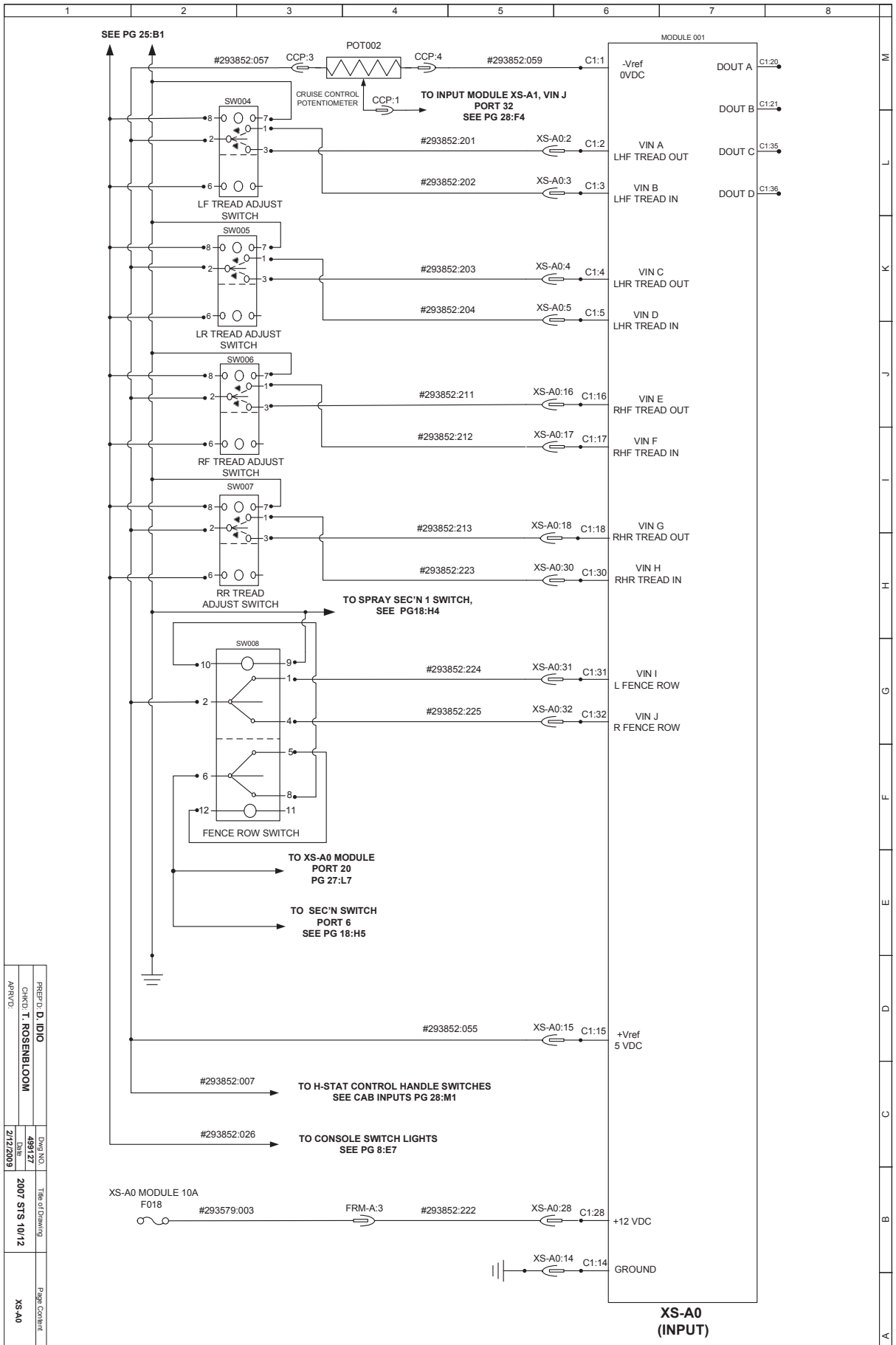
Visible	Select “Yes” to make this log visible from the master display or IQANrun, or select a digital value channel to control visibility at run time.
Enabled	Select “Yes” to make this log enabled all the time, or select a channel to enable/disable it in run-time. When the channel value is “False”, the log is disabled and will not log any events.



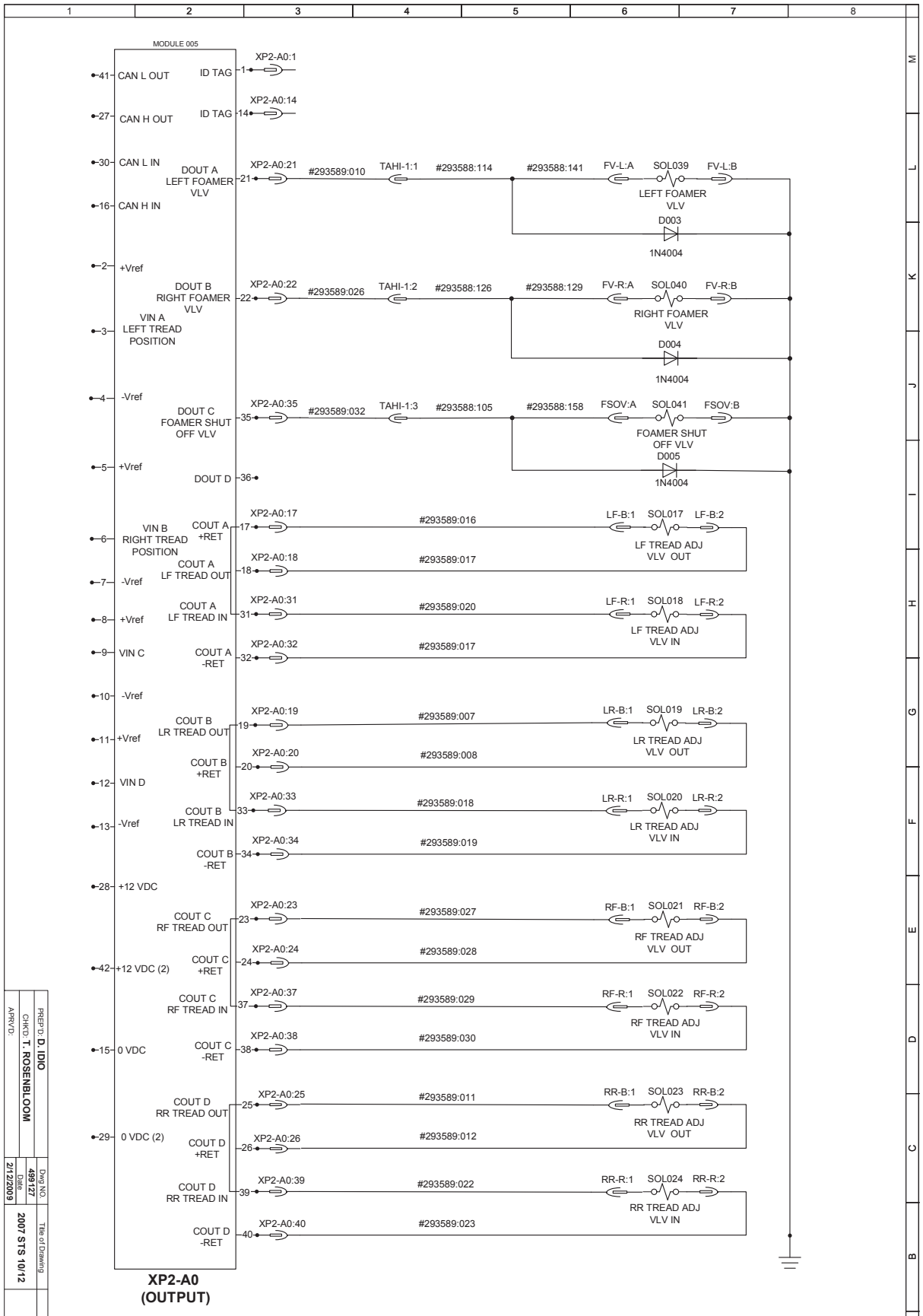
PREP'D: D. IDIO	Dwg NO. 499127	Title of Drawing	Page Content	Page 6
CHK'D: T. ROSENBLOOM	Date 2/12/2009	2007 STS 10/12	IGNITION	Rev 1
APRV'D:				



PREP'D: **D. IDIO**	Dwg NO. **499127**	Title of Drawing	Page Content	Page **16**
CHK'D: **T. ROSENBLOOM**	Date **2/12/2009**	**2007 STS 10/12**	**POWER POINTS/SEAT**	**Rev 1**
APRV'D:				



PREP'D:	D. IDIO
CHK'D:	T. ROSENBLOOM
APRV'D:	
Date	2/12/2009
Dwg NO.	499127
Title of Drawing	2007 STS 10/12
Page Content	XS-A0
Rev	1
Page	26



PREP'D: D. IDIO
CHK'D: T. ROSENBLOOM
APRV'D:
Date: 2/12/2009
Dwg NO.: 499127
Title of Drawing: 2007 STS 10/12
Page Content: XP2-A0
Page: 36
REV: 1

Reference	Description	Master	Location
AIR DRYER		AIR DRYER	P15.H11
ALTERNATOR		ALTERNATOR	P3.H2
BATTERY 1		BATTERY	P3.H1
BATTERY 2		BATTERY	P3.H1
BOOST BOX		BOOST BOX	P20.F10
CR001	HANDLE FORWARD	COIL	P6.H11
CR002	HANDLE REVERSE	COIL	P6.F11
CR003	HEADLIGHTS 2	COIL	P8.G11
CR004	CONSOLE LIGHTS	COIL	P9.C11
CR005	FIELD LIGHTS 1	COIL	P9.D11
CR009	SPARE	COIL	P30.K7
CR011	IGNITION ON	COIL	P6.H11
CR012	FAN HIGH RELAY	COIL	P13.B11
CR013	HEADLIGHTS 1	COIL	P8.F11
CR014	WORK LIGHTS 1	COIL	P9.B11
CR015	WORK LIGHTS 2	COIL	P9.B11
CR016	START RELAY	COIL	P6.D11
CR017	INTAKE HTR RELAY 1	COIL	P7.F11
CR018	INTAKE HTR RELAY 2	COIL	P7.E11
MCR001	MASTER CONTROL RELAY	COIL	P6.E11
SR001	START SOLENOID	COIL	P6.C11
SR002	INTAKE HTR SOLENOID 1	COIL	P7.C11
SR003	INTAKE HTR SOLENOID 2	COIL	P7.C11
100FRV-L:A		CONNECTOR	P38.J6
100FRV-R:A		CONNECTOR	P39.J6
120N-L1:A		CONNECTOR	P42.H1
120N-L1:B		CONNECTOR	P42.G1
120N-L2:1		CONNECTOR	P42.F1
120N-L2:2		CONNECTOR	P42.F1
120N-R1:A		CONNECTOR	P42.H11
120N-R1:B		CONNECTOR	P42.H11
120N-R2:1		CONNECTOR	P42.F11
120N-R2:2		CONNECTOR	P42.F11
60/90FV-B:1		CONNECTOR	P38.F7
60/90FV-B:1		CONNECTOR	P38.G7
90FRV-L:A		CONNECTOR	P38.J7
90FRV-R:A		CONNECTOR	P39.J7
90FRV-R:B		CONNECTOR	P39.J7
90FV-B:2		CONNECTOR	P38.F7
90FV-B:2		CONNECTOR	P38.F7
ACV:1		CONNECTOR	P37.K6
ACV:2		CONNECTOR	P37.L7
AD:A		CONNECTOR	P15.H10
AD:B		CONNECTOR	P15.H11
AV:1		CONNECTOR	P27.L7
AV:2		CONNECTOR	P27.K7
AV:3		CONNECTOR	P27.L7
AV:4		CONNECTOR	P27.K7
BFV-R-B:1		CONNECTOR	P38.H7
BFV-R-B:2		CONNECTOR	P38.H7
BFV-R-R:1		CONNECTOR	P38.I7
BFV-R-R:2		CONNECTOR	P38.H7
BH1-L:4		CONNECTOR	P38.J5
BH1-L:5		CONNECTOR	P22.H7
BH1-R:1		CONNECTOR	P39.C6
BH1-R:2		CONNECTOR	P39.B6
BH1-R:3		CONNECTOR	P39.K6
BH1-R:4		CONNECTOR	P39.J5
BH1-R:5		CONNECTOR	P22.E7
BHI-L:1		CONNECTOR	P38.C6
BHI-L:2		CONNECTOR	P38.C6
BHI-L:3		CONNECTOR	P38.K6
BLV-L-B:1		CONNECTOR	P37.F6
BLV-L-B:2		CONNECTOR	P37.F6
BLV-L-R:1		CONNECTOR	P37.G6
BLV-L-R:2		CONNECTOR	P37.G6
BLV-R-B:1		CONNECTOR	P37.E6
BLV-R-B:2		CONNECTOR	P37.D6
BLV-R-R:1		CONNECTOR	P37.E6
BLV-R-R:2		CONNECTOR	P37.E6
BRV:1		CONNECTOR	P30.I7
BRV:3		CONNECTOR	P30.I7
BRV:4		CONNECTOR	P30.I7
BV:1		CONNECTOR	P34.J6
BV:2		CONNECTOR	P34.J7
CCP:1		CONNECTOR	P26.M3
CCP:3		CONNECTOR	P26.M2
CCP:4		CONNECTOR	P26.M4
CH-A:1		CONNECTOR	P28.L3
CH-A:2		CONNECTOR	P28.K3
CH-A:3		CONNECTOR	P28.K3
CH-A:4		CONNECTOR	P28.J3
CH-A:5		CONNECTOR	P28.I3
CH-A:6		CONNECTOR	P28.I3
CH-A:7		CONNECTOR	P28.I3
CH-A:8		CONNECTOR	P28.G3
CH-B:1		CONNECTOR	P29.M3
CH-B:12		CONNECTOR	P28.L1
CH-B:2		CONNECTOR	P29.M3
CH-B:3		CONNECTOR	P29.L3
CH-B:6		CONNECTOR	P29.K3

Reference	Description	Master	Location
F002	IGN/HAZ/HDLT SW PWR 10A	FUSE	P4.D3
F002	IGN/HAZ/HDLT SW PWR 10A	FUSE	P8.H1
F003	POWER POINT 1 15A	FUSE	P16.H1
F003	POWER POINT 1 15A	FUSE	P4.C3
F004	SPRAY MONITOR 20A	FUSE	P18.H1
F004	SPRAY MONITOR 20A	FUSE	P4.C3
F005	CONSOLE LTS 5A	FUSE	P4.B3
F005	CONSOLE LIGHTS 5A	FUSE	P8.E1
F006	HVAC CONTROL 15A	FUSE	P13.H1
F006	HVAC CONTROL 15A	FUSE	P4.D5
F007	FAN HIGH 25A	FUSE	P13.G1
F007	FAN HIGH 25A	FUSE	P4.D5
F008	AIR RIDE SEAT 10A	FUSE	P16.D1
F008	AIR RIDE SEAT 10A	FUSE	P4.C5
F009	WIPER/WASHER 15A	FUSE	P12.G1
F009	WIPER/WASHER 15A	FUSE	P4.C5
F010	NOT USED	FUSE	P4.B5
F011	FIELD/WORK LTS SW PWR 5A	FUSE	P4.D7
F011	FIELD/WORK LTS SW PWR 5A	FUSE	P9.D1
F012	POWER POINT 2 15A	FUSE	P16.F1
F012	POWER POINT 2 15A	FUSE	P4.D7
F013	CONSOLE SWITCH PWR 5A	FUSE	P25.B2
F013	CONSOLE SW PWR 5A	FUSE	P4.C7
F014	SPARE 5A	FUSE	P4.C7
F015	SPARE 15A	FUSE	P17.F1
F015	SPARE 15A	FUSE	P4.B7
F016	SPARE 15A	FUSE	P17.G1
F016	SPARE 15A	FUSE	P4.D9
F017	MDM MODULE 3A	FUSE	P23.E1
F017	MDM MODULE 3A	FUSE	P4.D9
F018	XS-A0 MODULE 10A	FUSE	P26.B1
F018	XS-A0 MODULE 10A	FUSE	P4.C9
F019	XS-A1 MODULE 10A	FUSE	P4.C9
F020	SPARE	FUSE	P4.B9
F021	RADIO/DOME/MDM 10A	FUSE	P14.H1
F021	RADIO/DOME/MDM 10A	FUSE	P5.F3
F022	HEADLIGHTS 2 15A	FUSE	P5.F3
F022	HEADLIGHTS 2 15A	FUSE	P8.D1
F023	IGNITION ON 5A	FUSE	P5.E3
F023	IGNITION ON 5A	FUSE	P6.B1
F024	DIAGNOSTIC PLUG 10A	FUSE	P41.G6
F024	DIAGNOSTIC PLUG 10A	FUSE	P5.D3
F025	SPARE 15A	FUSE	P17.E1
F025	SPARE 15A	FUSE	P5.D3
F026	XP2-A0 TREAD ADJUST MODULE 20A	FUSE	P35.F2
F026	XP2-A0 MODULE 20A	FUSE	P5.F5
F027	XT2-A0 CHASSIS #1 20A	FUSE	P33.D2
F027	XT2-A0 MODULE 20A	FUSE	P5.E5
F028	XP2-A1 BOOM #1 MODULE 20A	FUSE	P37.F1
F028	XP2-A1 MODULE 20A	FUSE	P5.E5
F029	XP2-A2 BOOM #2 MODULE 20A	FUSE	P38.F1
F029	XP2-A2 MODULE 20A	FUSE	P5.D5
F030	XP2-A3 BOOM #2 MODULE 20A	FUSE	P39.D1
F030	XP2-A3 MODULE 20A	FUSE	P5.D5
F031	NOT USED	FUSE	P5.F7
F032	BRAKE/TAIL LIGHTS	FUSE	P5.E7
F032	BRAKE LIGHTS	FUSE	P9.F1
F033	BOOM SPRAY VALVES 20A	FUSE	P22.H1
F033	BOOM SPRAY VALVES 20A	FUSE	P5.E7
F034	SOL'N PUMP VALVES 15A	FUSE	P30.F3
F034	SOLUTION PUMP VALVES 15A	FUSE	P5.D7
F035	AIR DRYER/SIDE FILL/ PRESS. WSHR 15A	FUSE	P15.H1
F035	AIR DRYER/SIDE FILL/PRESS WSHR 15A	FUSE	P5.D7
F036	FIELD LIGHTS 1 15A	FUSE	P10.D1
F036	FIELD LIGHTS 1 15A	FUSE	P5.F9
F037	FIELD LIGHTS 2 15A	FUSE	P10.B1
F037	FIELD LIGHTS 2 15A	FUSE	P5.E9
F038	RADIO 10A	FUSE	P14.H1
F038	RADIO 10A	FUSE	P5.E9
F039	NOT USED	FUSE	P5.D9
F040	NOT USED	FUSE	P5.D9
F041	HEADLIGHTS 1 15A	FUSE	P4.H3
F041	HEAD/TAIL LIGHTS 1 15A	FUSE	P9.H1
F042	WORK LIGHTS 1 15A	FUSE	P10.H1
F042	WORK LIGHTS 1 15A	FUSE	P4.H3
F043	WORK LIGHTS 2 15A	FUSE	P10.F1
F043	WORK LIGHTS 2 15A	FUSE	P4.G3
F044	TURN/FLASHER MODULE 15A	FUSE	P11.D1
F044	TURN/FLASHER MODULE 15A	FUSE	P4.G3
F045	SPARE	FUSE	P3.E5
F046	SPARE	FUSE	P3.D5
F047	SPARE	FUSE	P3.D5
F048	SPARE	FUSE	P3.C5
F049	START/INTAKE HTR RELAY PWR 20A	FUSE	P3.C5
F049	START/INTAKE HTR RELAY PWR 20 A	FUSE	P6.C1
F050	SPARE	FUSE	P3.C5
F051	SPARE	FUSE	P3.B5
F052	SPARE	FUSE	P3.B5
F053	INTAKE HEATER 1 125A	FUSE	P3.F5
F053	INTAKE HEATER 1 125A	FUSE	P7.B1
F054	INTAKE HEATER 2 125A	FUSE	P3.F5

Drive Pumps
Wheel Motors
Drive Hubs

Hydrostatic Drive Pumps				
Hagie Part Number	**Sauer-Danfoss Part Number**	**Model Code**	**Description**	**Machine Applicability**
606170	**9521961**		**Series 90 Tandem Pump 90R075 + 90R075 (0 deg Orientation**	**STS 10/10C STS 12/12C**
	Replaced 9521955		Production July 04	
			Front Pump	
606173	**9522679**		**90R075-KT-1-CD-60-S-4-C7-D-03-GBA-43-43-24-F060**	
		90	Series 90	
		R	CW – Right Hand Rotation	
		075	75 cc/rev (4.57 cid)	
		KT	EDC, Deutsch connector, std porting, dual coil (14 - 85 mA)	
		1	Pressure Limiter in Port A & B Below 450 Bar	
		CD	“C” Auxiliary Mounting Pad for 14T splined shaft	
		60	Side Ports	
		S	Suction Filtration	
		4	Factory Set at Max. Displacement	
		C7	23 Teeth 16/32 Pitch Shaft Configuration	
		D	17 cc/rev (1.03 cid) Charge Pump	
		03	.032” Control Orifice	
		GBA	Std. Valve Plate	
		43	430 Bar (6235 psi) Port “A” High Pressure Setting	
		43	430 Bar (6235 psi) Port “B” High Pressure Setting	
		24	24 Bar (348 psi) Charge Pressure Setting	
		F060	Displacement Limiters: “A” = 75 cc, “B” = 34 cc	
			Rear Pump	
606176	**9522678**		**90R075-KT-1-BC-60-S-4-S1-D-03-GBA-43-43-24-F060**	
		90	Series 90	
		R	CW – Right Hand Rotation	
		075	75 cc/rev (4.57 cid)	
		KT	EDC, Deutsch connector, std porting, dual coil (14 - 85 mA)	
		1	Pressure Limiter in Port A & B Below 450 Bar	
		BC	“B” Auxiliary Mounting Pad for 13T splined shaft	
		60	Side Ports	
		S	Suction Filtration	
		4	Factory Set at Max. Displacement	
		S1	14 Teeth 12/24 Pitch Shaft Configuration	
		D	17 cc/rev (1.03 cid) Charge Pump	
		03	.032” Control Orifice	
		GBA	Std. Valve Plate	
		43	430 Bar (6235 psi) Port “A” High Pressure Setting	
		43	430 Bar (6235 psi) Port “B” High Pressure Setting	
		24	24 Bar (348 psi) Charge Pressure Setting	
		F060	Displacement Limiters: “A” = 75 cc, “B” = 34 cc	

SAUER DANFOSS

2800 East 13th Street, Ames, IA, 50010 USA
Phone: 515-239-6366 Fax: 515-239-6618

Genuine Parts

Service Bulletin

SB-2007-051A

Products Affected:
Series 90 pumps; 55, 75 and 100 cc

Subject:
SAE C auxiliary mounting flange

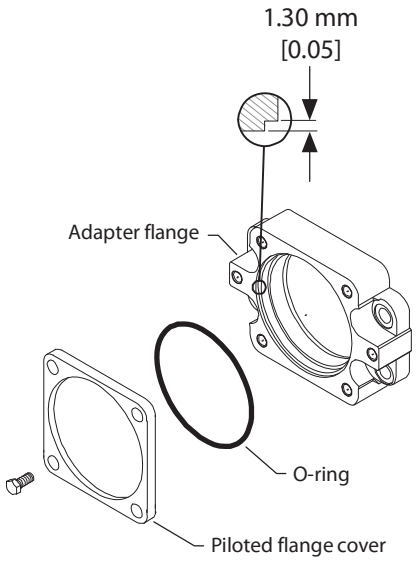
Description:

Sauer-Danfoss is pleased to announce a design improvement on the SAE C auxiliary mounting flange adapter on its series 90 pumps. The frame sizes affected by this change are 55, 75, and 100cc. All manufacturing locations producing these pumps will be changed to this configuration.

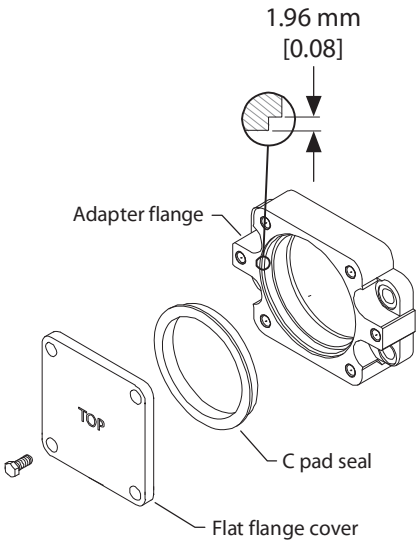
The improvement comes in the form of a more robust sealing geometry with a larger cross-section O-ring. The O-ring groove in the flange will now be sized to mate with a 2.62mm [0.103] cross section O-ring rather than the old 1.78mm [0.070] cross-section O-ring. The Sauer-Danfoss part number for the new O-ring is 9004104-1580 (2.62mm [0.103] x 120.32mm [4.737]). The larger cross-section sealing geometry allows for the use of a donut style C pad seal and a new flat cover for improved assembly. This new configuration is qualified as a running cover. When installing an auxiliary pump, the donut style C pad seal must be discarded and part number 9004104-1580 O-ring used.

The pumps will now be supplied with the donut style seal and new flat cover, instead of the small O-ring and cover plate (shown in the drawing below).

The overhaul seal kit will include the old O-ring, the new O-ring and the new C pad seal



Old design



New design

CONTROL OPTIONS

In the many industrial processes where flammable materials are handled, any leak or spillage may lead to an explosive atmosphere. To protect both property and personnel, precautions must be taken to ensure that this atmosphere cannot be ignited. The areas at risk are known as hazardous areas and the materials that are commonly involved include crude oil and its derivatives, alcohol, natural and synthetic process starch, grain, fibers and flyings.

Intrinsic safety is based on the principle of restricting the electrical energy available in hazardous-area circuits such that any sparks or hot surfaces that may occur as a result of electrical faults are too weak to cause ignition. Factory mutual Research (FM) has approved the following model listed below for use in Class I, II, or III, Division 1, Group C, D, F, and G hazardous locations as defined by the National Electrical code, NFPA-70 when used with approved barriers. This device is also factory Mutual certified for use in Division 2, Group C, D, F, G. If a given application requires only Division 2 approval, an inline barrier may bot be required.

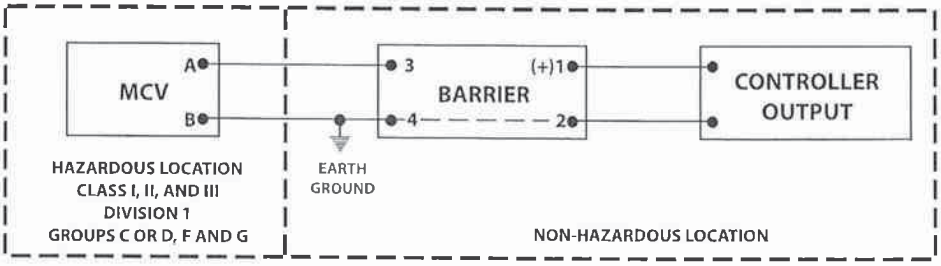
Part Number	Series 90 Frame Size	Current Range (mA)
KVEBS0599	30, 42, 55 cc	4 - 20
KVEBS0799	75 cc	4 - 20
KVEBS1099	100 cc	4 - 20
KVEBS1499	130 cc	4 - 20
KVEBS1899	180/250 cc	4 - 20

WIRING

A suppression circuit is incorporated in the PCP torque motor cover but by itself does not insure intrinsic safety. An additional suppression circuit (Zener barrier) must be connected in series with the valve coils. The Zener barrier and electrical controller must be isolated from the hazardous area either through use of a purge enclosure or mounted in a safe area. The intrinsically safe device enclosure grounding terminal is shown in the illustration of the KVEBS 1499 on the first page. Electrical connections and suggested barrier model numbers are shown the connection diagram below.

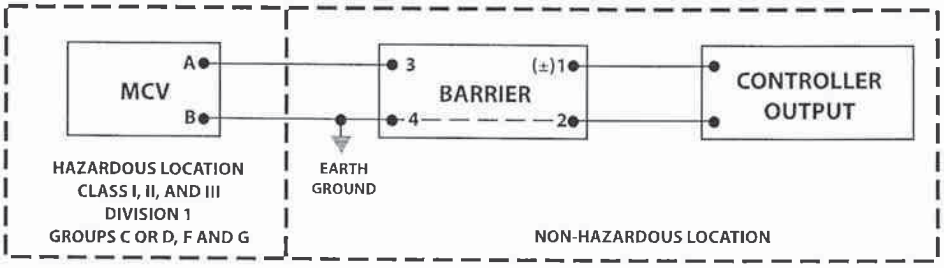
UNIDIRECTIONAL CONTROL, SELECT ONE OF THE FOLLOWING DC CURRENT BARRIERS

* Stahl Barrier 9001/01-158-150-10 (12V) Impedence 127 N
  Groups A, B, C, D, F and G (maximum voltage 15.8V)



BIDIRECTIONAL CONTROL, SELECT ONE OF THE FOLLOWING BARRIERS

¥ Stahl Barrier 9001/02-175-200-10 (12V) Impedence 110 N
  Groups A, B, C, D, F and G (maximum voltage ±17.2V)



To obtain a barrier or specific information about a barrier, contact R. Stahl, Inc. at 1-800-782-4357 or e-mail at http://www.rstahl.com.

NO CHANGES TO THIS DRAWING WITHOUT PRIOR WRITTEN AUTHORIZATION FROM FACTORY MUTUAL.

CUSTOMER SERVICE

NORTH AMERICA

ORDER FROM

Sauer-Danfoss (US) Company
Customer Service Department
3500 Annapolis Lane North
Minneapolis, Minnesota 55447
Phone: (763) 509-2084
Fax: (763) 559-0108

DEVICE REPAIR

For devices in need of repair or evaluation, include a description of the problem and what work you believe needs to be done, along with your name, address and telephone number.

RETURN TO

Sauer-Danfoss (US) Company
Return Goods Department
3500 Annapolis Lane North
Minneapolis, Minnesota 55447

EUROPE

ORDER FROM

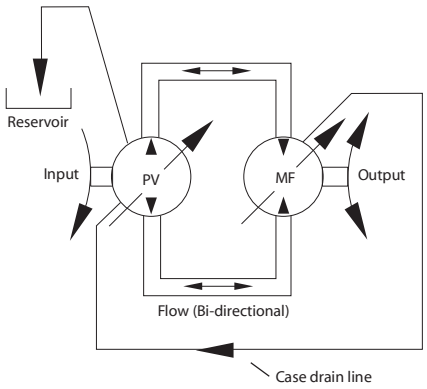
Sauer-Danfoss (Neumünster) GmbH& Co.
Order Entry Department
Krokamp 35
Postfach 2460
D-24531 Neumünster
Germany
Phone: +49 4321 871-0
Fax: +49 4321 871-284

THE SYSTEM CIRCUIT

The basic closed circuit

Hydraulic lines connect the main ports of the pump to the main ports of the motor. Fluid flows in either direction from the pump to the motor then back to the pump in this closed circuit. Either of the hydraulic lines can be under high pressure. In pumping mode the position of the pump swashplate determines which line is high pressure as well as the direction of fluid flow.

Basic closed circuit diagram

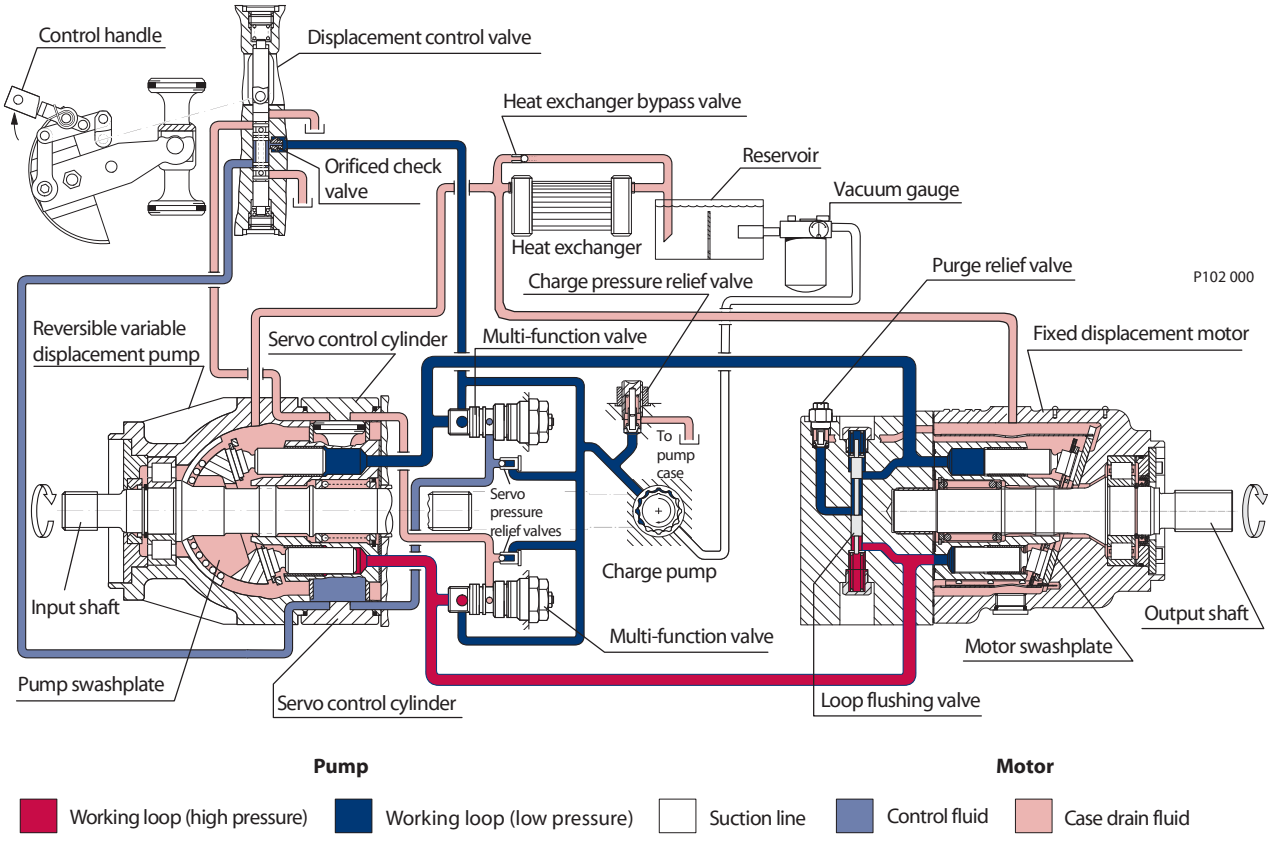


P104 120E

Case drain and heat exchanger

The pump and motor require case drain lines to remove hot fluid from the system. The topmost port drains the motor to ensure the case remains full of fluid. Fluid routes through the lower drain port on the pump and out the topmost port to the reservoir. A heat exchanger, with a bypass valve, cools the case drain fluid before it returns to the reservoir.

System circuit diagram



OVERVIEW

Specifications and operating parameters for pumps appear here for reference.

FEATURES AND OPTIONS

Model	Series 90 Pumps
Mount	SAE B, SAE C and E (SAE J 744)
Pump type	Axial piston type
Rotation	Bidirectional
Installation position	Discretionary: Housing must always be filled with hydraulic fluid. Do not install with control on bottom.
Input shafts	Splined
Control options	MDC (with options), EDC, HDC, FNR

OPERATING PARAMETERS

Parameter		Unit	Pressure
System pressure	Rated	bar [psi]	420 [6000]
	Maximum		480 [7000]
	Minimum low loop		10 [150]
Charge pressure	Minimum	bar [psi]	10 [150]
	Maximum		35 [508]
Charge inlet pressure	Rated	bar (absolute) [in Hg vacuum]	0.7 [9]
	Minimum (cold start)		0.2 [24]
Case pressure	Rated	bar [psi]	3.0 [40]
	Maximum		5.0 [75]

Parameter	Unit	Frame size						
		042	055	075	100	130	180	250
Displacement (maximum)	**cm³** [in³]	42 [2.56]	55 [3.35]	75 [4.57]	100 [6.10]	130 [7.93]	180 [10.98]	250 [15.25]
Minimum speed	**min^{-1}** (rpm)	500	500	500	500	500	500	500
Rated speed	**min^{-1}** (rpm)	4200	3900	3600	3300	3100	2600	2300
Maximum speed	**min^{-1}** (rpm)	4600	4250	3950	3650	3400	2850	2500
Maximum attainable speed at maximum displacement	**min^{-1}** (rpm)	5000	4700	4300	4000	3700	3150	3750
Theoretical torque at maximum displacement	**N•m/bar** [lbf•in/1000 psi]	0.67 [380]	0.88 [530]	1.19 [730]	1.59 [870]	2.07 [1260]	2.87 [1750]	3.97 [2433]
Weight (base unit only)	**kg** [lb]	34 [75]	40 [88]	49 [108]	68 [150]	88 [195]	136 [300]	154 [340]

FLUID SPECIFICATIONS

Parameter	Unit	Minimum	Continuous	Maximum
Viscosity	mm²/sec (cSt) [SUS]	7 [47]	12-60 [66-278]	1600 [7500]
Temperature	°C [°F]	-40 [-40]	104 [220]	115 [240]
Cleanliness		ISO 4406 Class 22/18/13 or better		
Filtration efficiency	suction filtration	β_{35-44}=75 ($\beta_{10}\geq$2)		
	charge filtration	β_{15-20}=75 ($\beta_{10}\geq$10)		

Ratings and data are based on operation with premium petroleum-based hydraulic fluids containing oxidation and foam inhibitors.

STANDARD PROCEDURES, INSPECTIONS, AND ADJUSTMENTS

Before working on the pump, clean the outside of the pump.

Caution

Contamination can damage internal components and void your warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines.

1. With the prime mover off, thoroughly clean the outside of the pump.
2. If removing the pump, tag each hydraulic line connected to the pump. If hydraulic lines are disconnected, plug each open port with a clean plug, to ensure that dirt and contamination do not get into the pump.
3. Ensure the surrounding areas are clean and free of contaminants.
4. Inspect the system for contamination.
5. Visually inspect the hydraulic fluid for signs of system contamination, fluid discoloration, foam in the fluid, sludge, or small metal particles.
6. If there are signs of contamination in the hydraulic fluid, replace all filters, drain and flush the hydraulic system, and fill with the correct filtered hydraulic fluid.
7. Flush the lines before replacing the hydraulic fluid.

MDC NEUTRAL START SWITCH (NSS) ADJUSTMENTS (continued)

Adjust the Neutral Start Switch to meet the following three requirements:

i. The distance you can move the control handle without opening the NSS is the **NSS deadband**. The distance you can move the control handle without moving the control spool enough to port hydraulic fluid to the pump displacement control cylinders is the **control deadband**. These deadbands must be concentric.

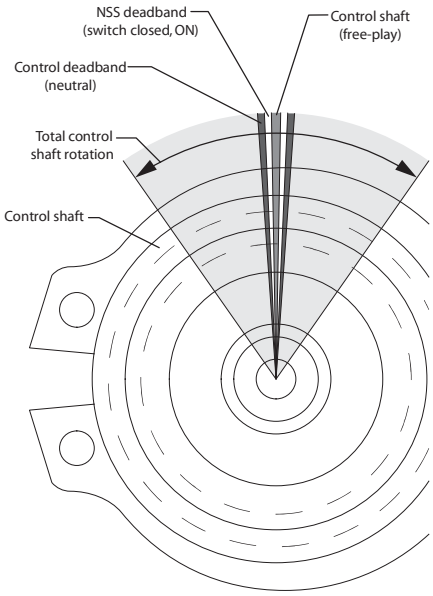
   Since you cannot adjust the position of the control deadband, you must adjust the position of the NSS deadband to match it.

ii. The NSS deadband must be wide enough so the NSS will not open within the loose area of control handle movement caused by normal operating clearances in the control linkage (control shaft free-play).

   By setting the NSS to open outside this area, the control spool springs or control shaft centering spring can always return the handle to neutral and re-close the NSS.

iii. The NSS deadband must be narrow enough so the NSS will open before the unit builds 7 bar [100 psi] differential system pressure in either direction.

Neutral start switch adjustment requirements

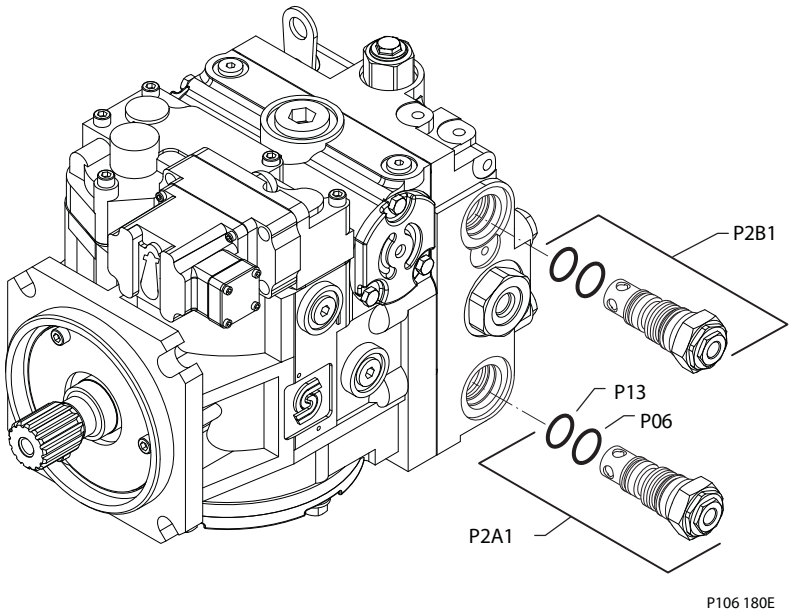


P104 147E

MULTI-FUNCTION VALVE CARTRIDGES

Older multifunction valves (pre 1988) contain different components. See *multifunction valves - Pre 1988*, (page 52) for disassembly instructions.

Multi-function valve removal / installation



P106 180E

Removal

1. Remove multi-function valves (P2A1 and P2B1) using hex wrench listed in table.

Multi-function valve wrench size

Frame size	Wrench size
030 – 100	1-1/4 inch
130 – 250	1-5/8 inch

2. Remove and discard O-rings (P13 and P06).

3. Relieve spring pressure by removing bypass actuator (P03), using a 1-1/16 wrench. To retain pressure setting, do not separate adjusting screw (P01), and locknut (P04) from bypass actuator (P03).

4. Remove and discard O-ring (P02).

Multi-function valves are sold as complete units only. You may purchase O-rings separately.

5. The poppet seat section is pressed over a lip. Place the cartridge in a vise and pry the poppet seat (P12) off with an appropriate tool. Maintain sufficient control to prevent the internal components from flying loose. Do not damage parts during disassembly.

6. Remove internal parts (P07, P08, P17, P16, P15, P14, P09, and P11).

PUMP CONTROL COVER PLATE

Removal

1. Thoroughly clean external surfaces prior to removal of cover plate.

2. Using a 5 mm internal hex wrench, remove the six cover plate mounting screws (M90). Remove the cover plate (M1) and gasket (M11) from housing. Discard the gasket.

Caution

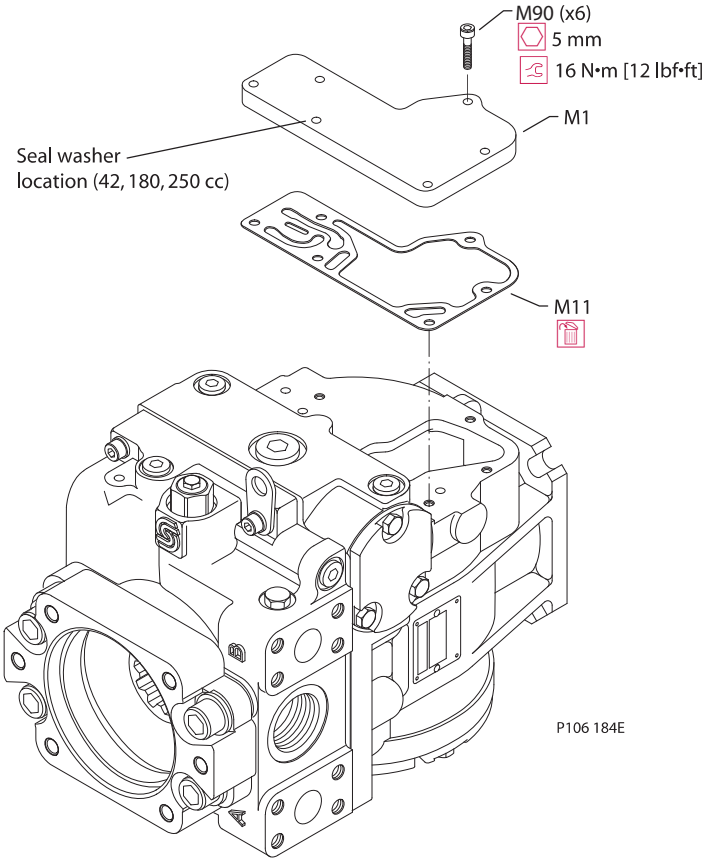
Protect exposed surfaces and cavities from damage and foreign material.

Reassembly

3. Install a new gasket on the housing. Install the cover plate and install the screws. Torque the screws to 16 N•m [12 lbf•ft].

Install a sealing washer under the head of any mounting screws that are installed into through holes in the housing.

Pump controls cover plate



PLUG SIZE AND TORQUE CHART

If any plugs or fittings are removed from the pump during servicing,install and torque as indicated in the accompanying table.

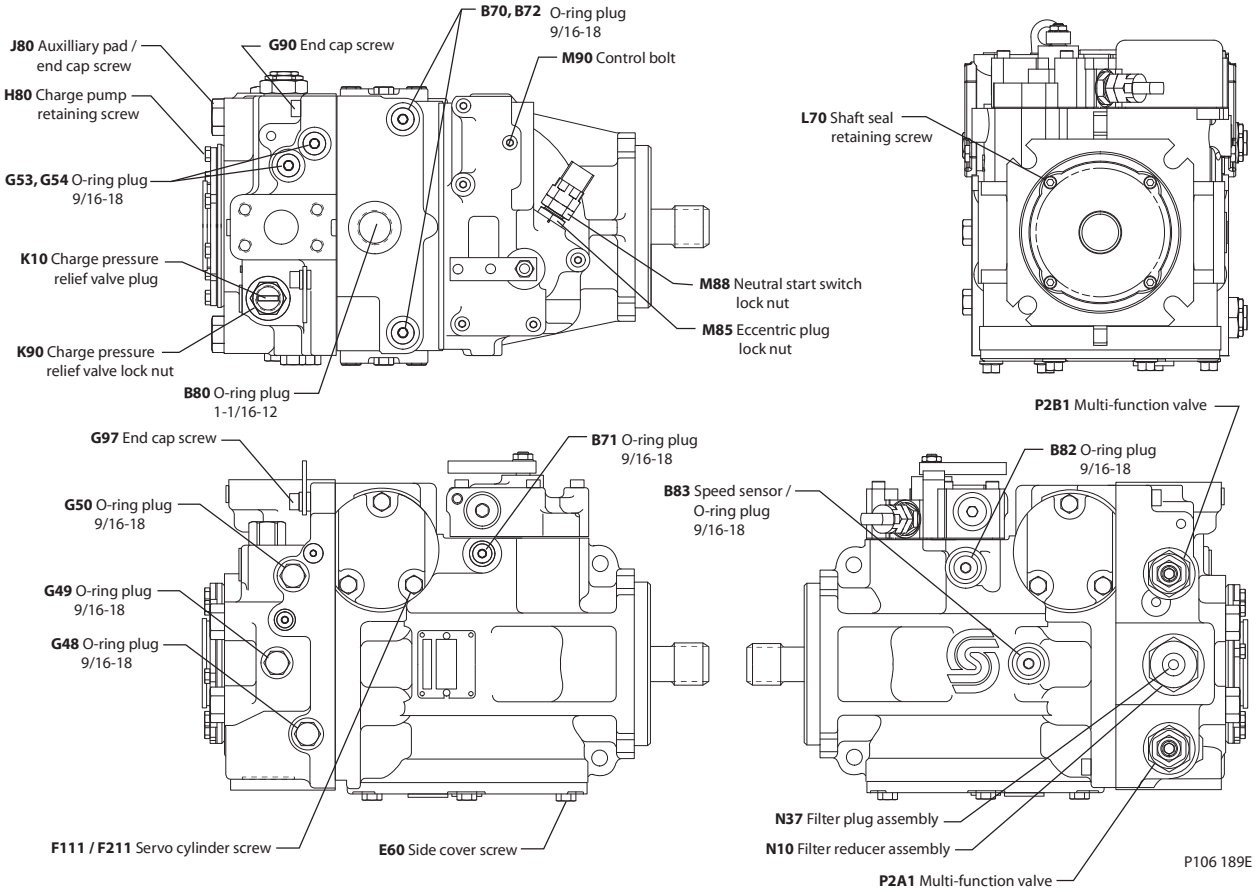
Always install new O-rings before reinstalling the plugs or fittings.

Caution
Torque plugs or fittings installed into aluminum housings to the lower values specified for internal hex plugs of the same size.

Item	O-ring plug	Wrench size	Torque
B70, B72	9/16-18	3/16 internal hex wrench	40 N•m [30 lbf•ft]
B71	9/16-18	3/16 internal hex wrench	12 N•m [9 lbf•ft]
B80	1-1/16-12	9/16 internal hex wrench	115 N•m [85 lbf•ft]
B82, B83	9/16-18	1/4 internal hex wrench	40 N•m [30 lbf•ft]
G18	7/16-20	3/16 internal hex wrench	12 N•m [9 lbf•ft]
G45-G50	9/16-18	11/16 inch hex wrench	40 N•m [30 lbf•ft]
G52-G54	9/16-18	1/4 internal hex wrench	23 N•m [17 lbf•ft]
H90 (not shown)	1-5/16-12	5/8 internal hex wrench	129 N•m [95 lbf•ft]
N35, N36 (not shown)	9/16-18	11/16 inch hex wrench	37 N•m [27 lbf•ft]
N37	9/16-18	1/4 internal hex wrench	40 N•m [30 lbf•ft]

FASTENERS AND PLUGS

Fastener and plug locations



FEATURES AND OPTIONS

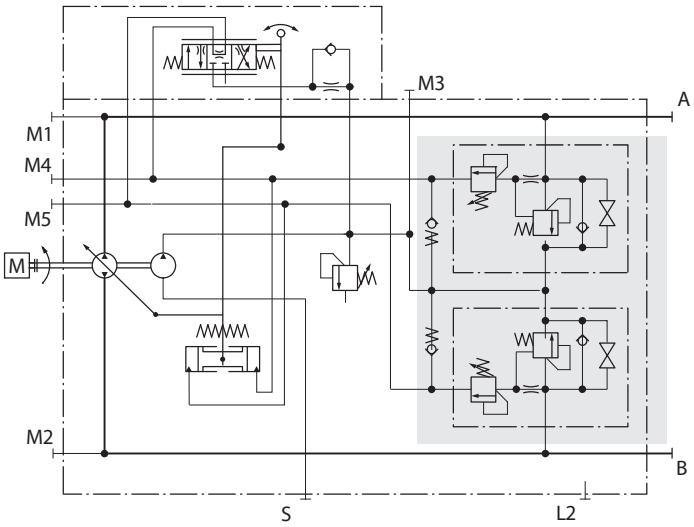
Feature	Unit	Frame						
		042	055	075	100	130	180	250
Displacement	cm^3/rev	42	55	75	100	130	180	250
	[in^3]/rev	[2.56]	[3.35]	[4.59]	[6.10]	[7.93]	[10.98]	[15.25]
Flow at rated speed	l/min	176	215	270	330	403	468	575
(theoretical)	[US gal/min]	[46]	[57]	[71]	[87]	[106]	[124]	[160]
Torque at maximum	N•m/bar	0.67	0.88	1.19	1.59	2.07	2.87	3.97
displacement (theoretical)	[lbf•in/1000 psi]	[410]	[530]	[730]	[970]	[1260]	[1750]	[2433]
Mass moment of inertia of	kg•m^2	0.0023	0.0060	0.0096	0.0150	0.0023	0.0380	0.0650
rotating components	[slug•ft^2]	[0.0017]	[0.0044]	[0.0071]	[0.0111]	[0.0170]	[0.0280]	[0.0479]
Weight (with control opt. MA)	kg [lb]	34 [75]	40 [88]	49 [108]	68 [150]	88 [195]	136 [300]	154 [340]
Mounting (per SAE J744)		B	C	C	C	D	E	E
Rotation		Clockwise or Counterclockwise						
Main ports: 4-bolt split-flange	mm	19.05	25.4	25.4	25.4	31.75	31.75	38.1
(per SAE J518 code 62)	[in]	[0.75]	[1.0]	[1.0]	[1.0]	[1.25]	[1.25]	[1.5]
Main port configuration		Radial	Radial or axial			Radial		
Case drain ports (SAE O-ring boss)	UNF thread (in.)	0.875–14	1.0625–12	1.0625–12	1.0625–12	1.625–12	1.625–12	1.625–12
Other ports		SAE O-ring boss. See *Installation drawings*, page 34.						
Shafts		Splined, straight keyed, and tapered shafts available. See *Shafts*, page 15.						
Auxiliary mounting		SAE-A, B, C				SAE-A, B, C, D	SAE-A, B, C, D, E	
Installation position		Installation is recommended with control on the top or side. Consult your Sauer-Danfoss representative for nonconformance guidelines. The housing must remain filled with hydraulic fluid.						

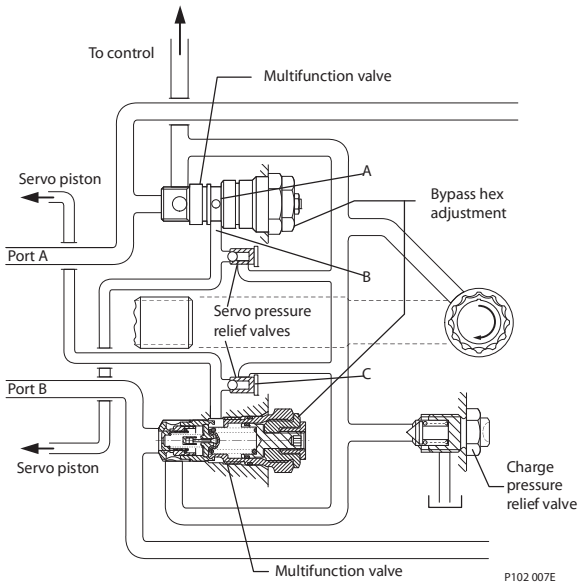
OPERATING PARAMETERS

Parameter	Unit	Frame						
		042	055	075	100	130	180	250
Input speed								
Minimum	min^{-1}(rpm)	500	500	500	500	500	500	500
Continuous		4200	3900	3600	3300	3100	2600	2300
Maximum		4600	4250	3950	3650	3400	2850	2500
System pressure								
Rated	bar [psi]	420 [6000]						
Maximum		450 [6500]						
Minimum low loop		10 [150]						
Inlet pressure (charge inlet)								
Minimum (continuous)	bar (abs.)	0.7 [9]						
Minimum (cold start)	[in. Hg vac.]	0.2 [24]						
Case pressure								
Continuous	bar [psi]	3 [40]						
Maximum (cold start)		5 [75]						

MULTI-FUNCTION VALVES (continued)

Multifunction valve, pressure limiter, pressure regulation, option 1





Bypass Function

In some applications it is desirable to bypass fluid around the variable displacement pump when pump shaft rotation is either not possible or not desired. For example, an inoperable vehicle may be moved to a service or repair location or winched onto a trailer without operating the prime mover. To provide for this, Series 90 pumps are designed with a bypass function.

The bypass is operated by mechanically rotating the bypass hex on both multifunction valves three (3) turns counterclockwise (CCW). This connects working loop A and B and allows fluid to circulate without rotating the pump and prime mover.

Caution

Possible pump and/or motor damage

Bypass valves are intended for moving a machine or vehicle for very short distances at very slow speeds. They are NOT intended as tow valves.

MANUAL DISPLACEMENT CONTROL (MDC)

Operation

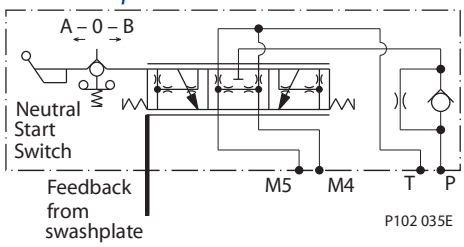
The manual displacement control converts a mechanical input signal to a hydraulic signal that tilts the cradle swashplate through an angular rotation varying the pump's displacement from full displacement in one direction to full displacement in the opposite direction.

The manual displacement control has a mechanical feedback mechanism which moves a servo valve in the proper relationship to the input signal and the angular position of the swashplate. The control is designed so that the angular rotation of the swashplate is proportional to the mechanical input signal. The control is designed with an internal override mechanism which allows the mechanical input to be moved at a faster rate than the movement of the swashplate without damage to the control.

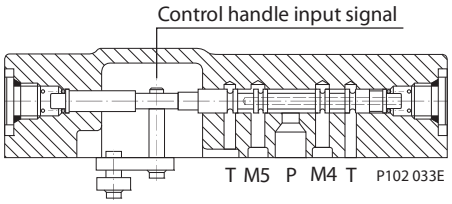
Features and benefits of the manual displacement control:

- Precision parts provide repeatable, accurate displacement settings with a given input signal.
- The manual displacement control is a high gain control: With only small movement of the control handle (input signal), the servo valve moves to full open position porting maximum flow to the servo cylinder. This is a high response system with low input force.
- The integral override mechanism allows rapid changes in input signal without damaging the control mechanism.
- Precision parts provide repeatable, accurate displacement settings with a given input signal.
- The double-acting servo piston is coupled to a spring centering mechanism. The servo control valve is spring centered such that with no input signal the servo valve is open centered and thus no fluid is ported to the servo cylinder.
- Benefits:
  - Pump returns to neutral after prime mover shuts down.
  - Pump returns to neutral if external control linkage fails at the control handle or if there is a loss of charge pressure.

Manual displacement control schematic



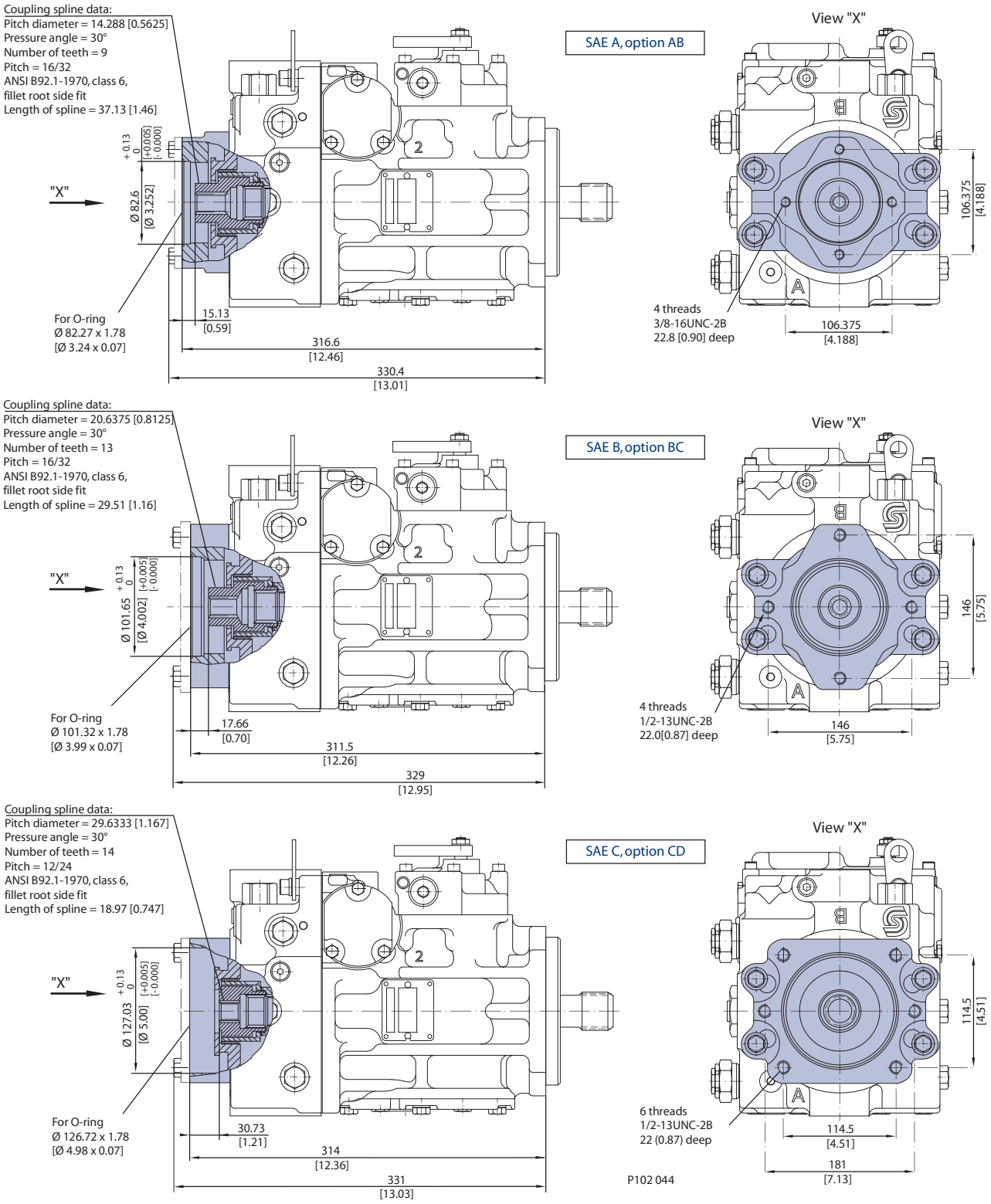
Cross-section



mm [in]

FRAME SIZE 055 (continued)

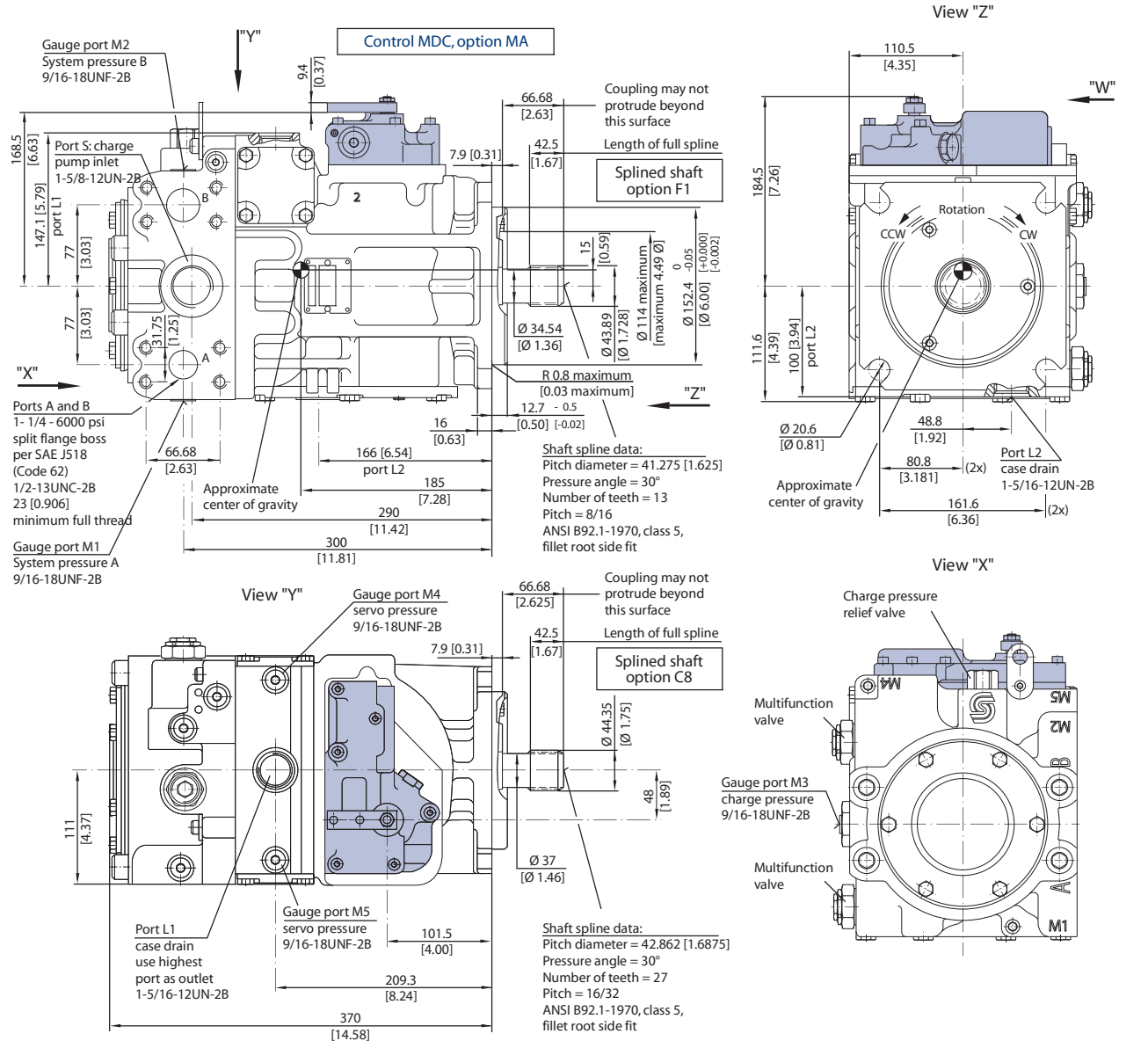
Auxiliary mounting pad – options AB, BC, CD, BB



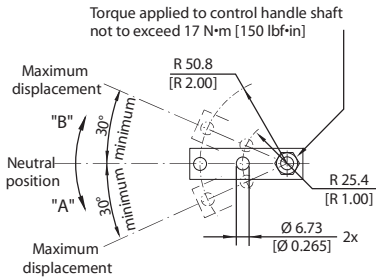
mm [in]

FRAME SIZE 130

Manual Displacement Control (MDC), end cap twin ports, option 80



Manual displacement control handle dimensions

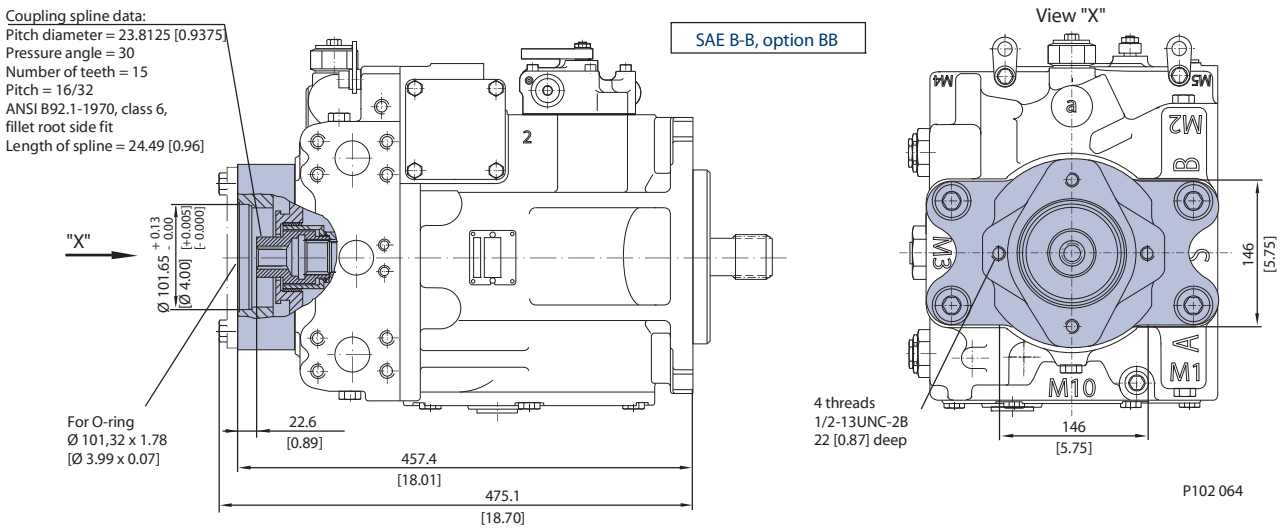


P102 052

mm [in]

FRAME SIZE 250 (continued)

Auxiliary mounting pad – options AB, BC, CD, DE, EF, EG, BB



SAUER DANFOSS

OUR PRODUCTS

Hydrostatic transmissions

Hydraulic power steering

Electric power steering

Electrohydraulic power steering

Closed and open circuit axial piston pumps and motors

Gear pumps and motors

Bent axis motors

Orbital motors

Transit mixer drives

Planetary compact gears

Proportional valves

Directional spool valves

Cartridge valves

Hydraulic integrated circuits

Hydrostatic transaxles

Integrated systems

Fan drive systems

Electrohydraulics

Microcontrollers and software

Electric motors and inverters

Joysticks and control handles

Displays

Sensors

Sauer-Danfoss Mobile Power and Control Systems – Market Leaders Worldwide

Sauer-Danfoss is a comprehensive supplier providing complete systems to the global mobile market.

Sauer-Danfoss serves markets such as agriculture, construction, road building, material handling, municipal, forestry, turf care, and many others.

We offer our customers optimum solutions for their needs and develop new products and systems in close cooperation and partnership with them.

Sauer-Danfoss specializes in integrating a full range of system components to provide vehicle designers with the most advanced total system design.

Sauer-Danfoss provides comprehensive worldwide service for its products through an extensive network of Global Service Partners strategically located in all parts of the world.

Local address:

Sauer-Danfoss (US) Company
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239-6000
Fax: +1 515 239-6618

Sauer-Danfoss ApS
DK-6430 Nordborg, Denmark
Phone: +45 7488 4444
Fax: +45 7488 4400

Sauer-Danfoss GmbH & Co. OHG
Postfach 2460, D-24531 Neumünster
Krokamp 35, D-24539 Neumünster, Germany
Phone: +49 4321 871-0
Fax: +49 4321 871 122

Sauer-Danfoss-Daikin LTD
Sannomiya Grand Bldg. 8F
2-2-21 Isogami-dori, Chuo-ku
Kobe, Hyogo 651-0086, Japan
Phone: +81 78 231 5001
Fax: +81 78 231 5004

www.sauer-danfoss.com

520L0603 • Rev EB • July 2007

Procedure 1: Disconnect jump hose between drive pumps

Goal: Isolate drive pump loops from each other.

Table of Contents

1. Assemble engine assembly leaving one end of hose 616038 (highlighted in red below) disconnected.

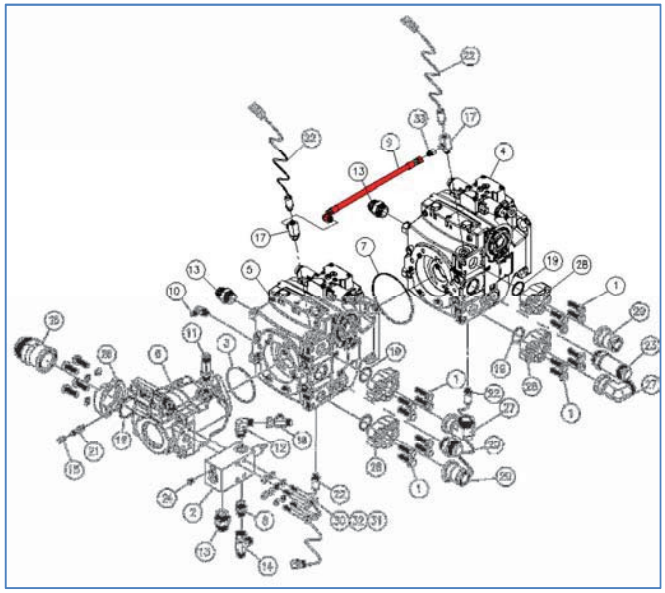


Figure 1: STS 10/12/14

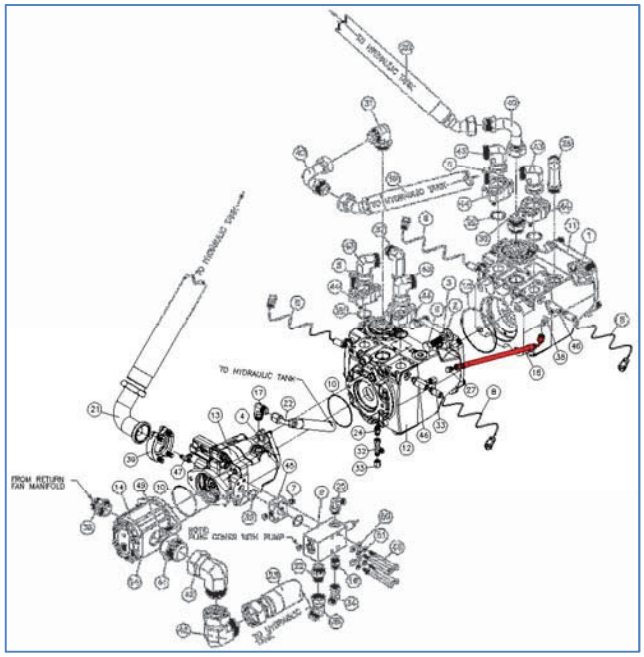


Figure 2: STS 16

2. Install 9/16 JIC cap 618458 into loose end of hose 616038 and 9/16 fitting with cap nut 618531.

Goal 2

1. Navigate to ***drive pumps or DP1*** max current parameter in ***Adjust*** menu of MD3.

   NOTE: If DP1 was adjusted under Scenario 2 above it needs no further adjustment; proceed with DP2 and vice versa.

Record the initial maximum current value for DP1 on the calibration data sheet before adjusting.
NOTE: Values shown here are program defaults.

2. Start graphing ***drive pump M-group*** on your laptop computer.
3. Move control handle to full forward position and allow machine to stabilize speed.
4. Start slowly decreasing the max current value for DP1 using down arrow on MD3 until the PT4 pressure trace begins to drop.
5. Start slowly increasing the max current value for DP1 using up arrow on MD3 until the PT4 pressure matches PT6 on the graph. Once pressure match is achieved, this pump should require no further max current adjustment. ***Record the final maximum current value for DP1 on the calibration data sheet.***
6. Repeat steps 1-6 for DP2
7. Repeat all steps for Procedure 5 for reverse.

Table of Contents

Return to:

- Table of Contents
- Procedure 2: Baseline
- Procedure 3: Checking neutral, charge pressure
- Procedure 4: Check pressure limiter setting
- Procedure 5: Minimum current adjust
- Procedure 6: Adjusting maximum drive pump current
- Procedure 7: Pump calibration
- Procedure 8: Min/Max current measurement
- Procedure 9: Documentation

Series 51-1 Controls Service Manual

Contents

MINOR REPAIR (continued)

Assembly

1. If removed, install control orifices T2, T3, and U5 to their proper location. Using a 3mm internal hex wrench, torque the orifices to 6 N•m [4 lbf•ft].

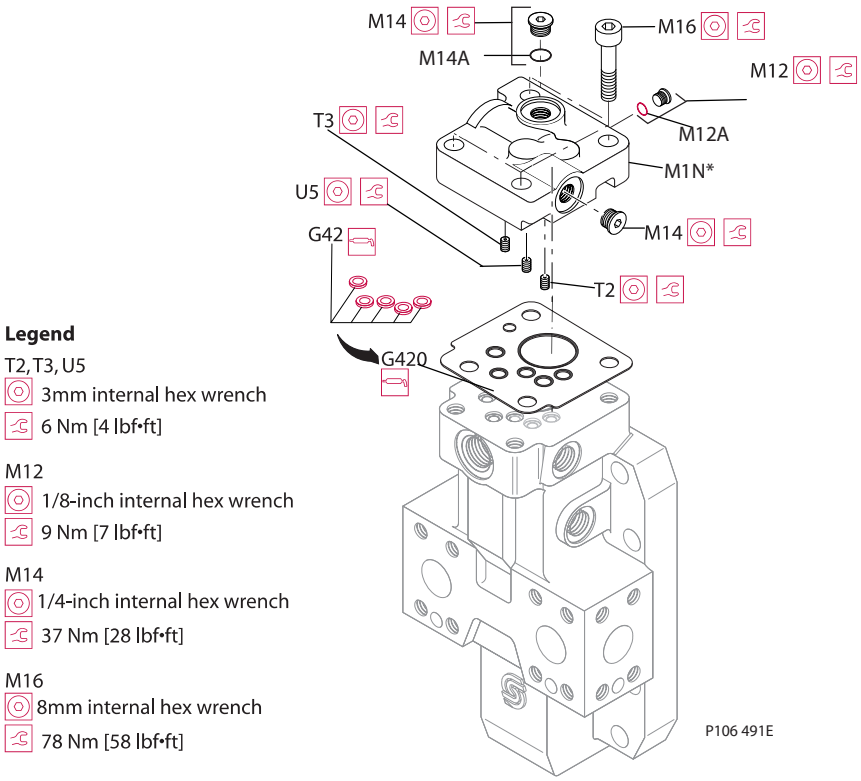
2. Lubricate and install new O-rings on the housing plugs (M12). Using a 1/8-inch internal hex wrench, torque them to 9 N•m [7 lbf•ft]

3. Lubricate and install new O-rings on the housing plugs (M14). Using a 1/4-inch internal hex wrench, torque them to 37 N•m [28 lbf•ft].

4. Using clean petroleum jelly to retain them, install new interface O-rings (G42) or a new control gasket (G420) on the endcap.

5. Install the control housing and retaining screws (M16) on the endcap. Using an 8mm internal hex wrench torque the retaining screws to 78 N•m [58 lbf•ft].

N1 control assembly



Legend

T2, T3, U5
3mm internal hex wrench
6 Nm [4 lbf•ft]

M12
1/8-inch internal hex wrench
9 Nm [7 lbf•ft]

M14
1/4-inch internal hex wrench
37 Nm [28 lbf•ft]

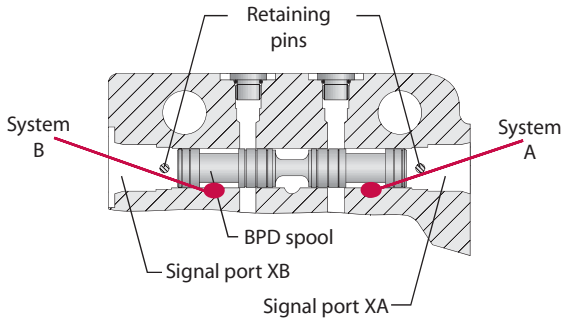
M16
8mm internal hex wrench
78 Nm [58 lbf•ft]

FUNCTIONAL DESCRIPTION (continued)

Option CA

An external hydraulic signal at ports **XA** or **XB** operates the BPD feature. Pressure applied at port **XA** allows PC functions to operate only when system port **A** has high pressure, defeating PC operation when system port **B** is high. Pressure applied at port **XB** allows PC functions to operate only when system port **B** has high pressure, defeating PC operation when system port **A** is high.

BPD option CA cross section

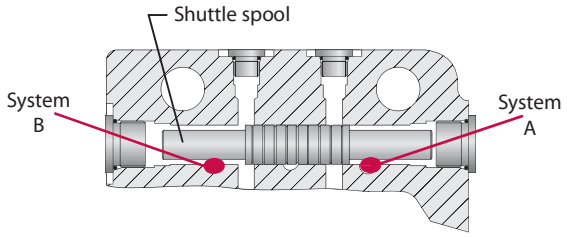


P101183E

Option C2

No BPD features are used. PC operation is allowed in either direction. The BPD spool resolves high pressure and routes it to the PC spool.

BPD option C2cross section



P101185E

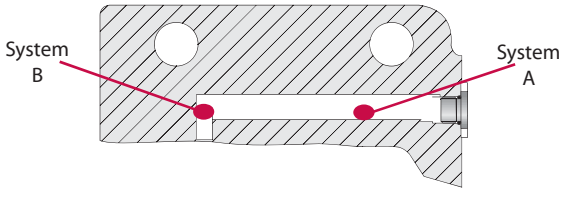
Option R5

No BPD features are used. PC operation is allowed only when system port **A** has high pressure. No BPD spool is used. System **B** interface port is plugged.

Option L5

No BPD features are used. PC operation is allowed only when system port **B** has high pressure. No BPD spool is used. System **A** interface port is plugged.

BPD option R5/L5 cross section



P101185Ebpd

MINOR REPAIR (continued)

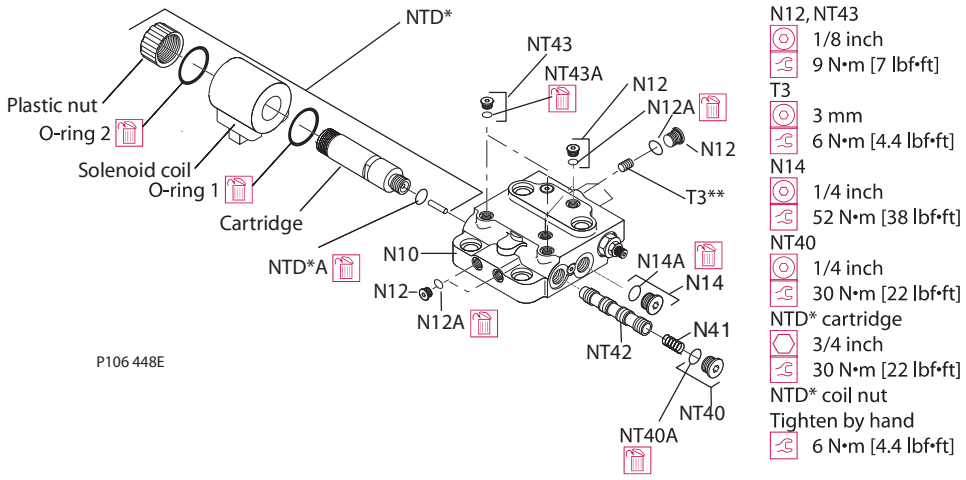
Always ensure you have the correct replacement parts (O-rings/seals) before discarding the used ones.

Servo/PC supply options D1/D2/D7

Disassembly

1. Thoroughly clean all external surfaces before disassembly.
2. Using a 1/8 inch internal hex wrench, remove seven plugs (N12). Remove and discard the O-rings (N12A).

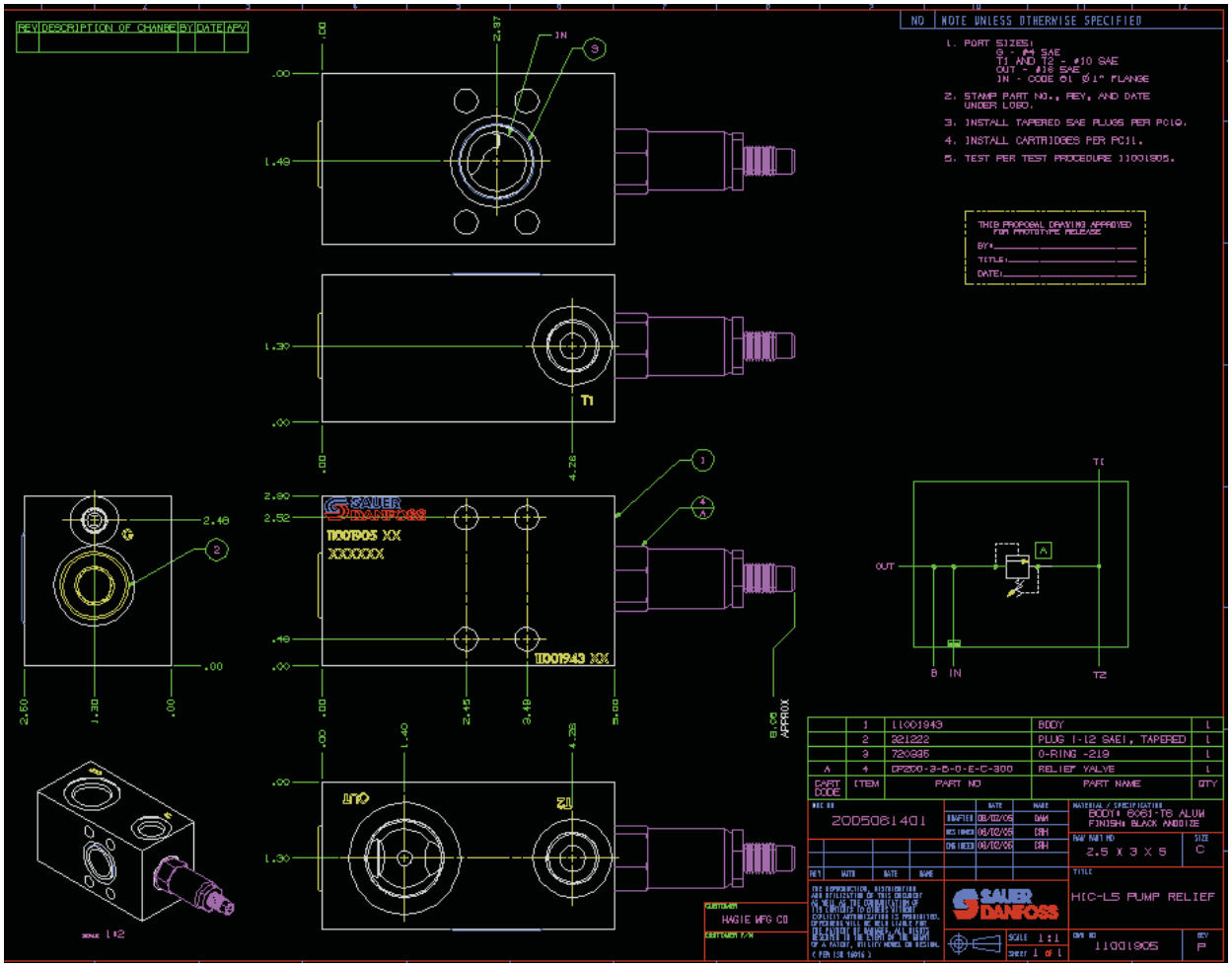
D1/D2/D7 components

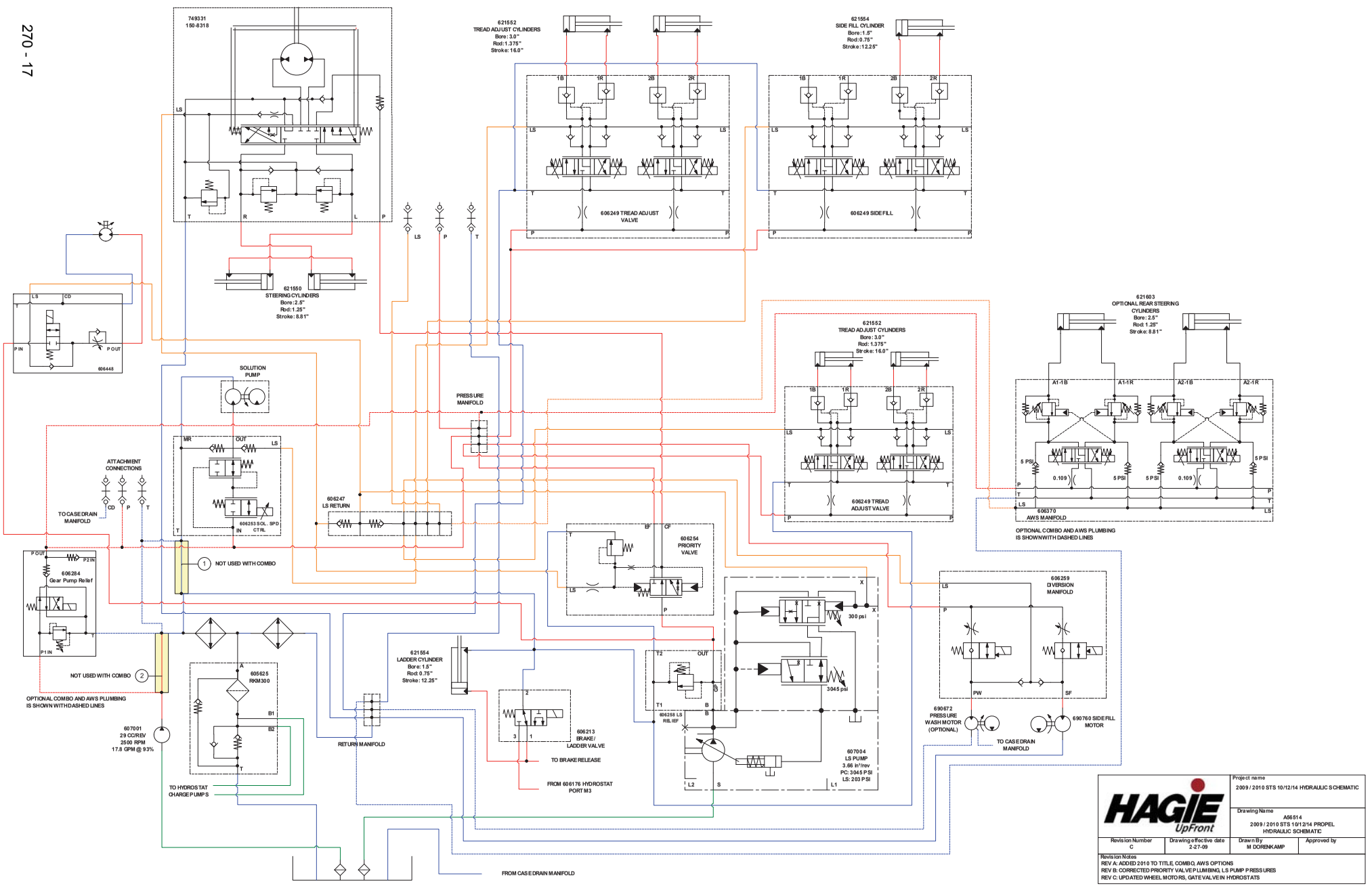


3. Using a 1/4 inch internal hex wrench, remove the plug (N14). Remove and discard the O-ring (N14A).
4. Using a 1/4 inch internal hex wrench, remove plug (NT40) from port XB. Remove and discard the O-ring (NT40A).
5. Using a 1/8 inch internal hex wrench, remove two plugs (NT43). Remove and discard the O-rings (NT43A).
6. Using a 3mm internal hex wrench, remove orifice (T3). Note the location for reassembly.
7. Remove the spring (NT41) and BPD spool (NT42) from the housing bore.
8. Remove the plastic coil nut from the solenoid (NTD*). Remove the coil and two O-rings. Discard the O-rings.
9. Remove the coil.
10. Remove the second O-ring.
11. Remove the cartridge from the control housing using a thin 3/4 inch hex wrench on the flats provided.
12. Remove the pushrod from the cartridge.

Hagie Manufacturing Company

606258 LS Relief Block





HAGIE UpFront

Project name	
2009 / 2010 STS 10/12/14 HYDRAULIC SCHEMATIC	
Drawing Name	
A56514 2009 / 2010 STS 10/12/14 PROPEL HYDRAULIC SCHEMATIC	
Revision Number C	Drawing effective date 2-27-09
Drawn By M DORENKAMP	Approved by

Revision Notes
REV A: ADDED 2010 TO TITLE, COMBO, AWS OPTIONS
REV B: CORRECTED PRIORITY VALVE PLUMBING, LS PUMP PRESSURES
REV C: UPDATED WHEEL MOTORS, GATE VALVE IN HYDROSTATS

HISTORY OF REVISIONS

Table of Revisions

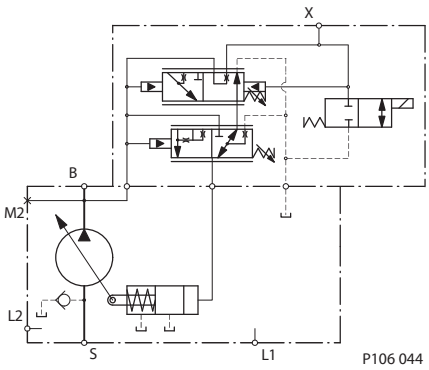
Date	Page	Changed	Rev.
November 2006	51, 52, 53	Revised schematics information	E
August 2005	-	Removed Frame H, added Frame J	D
April 2003		Added Frame E	C
May 2001	-	Added Frame H and Frame G	B
May 1999	-	First printing	A

Front cover illustrations: F101 178, F101 180, F101 337, F101 168, P101 992

ELECTRICAL ON/ OFF PRESSURE COMPENSATED CONTROLS

The electrical on/off pressure compensated control allows the pump to operate as a PC type control under normal operating conditions. A solenoid valve overrides the PC control allowing the pump to operate in a low-pressure standby mode. This function provides reduced horsepower and torque loss in certain situations. It may be particularly useful to reduce loads on a system during engine start.

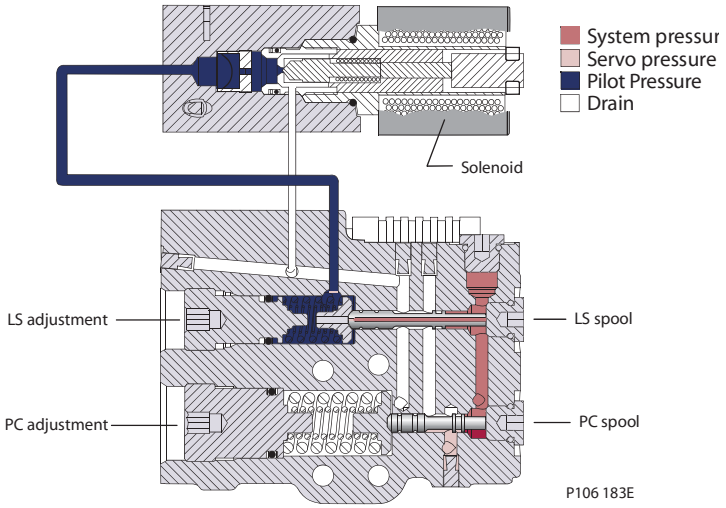
ED schematic (normally closed)



When closed, the solenoid valve prevents flow across the LS spool gain orifice, defeating the LS spool. The pump then functions as a PC control pump. When open, the solenoid valve allows flow across the LS spool gain orifice to reservoir. This flow generates a pressure differential across the LS spool that shifts the spool and de-strokes the pump. The pump then operates in a low-pressure standby condition. The solenoid valve is available in a normally closed or normally open configuration.

ED is the nomenclature for a normally closed on/off control for the L and K frame pumps. Other frame sizes and configurations have different order code designations.

(ED) Electric control cross-section



SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, *see page 13*. For system design parameters, including installation, filtration, reservoir, and line velocities, *see page 15*.

Features and options

Feature		Unit	Model L25C	Model L30D	Model K38C	Model K45D
Maximum Displacement		cm³ [in³]	25 [1.53]	30 [1.83]	38 [2.32]	45 [2.75]
Flow at rated speed (theoretical)		l/min [US gal/min]	80 [21]	96 [25.4]	100.7 [26.6]	119.3 [31.5]
Input torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	0.398 [243]	0.477 [291]	0.605 [369]	0.716 [438]
Mass moment of inertia of internal rotating components		kg•m² [slug•ft²]	0.00169 [0.00125]	0.00161 [0.00119]	0.00184 [0.00135]	0.00203 [0.00150]
Weight	Axial ports	kg [lb]	19 [42]			
	Radial ports		24 [53]			
Rotation			Clockwise, Counterclockwise			
Mounting			SAE-B			
Auxiliary mounting (*See page 34*)			SAE-A, SAE-B, SAE-BB			
System ports (type)			SAE O-ring boss			
System ports (location)			Axial, Radial			
Control types (*See page 29*)			ED, AA, PC, Remote PC, LS, LS with internal bleed			
Shafts (*See page 32*)		Splined	13 tooth, 15 tooth			
		Tapered	Ø 25.4 mm [1 in], 1:8 taper Ø 22.23 mm [0.875 in], 1:8 taper			
		Straight	Ø 22.23 mm [0.875 in] (short)		Ø 22.23 mm [0.875 in] (long)	
Displacement limiters (*See page 36*)			Optional, adjustable			

For definitions of pressure and speed ratings, *see page 14*. For more information on external shaft loads, *see page 16*; mounting flange loads, *see page 17*.

Ratings

Rating		Units	Model L25C	Model L30D	Model K38C	Model K45D
Input speed[1]	minimum	min^{-1} (rpm)	500	500	500	500
	continuous		3200	3200	2650	2650
	maximum		3600	3600	2800	2800
Working pressure	continuous	bar [psi]	260 [3770]	210 [3045]	260 [3770]	210 [3045]
	maximum		350 [5075]	300 [4350]	350 [5075]	300 [4350]
External shaft loads	External moment (M_e)	N•m [lbf•in]	61 [540]	61 [540]	76 [673]	76 [673]
	Thrust in (T_{in}), out (T_{out})	N [lbf]	1000 [225]	1000 [225]	1200 [270]	1200 [270]
Bearing life	at 140 bar [2030 psi]	B_{10} hours	49 100	24 600	35 300	19 600
	at 210 bar [3045 psi]		14 100	7230	11 400	6200
	at 260 bar [3770 psi]		6590	—	5870	—
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	1005 [8895]			
	Shock (max)		3550 [31 420]			

1. Input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. See *Inlet pressure vs. speed* charts.

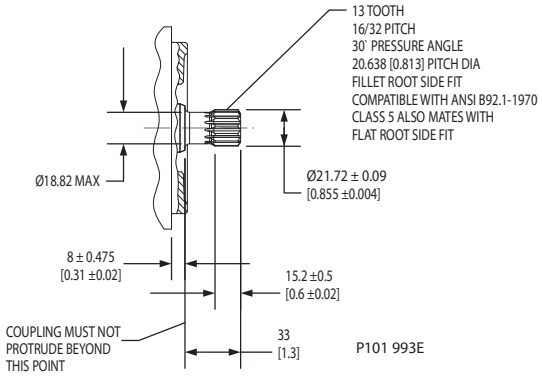
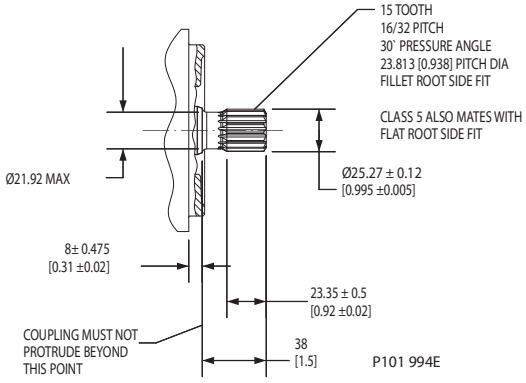
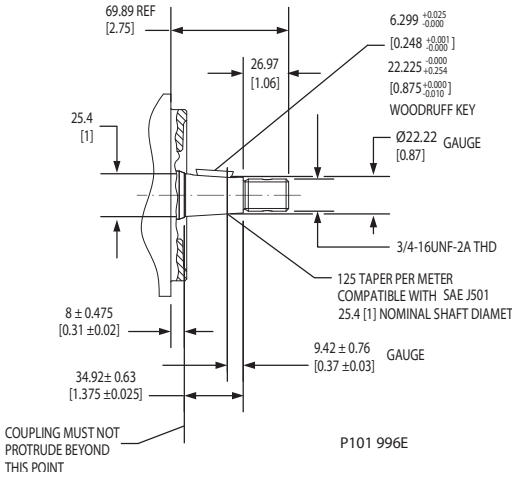
For more information on noise levels, *see page 19*.

Sound levels[2]

dB(A)	210 bar [3045 psi]		260 bar [3770 psi]	
Pump model	1800 min^{-1}(rpm)	Rated speed	1800 min^{-1}(rpm)	Rated speed
L25C	65	69	66	70
L30D	66	70	—	—
K38C	65	70	66	71
K45D	66	71	—	—

2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

INPUT SHAFTS

Code	Description	Maximum torque rating[1] N•m [lbf•in]	Drawing
C2	13 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)	288 [2546]	
C3	15 tooth spline 16/32 pitch (ANSI A92.1 1970 - Class 5)	404 [3575]	
T1	Ø 25.4 mm [1 in] 1:8 taper (SAE J501)	362 [3200]	

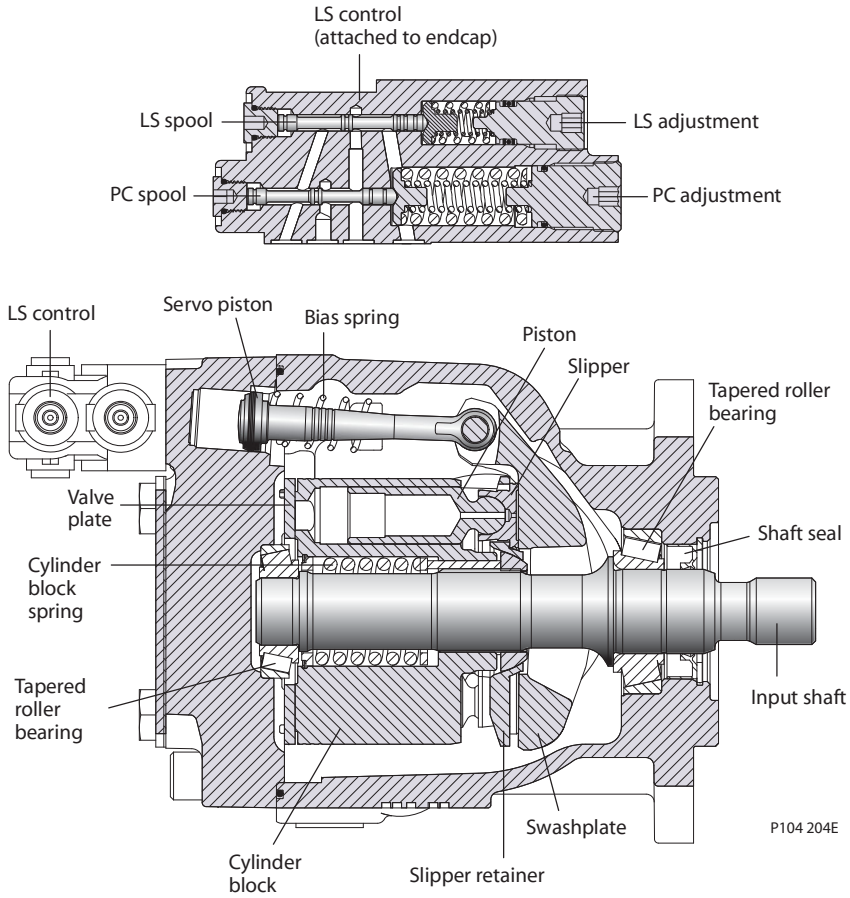
1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

DESIGN

Series 45 Frame J pumps have a single servo piston design with a cradle-type swashplate set in polymer-coated journal bearings. A bias spring and internal forces increase swashplate angle. The servo piston decreases swashplate angle. Nine reciprocating pistons displace fluid from the pump inlet to the pump outlet as the cylinder block rotates on the pump input shaft. The block spring holds the piston slippers to the swashplate via the slipper retainer. The cylinder block rides on a bi-metal valve plate optimized for high volumetric efficiency and low noise. Tapered roller bearings support the input shaft and a viton lip-seal protects against shaft leaks.

An adjustable one spool (PC only, not shown) or two spool (LS and PC) control senses system pressure and load pressure (LS controls). The control ports system pressure to the servo piston to control pump output flow.

Frame J cross section



CONTROLS (continued)

Load sensing control (LS, BS)

Specifications

PC control setting range

Code	J45B, J51B, J60B	J65C, J75C
LS	100-280 bar [1450-4060 psi]	100-260 bar [1450-3770 bar]
BS	290-310 bar [4205-4495 psi]	N/A

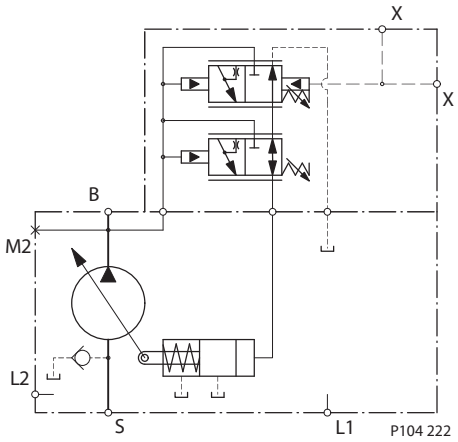
*Response/recovery times**

(MS)	J45B	J51B	J60B	J65B	J75B
Response	28	30	33	43	45
Recovery	111	125	140	101	140

* For definitions, *see page 11*.

Schematic diagram

LS Schematic



LS setting range

Model	bar	psi
All	10–30	145–435

Legend

B = Outlet
S = Inlet
L1, L2 = Case drain
X = LS signal port
M2* = System pressure gauge port

* M2 port is available on axially ported endcaps only

Load sensing control with internal bleed orifice (LB, BB)

Specifications

PC control setting range

Code	J45B, J51B, J60B	J65C, J75C
LB	100-280 bar [1450-4060 psi]	100-260 bar [1450-3770 bar]
BB	290-310 bar [4205-4495 psi]	N/A

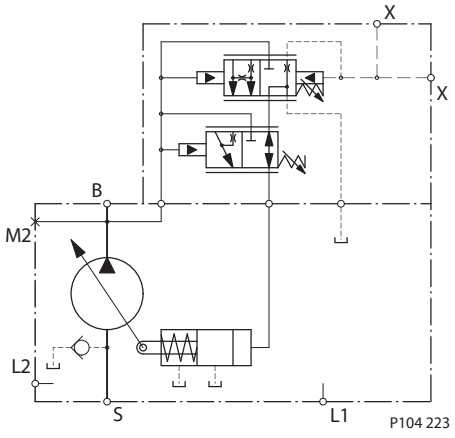
*Response/recovery times**

(MS)	J45B	J51B	J60B	J65B	J75B
Response	28	30	33	43	45
Recovery	111	125	140	101	140

* For definitions, *see page 11*.

Schematic diagram

LB Schematic



LS setting range

Model	bar	psi
All	10–30	145–435

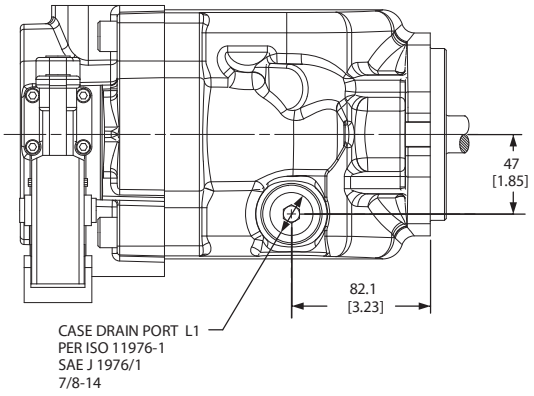
Legend

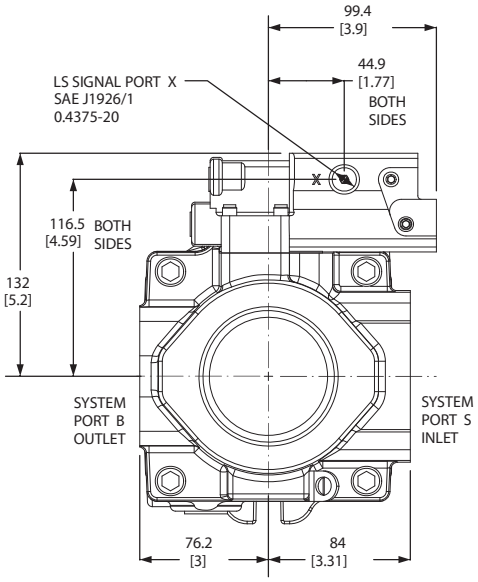
B = Outlet
S = Inlet
L1, L2 = Case drain
X = LS signal port
M2* = System pressure gauge port

* M2 port is available on axially ported endcaps only

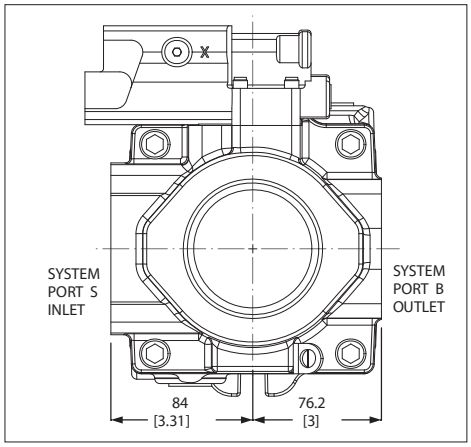
INSTALLATION DRAWINGS

Radial ported endcap

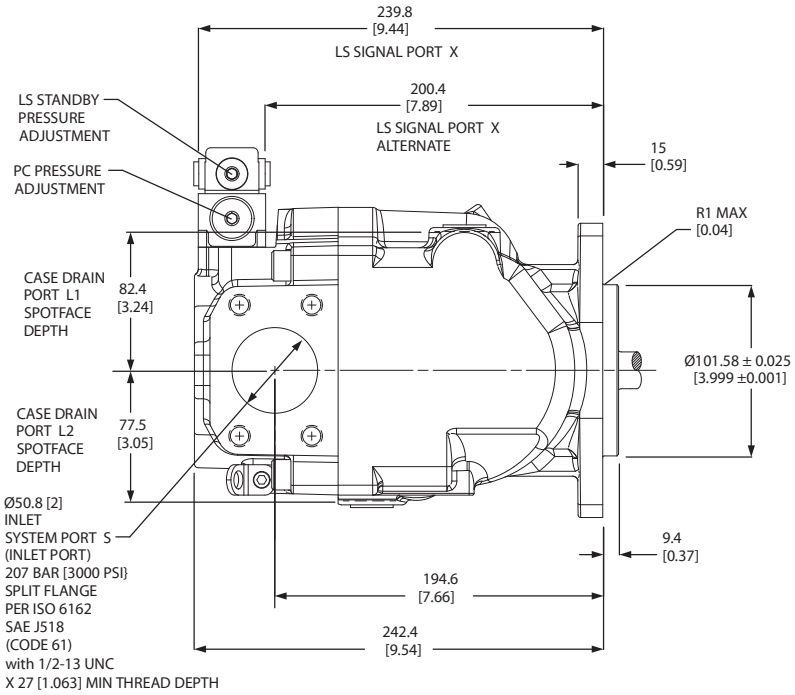


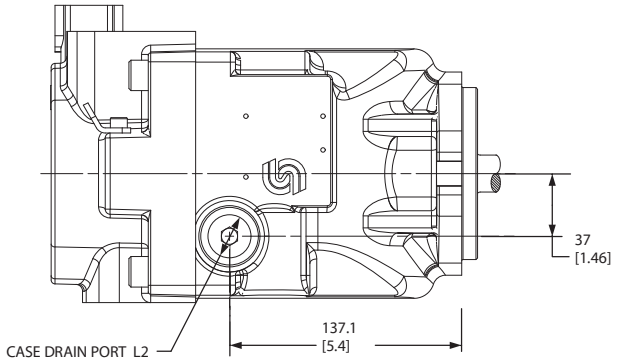


Counterclockwise rotation



Clockwise rotation





P106 173E

Third-angle projection
mm [in]

CONTROLS (continued)

Load sensing control (LS)

Specifications

PC setting range

Model	bar	psi
G74B	100–310	1450–4495
G90C	100–260	1450–3770

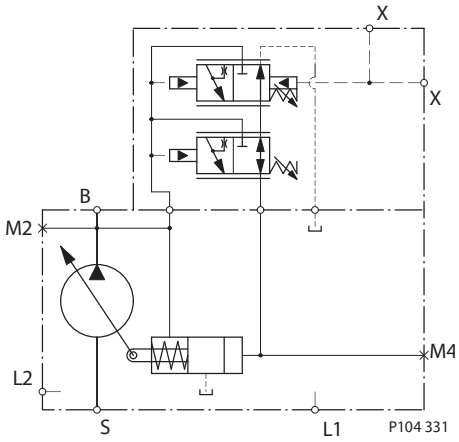
*Response/recovery times**

(ms)	Response	Recovery
G74B	35	100
G90C	40	130

* For definitions, *see page 11*

Schematic diagram

LS Schematic



LS setting range

Model	bar	psi
All	10–30	145–435

Legend

B = Outlet
S = Inlet
L1, L2 = Case drain
M2 = System pressure gauge port
M4 = Servo pressure gauge port
X = LS signal port

Load sensing control with internal bleed orifice (LB)

Specifications

PC setting range

Model	bar	psi
G74B	100–310	1450–4495
G90C	100–260	1450–3770

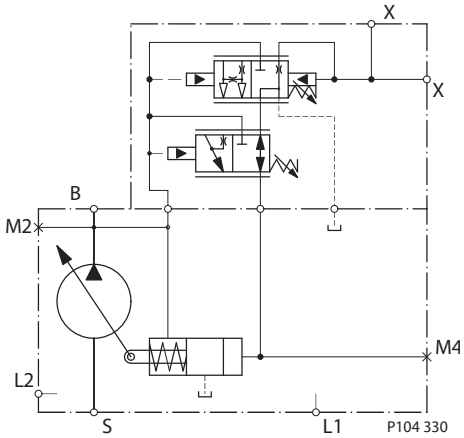
*Response/recovery times**

(ms)	Response	Recovery
G74B	35	100
G90C	40	130

* For definitions, *see page 11*.

Schematic diagram

LB Schematic



LS setting range

Model	bar	psi
All	10–30	145–435

Legend

B = Outlet
S = Inlet
L1, L2 = Case drain
M2 = System pressure gauge port
M4 = Servo pressure gauge port
X = LS signal port

SPECIFICATIONS

For general operating parameters, including fluid viscosity, temperature, and inlet and case pressures, *see page 13*. For system design parameters, including installation, filtration, reservoir, and line velocities, *see page 15*.

Features and options

Feature		Unit	Model E100B	Model E130B	Model E147C
Maximum Displacement		cm³ [in³]	100 [6.10]	130 [7.93]	147 [8.97]
Flow at rated speed (theoretical)		l/min [US gal/min]	245 [64.7]	286 [75.6]	309 [81.6]
Input torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	1.592 [972]	2.069 [1263]	2.340 [1428]
Mass moment of inertia of internal rotating components		kg•m² [slug•ft²]	0.0128 [0.0094]	0.0128 [0.0094]	0.0128 [0.0094]
Weight	Axial ports	kg [lb]	51.3 [113]		
	Radial ports		54.9 [121]		
Rotation			Clockwise, Counterclockwise		
Mounting			SAE-C		
Auxiliary mounting (*See page 92*)			SAE-A, SAE-B, SAE-BB, SAE-C, SAE-CC		
System ports (type)			4-bolt split flange		
System ports (location)			Axial, Radial		
Control types (*See page 88*)			PC, Remote PC, LS, LS with internal bleed		
Shafts (*See page 90*)		Splined	13-tooth, 14-tooth, 17-tooth		
		Straight	Ø 38.08 mm [1.5 in]		
Displacement limiters (*See page 94*)			Optional, adjustable		

For definitions of pressure and speed ratings, *see page 14*. For more information on external shaft loads, *see page 16*; mounting flange loads, *see page 17*.

Ratings

Rating		Units	Model E100B	Model E130B	Model E147C
Input speed[1]	minimum	min⁻¹ (rpm)	500	500	500
	continuous		2450	2200	2100
	maximum		2880	2600	2475
Working pressure	continuous	bar [psi]	310 [4495]	310 [4495]	260 [3770]
	maximum		400 [5800]	400 [5800]	350 [5075]
External shaft loads	External moment (M_e)	N•m [lbf•in]	455 [4030]	360 [3190]	396 [3500]
	Thrust in (T_{in}), out (T_{out})	N [lbf]	2846 [640]	1735 [390]	2113 [475]
	Thrust out (T_{out})		7740 [1740]	6672 [1500]	7117 [1600]
Bearing life	at 140 bar [2030 psi]	B_{10} hours	77 200	32 700	21 600
	at 210 bar [3045 psi]		19 800	8400	5500
	at 260 bar [3770 psi]		9700	4116	2700
	at 310 bar [4495 psi]		5400	2300	—
Mounting flange load moments	Vibratory (continuous)	N•m [lbf•in]	1920 [17 000]		
	Shock (max)		6779 [60 000]		

1. Input speeds are valid at 1 bar absolute [0 in Hg vac] inlet pressure. See *Inlet pressure vs. speed* charts.

For more information on noise levels, *see page 19*.

Sound levels[2]

dB(A)	210 bar [3045 psi]		260 bar [3770 psi]		310 bar [4495 psi]	
Model	1800 min⁻¹(rpm)	Rated speed	1800 min⁻¹(rpm)	Rated speed	1800 min⁻¹(rpm)	Rated speed
E100B	75	77	77	78	77	80
E130B	77	81	78	81	78	81
E147C	77	78	78	78	—	—

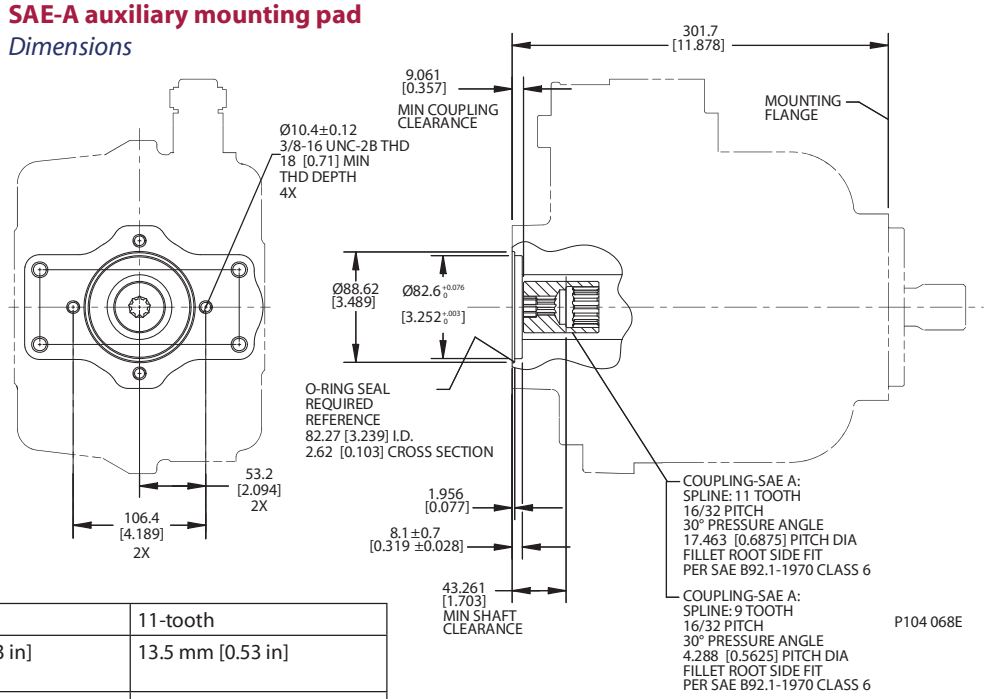
2. Sound data was collected in a *semi-anechoic* chamber. Values have been adjusted (-3 dB) to reflect *anechoic* levels.

AUXILIARY MOUNTING PADS

See page 18 for mating pump pilot and spline dimensions.

SAE-A auxiliary mounting pad

Dimensions



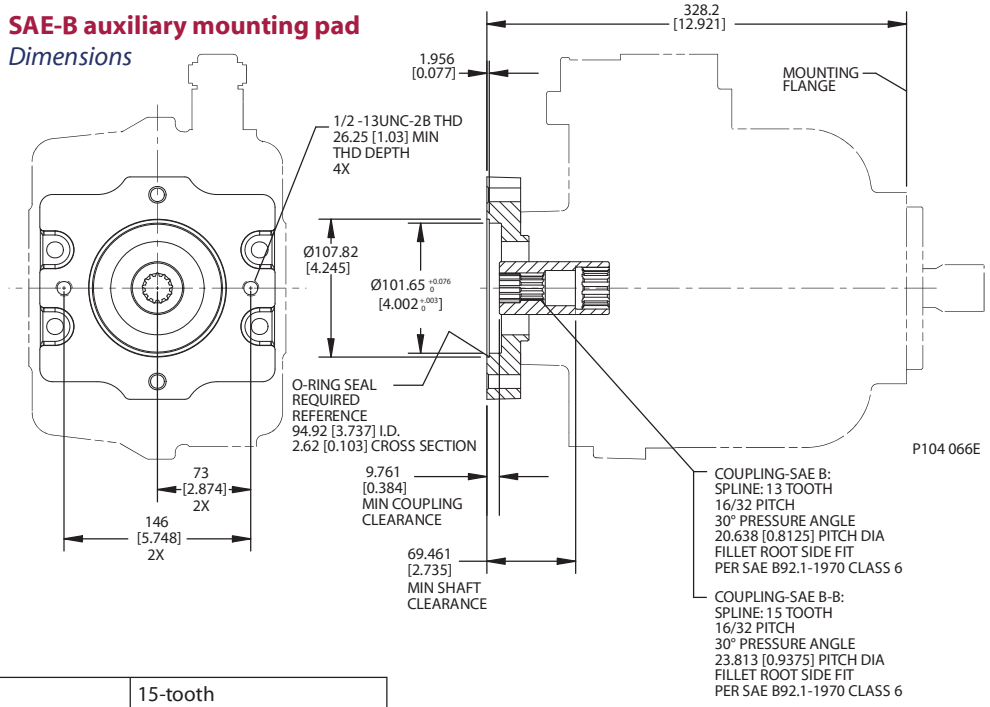
Specifications

Coupling	9-tooth	11-tooth
Spline minimum engagement	13.5 mm [0.53 in]	13.5 mm [0.53 in]
Maximum torque	107 N•m [950 lbf•in]	147 N•m [1300 lbf•in]

SAE-B auxiliary mounting pad

Dimensions

See page 18 for mating pump pilot and spline dimensions.

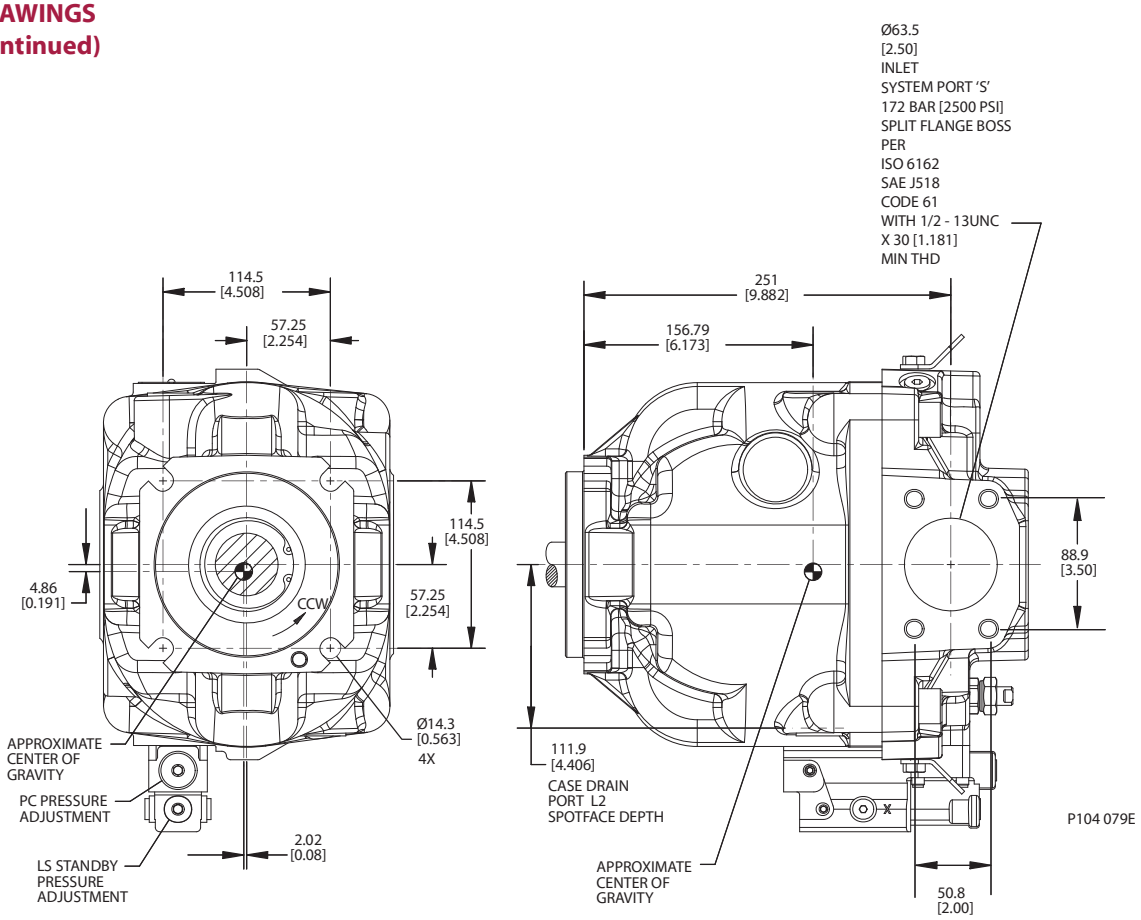


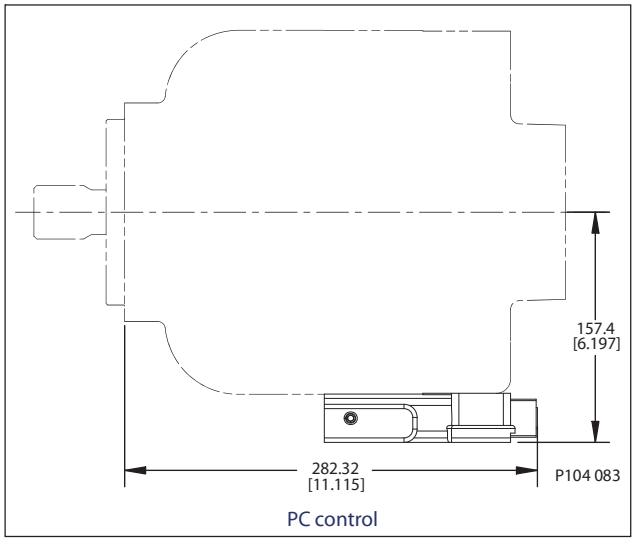
Specifications

Coupling	13-tooth	15-tooth
Spline minimum engagement	14.2 mm [0.56 in]	16.1 mm [0.63 in]
Maximum torque	249 N•m [2200 lbf•in]	339 N•m [3000 lbf•in]

INSTALLATION DRAWINGS (continued)

Radial ported endcap, counterclockwise rotation (continued)





Third-angle projection
mm [in]

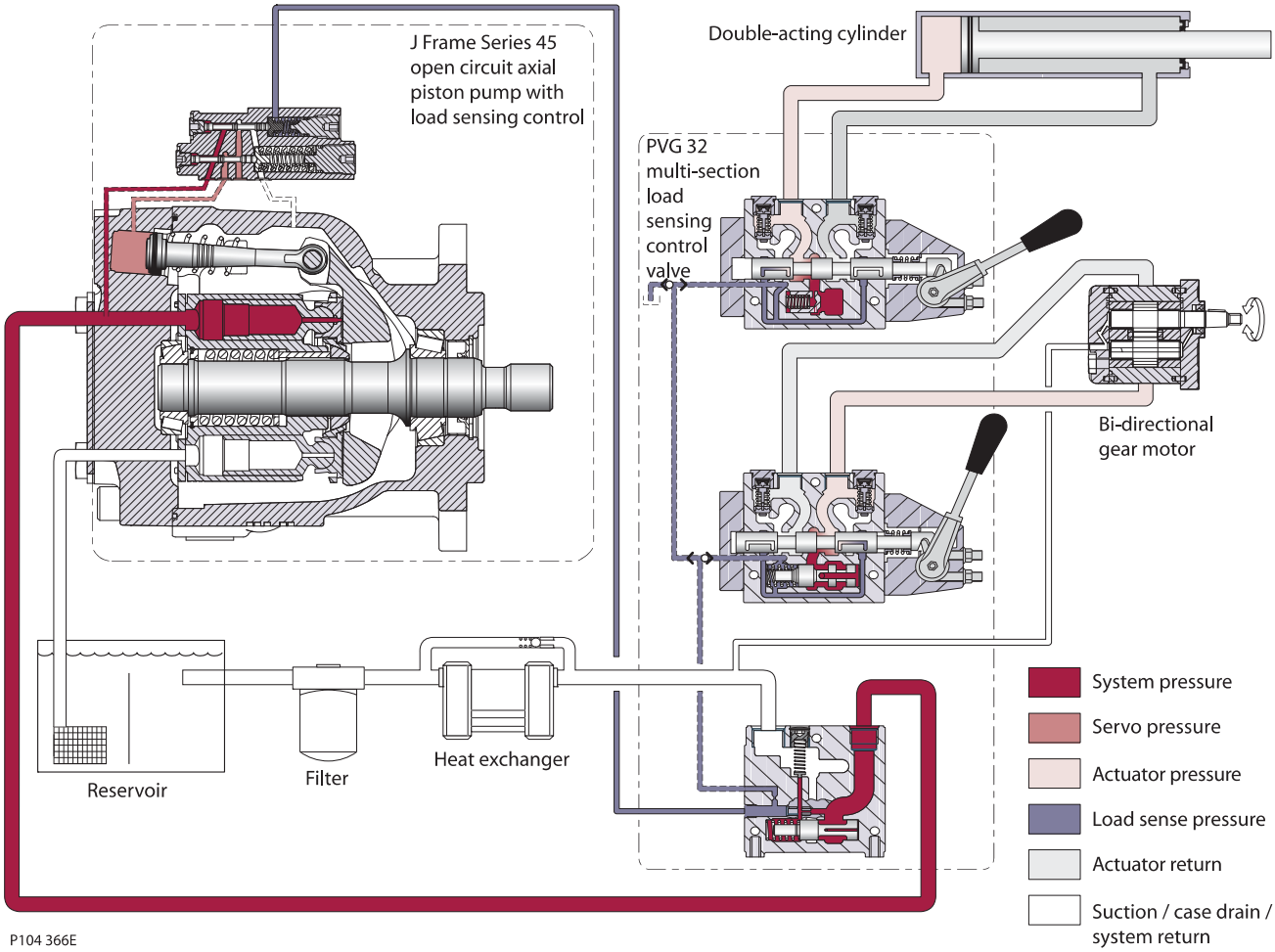
SYSTEM CIRCUIT

The pump receives fluid directly from the reservoir through the inlet line. A screen placed in the inlet protects the pump from large contaminants. The output of the pump is directed to a PVG-32 multi-section load sensing directional control valve which directs fluid to the actuators in the system. Fluid returning from the system is cooled by a heat exchanger and cleaned by a filter before returning to the reservoir.

The speed of the actuators in the system depends on the volume of fluid being provided by the pump. The operating pressure varies depending on actuator load, but is limited to an adjustable maximum setting by the PC section of the pump control and by a system relief valve integrated into the side module of the PVG valve.

The position of the PVG valve sets the demand for flow in the system and communicates this to the pump control by means of a hydraulic signal (load sense signal). The pump will provide as much flow to the system as it demands[1] while limiting the maximum pressure. Therefore flow and pressure in the system are compensated to meet requirements.

Pictorial circuit diagram



P104 366E

[1] Full available flow is a function of pump displacement, operating speed, and efficiency. Refer to *Series 45 Axial Piston Open Circuit Pumps Technical Information,* 520L0676 for details.

SYSTEM OPERATING HOT

Item	Description	Action
Check fluid level in reservoir.	Insufficient volume of hydraulic fluid will not meet cooling demands of system.	Fill reservoir to proper level. Verify proper size of reservoir.
Inspect heat exchanger. Check air flow and input air temperature for the heat exchanger.	Insufficient air flow, high input air temperature, or undersized heat exchanges will not meet cooling demands of the system.	Clean, repair, or replace heat exchanger as required. Verify proper size of heat exchanger.
Check external system relief valve setting.	Fluid passing through relief valve adds heat to system.	Adjust external system relief valve setting following manufacturer's recommendations. External relief valve setting must be above PC setting for proper operation.
Check pump inlet pressure/ vacuum.	High inlet vacuum adds heat to system.	Correct inlet pressure/vacuum conditions.

LOW PUMP OUTPUT FLOW

Item	Description	Action
Check fluid level in reservoir.	Insufficient hydraulic fluid will limit output flow and cause internal damage to pump.	Fill the reservoir to proper level.
Hydraulic fluid viscosity above acceptable limits.	Fluid viscosity above acceptable limits or low fluid temperature will not allow the pump to fill or control to operate properly.	Allow system to warm up before operating, or use fluid with the appropriate viscosity grade for expected operating temperatures. See *Hydraulic Fluids and Lubricants Technical Information Manual,* **520L0463**.
Check external system relief valve setting.	Eternal relief valve set below PC setting causes low output flow.	Adjust external relief valve following manufacturer's recommendation. External relief valve setting must be above PC setting to operate properly.
Check PC and LS control setting.	Low PC setting prevents the pump from achieving full stroke.	Adjust PC and LS setting. Refer to *Adjustment*, page 20.
Check pump inlet pressure/ vacuum.	High inlet vacuum causes low output flow.	Correct inlet pressure conditions.
Check input speed.	Low input speeds decrease flow.	Adjust input speed.
Check pump rotation.	Incorrect rotational configuration causes low flow.	Use pump with appropriate rotational configuration.

PRESSURE OR FLOW INSTABILITY

Item	Description	Action
Check for air in system.	Air in system causes erratic operation.	Activate PC allowing system to bleed air. Check inlet line for leaks and eliminate source of air ingression.
Check control spools.	Sticking control spools cause erratic operation.	Inspect spools for free movement in bore. Clean or replace.

SAUER DANFOSS

OUR PRODUCTS

Hydrostatic transmissions

Hydraulic power steering

Electric power steering

Electrohydraulic power steering

Closed and open circuit axial piston pumps and motors

Gear pumps and motors

Bent axis motors

Orbital motors

Transit mixer drives

Planetary compact gears

Proportional valves

Directional spool valves

Cartridge valves

Hydraulic integrated circuits

Hydrostatic transaxles

Integrated systems

Fan drive systems

Electrohydraulics

Microcontrollers and software

Electric motors and inverters

Joysticks and control handles

Displays

Sensors

Sauer-Danfoss Mobile Power and Control Systems – Market Leaders Worldwide

Sauer-Danfoss is a comprehensive supplier providing complete systems to the global mobile market.

Sauer-Danfoss serves markets such as agriculture, construction, road building, material handling, municipal, forestry, turf care, and many others.

We offer our customers optimum solutions for their needs and develop new products and systems in close cooperation and partnership with them.

Sauer-Danfoss specializes in integrating a full range of system components to provide vehicle designers with the most advanced total system design.

Sauer-Danfoss provides comprehensive worldwide service for its products through an extensive network of Authorized Service Centers strategically located in all parts of the world.

Sauer-Danfoss (US) Company
2800 East 13th Street
Ames, IA 50010, USA
Phone: +1 515 239-6000, Fax: +1 515 239 6618

Sauer-Danfoss GmbH & Co. OHG
Postfach 2460, D-24531 Neumünster
Krokamp 35, D-24539 Neumünster, Germany
Phone: +49 4321 871-0, Fax: +49 4321 871 122

Sauer-Danfoss ApS
DK-6430 Nordborg, Denmark
Phone: +45 7488 4444, Fax: +45 7488 4400

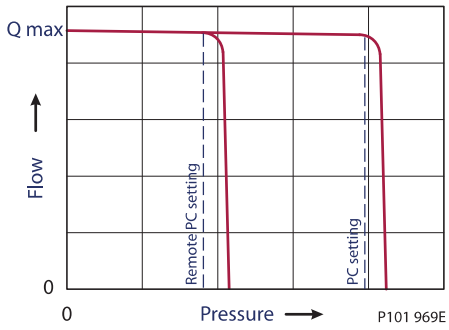
www.sauer-danfoss.com

BLN-10227 • **520L0607** • May 2005
270 - 157
JLG/0505

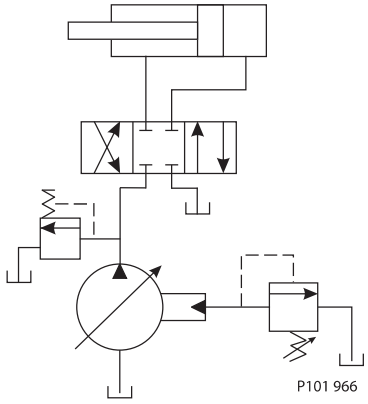
REMOTE PRESSURE COMPENSATED CONTROLS

The remote PC control is a two-stage control that allows multiple PC settings. Remote PC controls are commonly used in applications requiring low and high pressure PC operation.

Typical operating curve



Closed center circuit with remote PC



The remote PC control uses a pilot line connected to an external hydraulic valve. The external valve changes pressure in the pilot line, causing the PC control to operate at a lower pressure. When the pilot line is vented to reservoir, the pump maintains a low standby pressure of 15 to 20 bar [215 to 300 psi]. When pilot flow is blocked, the pump maintains pressure at the PC setting. An on-off solenoid valve can be used in the pilot line to create a low-pressure standby mode. A proportional solenoid valve, coupled with a microprocessor control, can produce an infinite range of operating pressures.

Each section includes control schematic diagrams, setting ranges, and response / recovery times for each control available. **Response** is the time (in milliseconds) for the pump to reach zero displacement when commanded by the control. **Recovery** is the time (in milliseconds) for the pump to reach full displacement when commanded by the control. Actual times can vary depending on application conditions.

Size the external valve and plumbing for a pilot flow of 3.8 l/min [1 US gal/min]. For additional system protection, install a relief valve in the pump outlet line.

Remote pressure compensated system characteristics

- Constant pressure and variable flow
- High or low pressure standby mode when flow is not needed
- System flow adjusts to meet system requirements
- Single pump can provide flow to multiple work functions
- Quick response to system flow and pressure requirements

Typical applications for remote pressure compensated systems

- Modulating fan drives
- Anti-stall control with engine speed feedback
- Front wheel assist

SIZING EQUATIONS

Use these equations to help choose the right pump size and displacement for your application:

	Based on SI units	Based on US units
Flow	Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{1000}$ (l/min)	Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{231}$ (US gal/min)
Torque	Input torque $M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_m}$ (N•m)	Input torque $M = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_m}$ (lbf•in)
Power	Input power $P = \frac{M \cdot n \cdot \pi}{30\,000} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ (kW)	Input power $P = \frac{M \cdot n \cdot \pi}{198\,000} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$ (hp)

Variables SI units [US units]

V_g	=	Displacement per revolution	cm^3/rev [in^3/rev]
p_O	=	Outlet pressure	bar [psi]
p_i	=	Inlet pressure	bar [psi]
Δp	=	$p_O - p_i$ (system pressure)	bar [psi]
n	=	Speed	min^{-1} (rpm)
η_v	=	Volumetric efficiency	
η_m	=	Mechanical efficiency	
η_t	=	Overall efficiency ($\eta_v \cdot \eta_m$)	

CONTROLS (continued)

Load sensing control (LS)

Specifications

PC setting range

Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

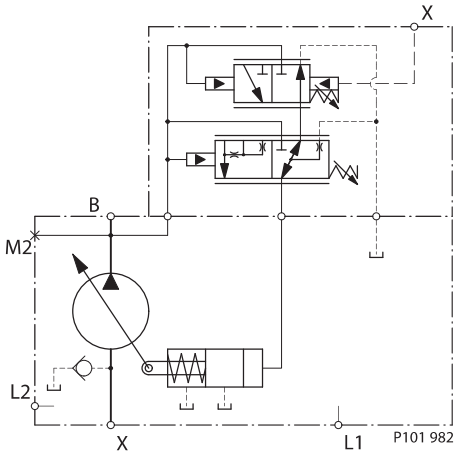
*Response/recovery times**

(ms)	Response	Recovery
L25C	30	70
L30D	30	70
K38C	30	80
K45D	30	80

* For definitions, *see page 11*.

Schematic diagram

LS Schematic



LS setting range

Model	bar	psi
All	12–40	174–580

Legend

B = Outlet
S = Inlet
L1, L2 = Case drain
M2 = System pressure gauge port
X = LS signal port

Load sensing control with internal bleed orifice (LB)

Specifications

PC setting range

Model	bar	psi
L25C	100–260	1450–3770
L30D	100–210	1450–3045
K38C	100–260	1450–3770
K45D	100–210	1450–3045

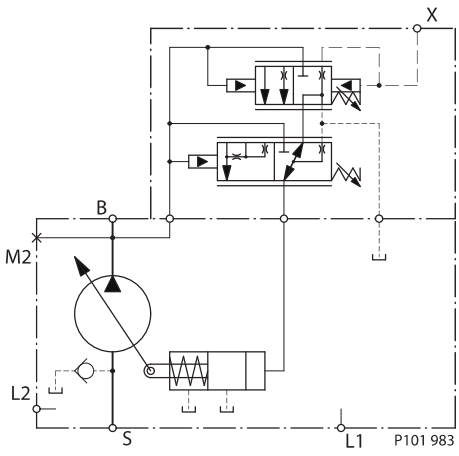
*Response/recovery times**

(ms)	Response	Recovery
L25C	30	70
L30D	30	70
K38C	30	80
K45D	30	80

* For definitions, *see page 11*.

Schematic diagram

LB Schematic



LS setting range

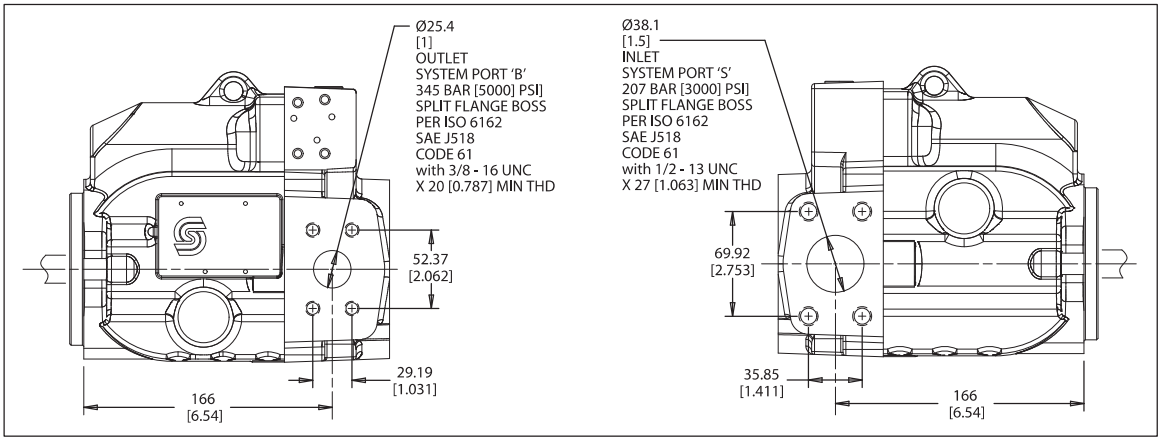
Model	bar	psi
All	12–40	174–580

Legend

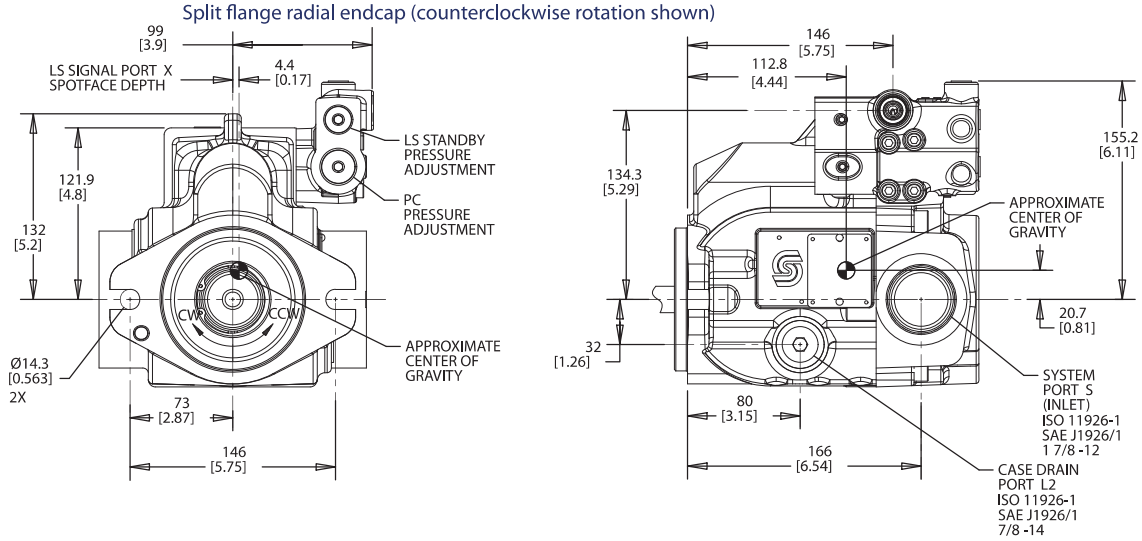
B = Outlet
S = Inlet
L1, L2 = Case drain
M2 = System pressure gauge port
X = LS signal port

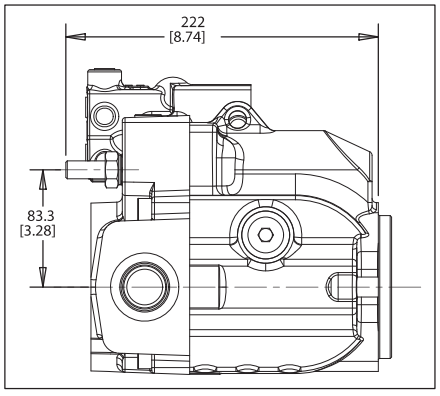
INSTALLATION DRAWINGS (continued)

Radial ported endcap (continued)



Split flange radial endcap (counterclockwise rotation shown)





P104 065E

Adjustable displacement limiter

Third-angle projection
mm [in]

ORDER CODE (continued)

J1 *Input shaft*

C2	13 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
C3	15 tooth, 16/32 pitch (ANSI A92.1 1970 - Class 5)
S1	14 tooth, 12/24 pitch (ANSI A92.1 1970 - Class 5)
K4	Ø 31.75 mm [1.25 in] straight key
TO	Ø 31.75 mm [1.25 in], 1:8 taper

J2 *Auxiliary mounting flange type and coupling*

N	None (Use with axial ported endcap options 2 and 3 below)
A	SAE-A, 9-tooth output spline
B	SAE-B, 13-tooth output spline
C	SAE-C, 14-tooth output spline
T	SAE-A, 11-tooth output spline
V	SAE-BB, 15-tooth output spline
R	Running cover (Radial ported endcap machined for aux. pad. Pad and coupling sold separately.)

J3 *Endcap option (system port size and location)*

Code	Port location	Port type	Inlet size	Outlet size
2	Radial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]
3	Axial	O-ring boss	1 7/8 in.	1 5/16 in.
4	Axial	4-bolt split flange	50.8 mm [2.0 in]	25.4 mm [1.0 in]

K1 *Shaft seal*

A	Single lip seal, viton

K2 *Mounting flange and housing port style*

2	SAE-C 4-bolt, SAE O-ring boss housing ports
8	SAE-B 2-bolt, SAE O-ring boss housing ports

K3 *Not used*

N	Not applicable

L *Displacement limiter*

NNN	Consult Sauer-Danfoss representative.

M *Special hardware*

NNN	None

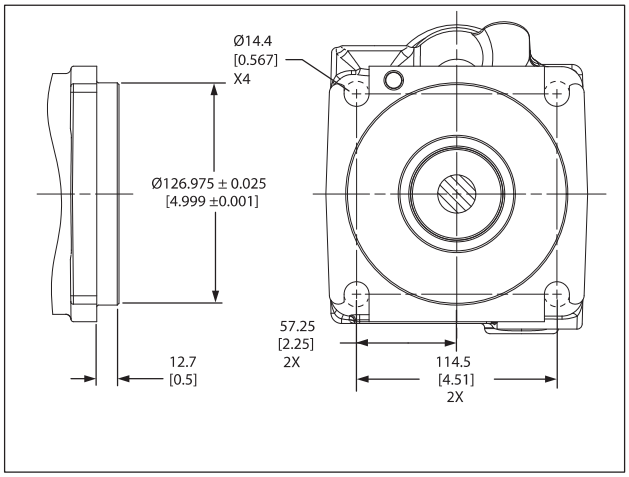
N *Special features*

NNN	None

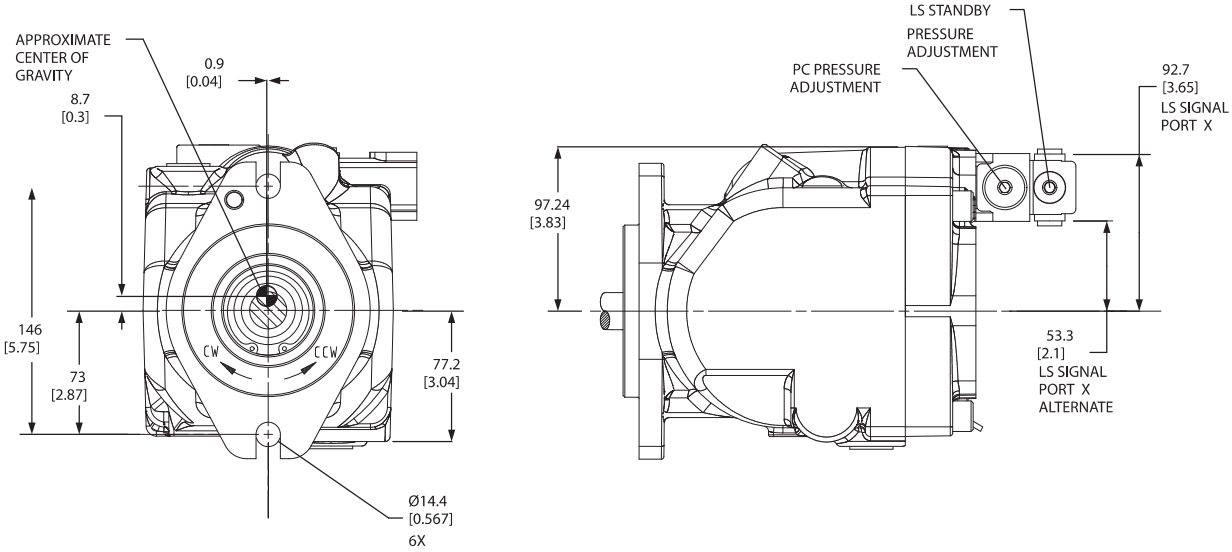
INSTALLATION DRAWINGS (continued)

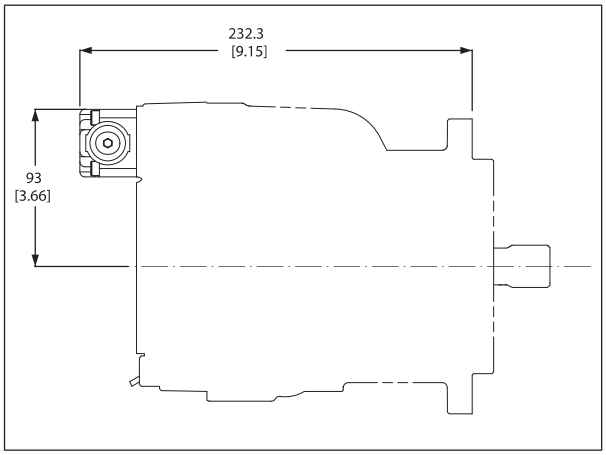
Axial ported endcap (continued)

The drawings on these pages show a pump with two-bolt SAE-B mounting flange. This pump is also available with a four-bolt SAE-C mounting flange. The differences are detailed in the drawing to the right. All other dimensions are common.



SAE-C four-bolt housing





PC only control

P104 234E

Third-angle projection mm [in]

ORDER CODE (continued)

G *Pilot orifice*

N	Standard

H *Gain orifice*

3	Standard

J1 *Input shaft*

S1	14 tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
S2	17 tooth, 12/24 pitch (ANSI B92.1 1970 - Class 5)
K4	Ø 31.75 mm [1.25 in], straight keyed

J2 *Auxiliary mounting flange*

N	None
A	SAE-A, 9-tooth coupling
T	SAE-A, 11-tooth coupling
B	SAE-B, 13-tooth coupling
V	SAE-BB, 15-tooth coupling
C	SAE-C, 14-tooth coupling

J3 *System port size and location*

Code	Location	Port type	Inlet size	Outlet size
2	Radial	4-bolt split-flange	2 in.	1 in.
4	Axial	4-bolt split-flange	2 in.	1 in.

K1 *Shaft seal*

A	Single lip seal, viton

K2 *Mounting flange and housing port style*

1	SAE-C 4-bolt, SAE O-ring boss housing ports

K3 *Not used*

N	Not applicable

L *Displacement limiter*

NNN	None
AAA	Adjustable, factory set at max angle (074B)
CAA	Adjustable, factory set at max angle (090C)

M *Special hardware*

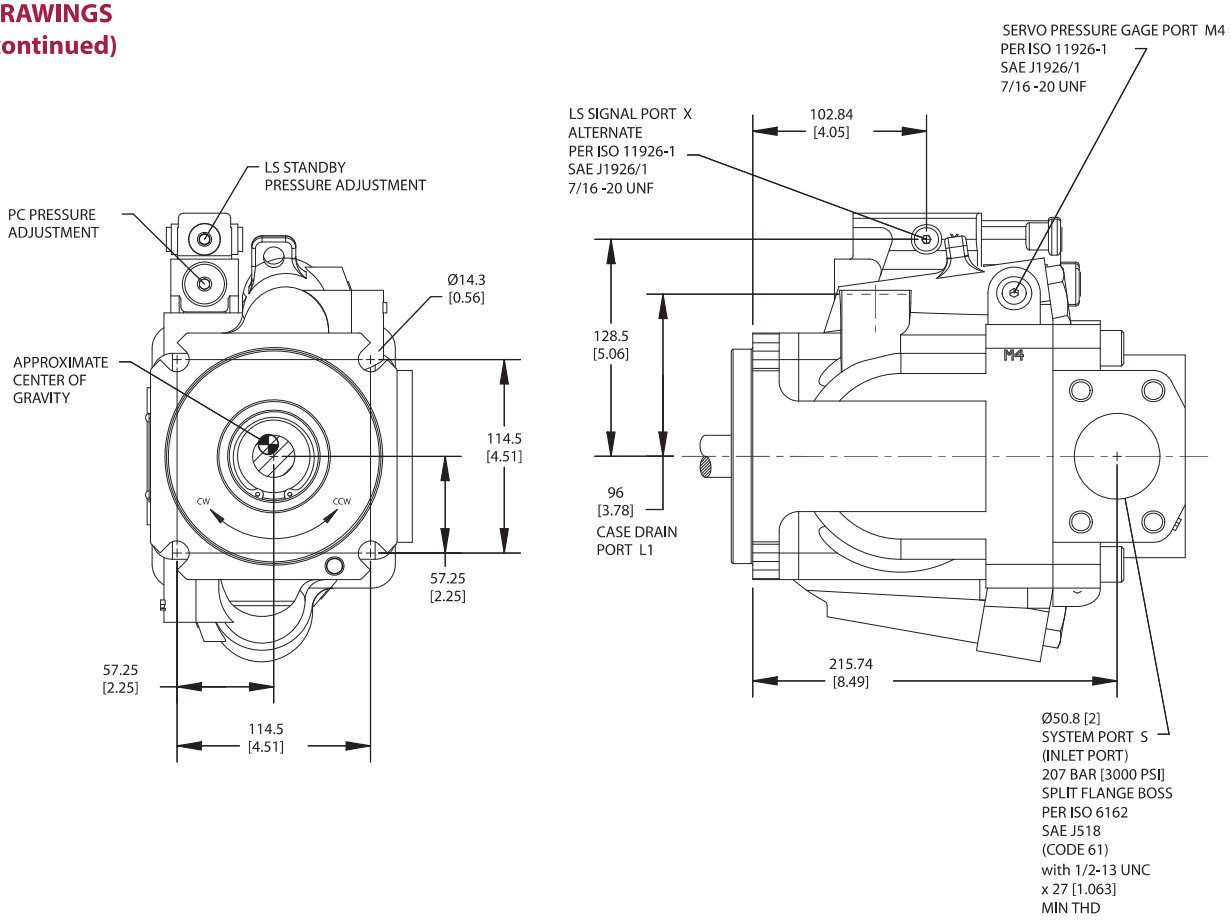
NNN	None

N *Special features*

NNN	None

INSTALLATION DRAWINGS (continued)

Radial ported endcap (continued)

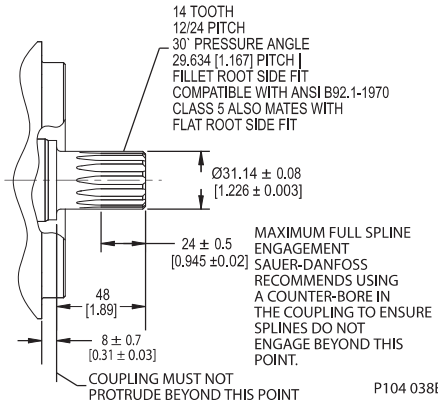
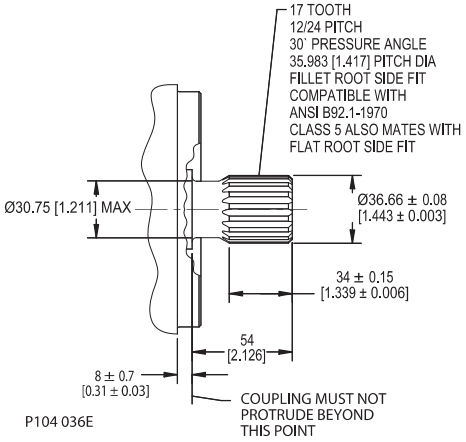
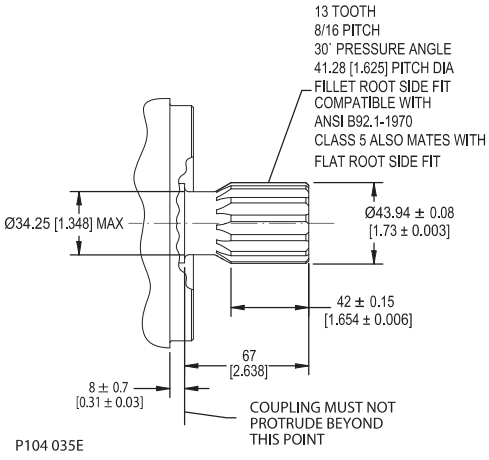


P104 075E

Third-angle projection
mm [in]

INPUT SHAFTS

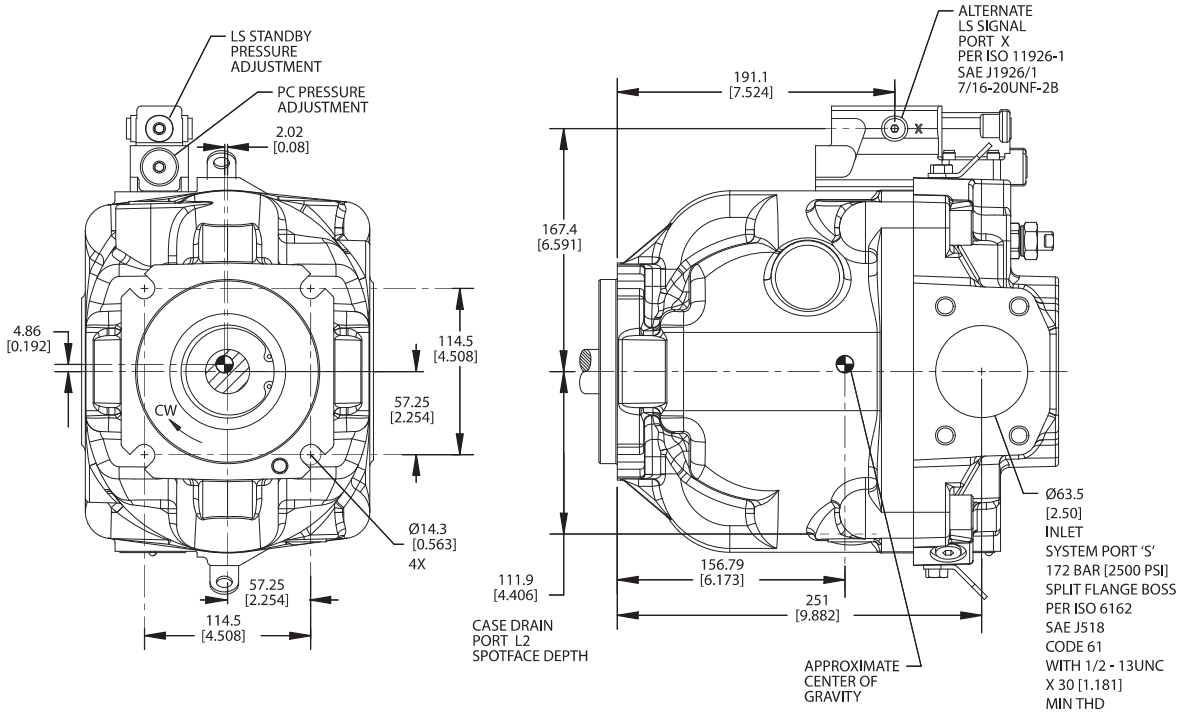
Shaft data

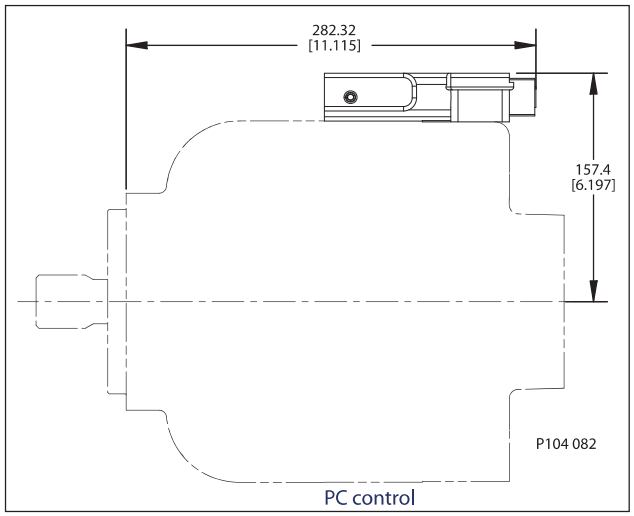
Code	Description	Maximum torque rating[1] N•m [lbf•in]	Drawing
S1	14-tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	1093 [9675]	
S2	17-tooth spline 12/24 pitch (ANSI B92.1 1970 - Class 5)	1044 [9240]	
S4	13-tooth spline 8/16 pitch (ANSI B92.1 1970 - Class 5)	1551 [13 730]	

1. See *Input shaft torque ratings*, page 18 for an explanation of maximum torque.

INSTALLATION DRAWINGS (continued)

Radial ported endcap, clockwise rotation (continued)





Third-angle projection mm [in]

TABLE OF CONTENTS

BATTERY CONNECTIONS

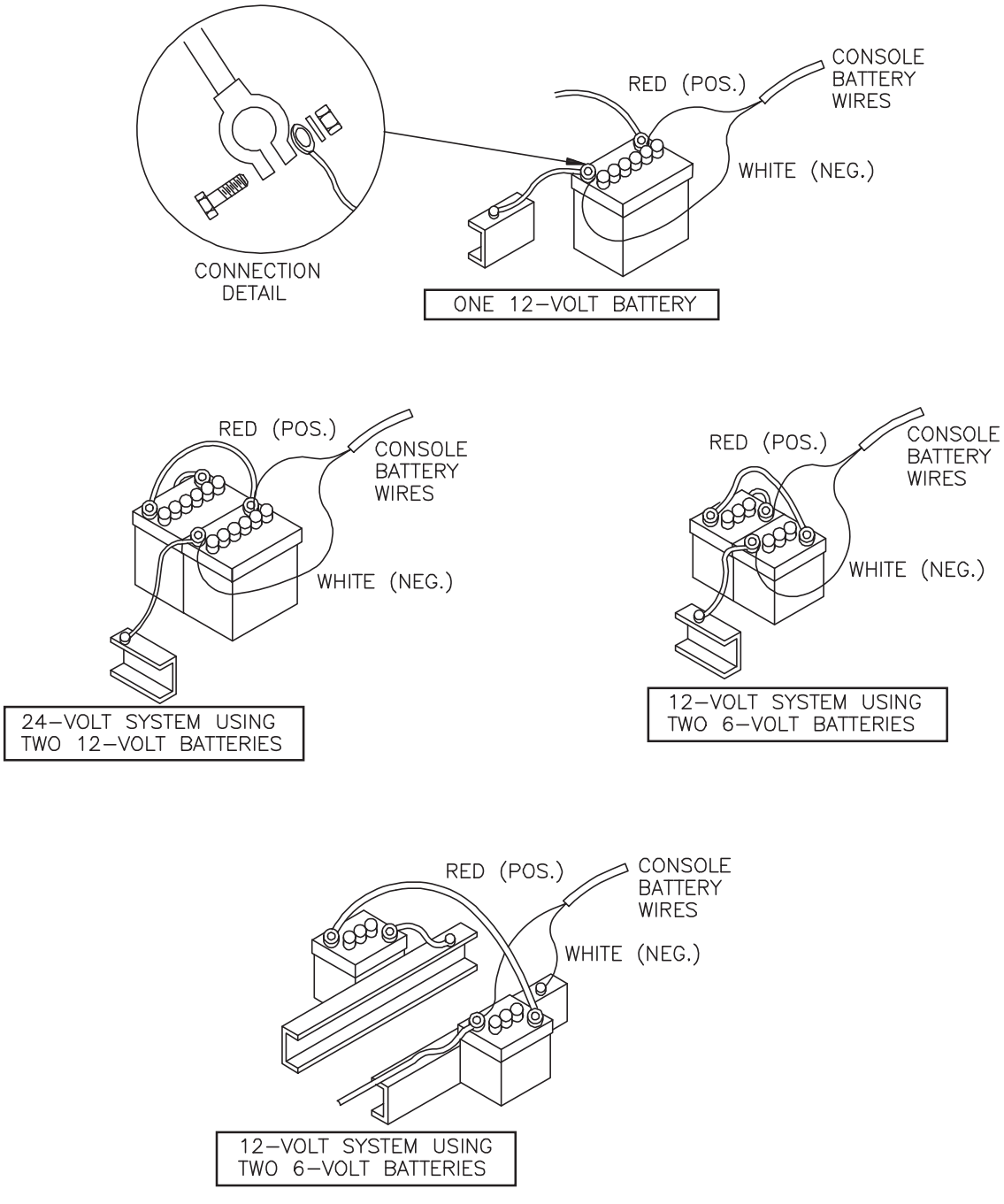


FIGURE 7

3. SELF TEST FEATURE

SELF-TEST allows speed simulation for testing the system while vehicle is not moving. Enter the simulated operating speed in SELF TEST. If 6 MPH [10 km/h] is desired, enter 6.0 [10.0]. Verify speed in lower left corner of display. The SELF-TEST speed will clear itself when motion of vehicle is detected by the Speed Sensor. A SPEED CAL value of 900 [230] or greater is recommended when operating in this mode.

NOTE: To prevent nuisance clearing of self-test speed, disconnect speed connector on Console Cable when Radar Speed Sensors are used.

4. DECIMAL SHIFT

The DECIMAL SHIFT feature is used to increase system accuracy at low application rates. Shifting of the decimal point is done during the entry of METER CAL/PRODUCT DENSITY. After entering METER CAL mode depress ENTER, the decimal shift, DISTANCE, enter the meter calibration constant number, and depress ENTER. The sequence to unshift the decimals while in METER CAL/PRODUCT DENSITY is to enter the meter calibration constant number or product density and depress ENTER. The following tables illustrate how shifting the decimal point can increase system accuracy.

DECIMAL PLACE LOCATIONS IN LIQUID MODE*

	US		*METRIC*		*TURF*	
	UNSHIFT	*SHIFT*	*UNSHIFT*	*SHIFT*	*UNSHIFT*	*SHIFT*
RATE DISPLAY	000.0	00.00	0000	000.0	00.00	00.00
RATE CAL	000.0	00.00	0000	000.0	00.00	00.00
TANK VOLUME	0000	000.0	0000	000.0	000.0	000.0
TOTAL AREA	000.0	000.0	000.0	000.0	0000	0000
TOTAL VOLUME	0000	000.0	0000	000.0	000.0	000.0
FIELD AREA	000.0	000.0	000.0	000.0	0000	0000
FIELD VOLUME	0000	000.0	0000	000.0	000.0	000.0
VOL/MINUTE	0000	000.0	0000	000.0	000.0	000.0
AREA/HOUR	000.0	000.0	000.0	000.0	0000	0000
RATE +/-	000.0	00.00	0000	000.0	00.00	00.00
LOW TANK LEVEL	0000	000.0	0000	000.0	000.0	000.0
LOW VOL/MIN	0000	000.0	0000	000.0	000.0	000.0

*When entering RATE CAL, remember that 2 GPA [20 lit/ha] is entered as 2.0 [20.0] when unshifted and 2.00 [20.00] when shifted.

INITIAL SYSTEM SET-UP (LIQUID APPLICATIONS)

1) Fill tank with water only. (If positive displacement pump is used, open pressure relief valve, PRV).

2) Place MASTER ON/OFF switch to ON and BOOM ON/OFF switches to OFF.

3) Turn console POWER ON.

4) Put console in MANUAL mode using AUTO/MANUAL key.

5) Verify that Boom Widths, SPEED CAL, METER CAL, VALVE CAL, and RATE CALs have been entered correctly into the Console. In SELF TEST mode, enter the normal sprayer operating speed.

6) Run pump at normal operating RPM.

7) If centrifugal pump is used, proceed with Step 8. If positive displacement pump is used, set pressure relief valve (PRV) to 65 PSI [450 kPa].

8) Verify that boom valves operate and that no nozzles are plugged by operating the BOOM ON/OFF switches.

9) Place all BOOM ON/OFF switches to ON.

10) Hold the FLOW CONTROL switch in INC position until pressure is at its maximum. This assures that the motorized Control Valve is fully open. Verify maximum pressure and RATE. (Pressure gauge is not supplied).

NOTE: A pressure gauge MUST be installed to properly monitor the system.

11) Adjust agitator line hand valve for desired agitation. Verify maximum pressure is still present.

12) Hold the FLOW CONTROL switch to DEC position until pressure is at its minimum. This assures that the motorized Control Valve is fully closed. Verify minimum pressure and RATE. If minimum pressure and RATE can not be obtained, consider by-pass plumbing system in Appendix 3.

INITIAL SYSTEM SET-UP (GRANULAR APPLICATIONS)

1) Verify that **NO** product is in bin.

2) Place all BOOM ON/OFF switches to OFF.

3) Turn console POWER ON.

4) Put console in MANUAL mode using AUTO/MANUAL key.

5) Verify correct Boom Widths, SPEED CAL, SPREADER CONSTANT, PRODUCT DENSITY, VALVE CAL, and RATE CAL have been entered in the Console.

6) Enter the normal operating speed into SELF TEST.

7) Place boom ON/OFF switches to ON.

8) Verify that each boom operates by operating boom ON/OFF switches.

9) Hold the INC/DEC switch in INC position for approximately 12 seconds. Note maximum rate displayed in the display.

10) Hold the INC/DEC switch in DEC position for approximately 12 seconds. Note minimum rate displayed in the display.

11) The target application rate must be between the maximum and minimum rate displayed.

INITIAL SYSTEM FIELD TEST (GRANULAR APPLICATIONS)

l) Drive down field or road at target speed with boom ON/OFF switches OFF, to verify SPEED readout on Console.

2) Turn on appropriate boom switches, and place the AUTO/MAN switch to RATE 1. Increase or decrease speed by one MPH [2 km/h]. The system should automatically correct to the target application rate.

3) If for any reason, the system is unable to correct to the desired RATE, check for improper vehicle speed or a defect in the system.

4) If the system does not appear to be correcting properly, first review INITIAL SYSTEM SET-UP, then refer to SERVICE MANUAL and TROUBLESHOOTING GUIDE.

5) At the end of each row, switch the boom ON/OFF switches to OFF to shut off application. This also shuts off the area totalizer.

6) Verify area covered and volume used.

APPENDIX 1
WHEEL DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION PROCEDURE

1. MOUNTING WHEEL DRIVE SPEED SENSOR

The Wheel Drive Speed Sensor consists of four magnets, a switch assembly with cable, and mounting hardware.

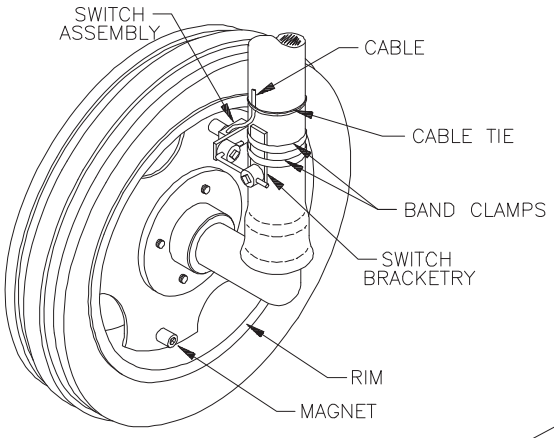
Sequence of mounting Speed Sensor:

I) Select a non-driven wheel (left front tractor wheel or implement wheel).

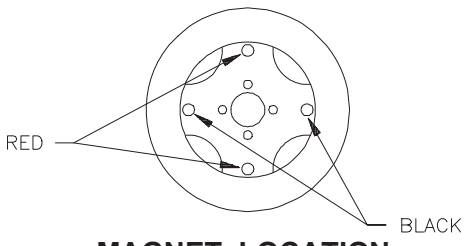
2) Check for predrilled holes in rim. If not predrilled, see "RIM DRILLING INSTRUCTIONS FOR WHEEL DRIVE SPEED SENSOR".

3) Mount the four magnets to the inside of rim and tighten (See Figures below). Magnets must be mounted in alternating red-black order.

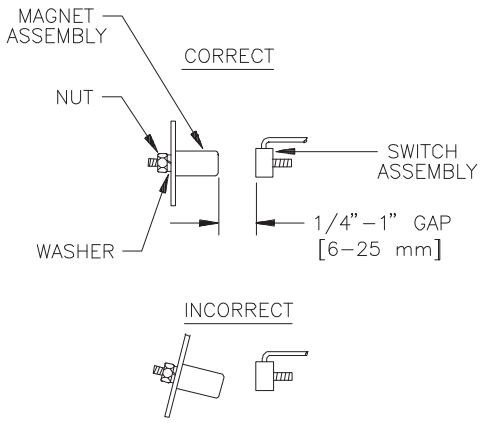
4) Mount switch assembly to stationary column with the hardware provided (See below). The switch assembly need not pivot with the wheel.



SWITCH ASSEMBLY



MAGNET LOCATION



MAGNET ASSEMBLY

5) Position switch assembly so that as the wheel rotates the magnets pass across the center of the black, molded switch assembly.

6) Clearance gap between magnets and switch assembly must be between 1/4 inch [6 mm] and 1 inch [25 mm]. With wheels pointed straight ahead, rotate wheel to ensure gap is correct. Make sure vehicle wheels can be turned to their extremes in each direction without the magnets hitting the switch assembly.

7) Tighten switch assembly bracketry.

8) Secure cable to column with plastic cable ties.

APPENDIX 7
PROCEDURE TO RE-CALIBRATE FLOW METER

1) Enter a METER CAL number of 10 [38] in the key labelled 

.

2) Enter a TOTAL VOLUME of 0 in the key labelled 

.

3) Switch OFF all booms.

4) Remove a boom hose and place it into a calibrated 5 gallon [19 liter] container.

5) Switch ON appropriate boom switch (for the hose that was just placed into the 5 gallon container) and the MASTER switch. Pump exactly 10 gallons [38 liters].

6) Readout in TOTAL VOLUME is the new METER CAL number. This number should be within +/- 3% of the calibration number stamped on the tag of the Flow Meter.

7) Repeat this procedure several times to confirm accuracy. (Always "zero out" the TOTAL VOLUME display *before* retesting).

NOTE:	For greatest precision, set METER CAL to 100 and pump 100 gallons (378 liters) of water.

8) To verify Flow Meter calibration, fill applicator tank with a predetermined amount of measured liquid (i.e. 250 gallons). **DO NOT RELY ON GRADUATION NUMBERS MOLDED INTO APPLICATOR TANK.** Empty the applicator tank under normal operating conditions. If the number displayed under TOTAL VOLUME is different from the predetermined amount of measured liquid by more than +/- 3%, complete the following calculation:

EXAMPLE:

METER CAL = 720 [190]
TOTAL VOLUME = 260 [984]
Predetermined amount of measured liquid = 250 [946]

$$\text{Corrected METER CAL} = \frac{\text{METER CAL} \times \text{TOTAL VOLUME}}{\text{Predetermined amount of measured liquid}}$$

ENGLISH UNITS:

$$= \frac{720 \times 260}{250} = 749$$

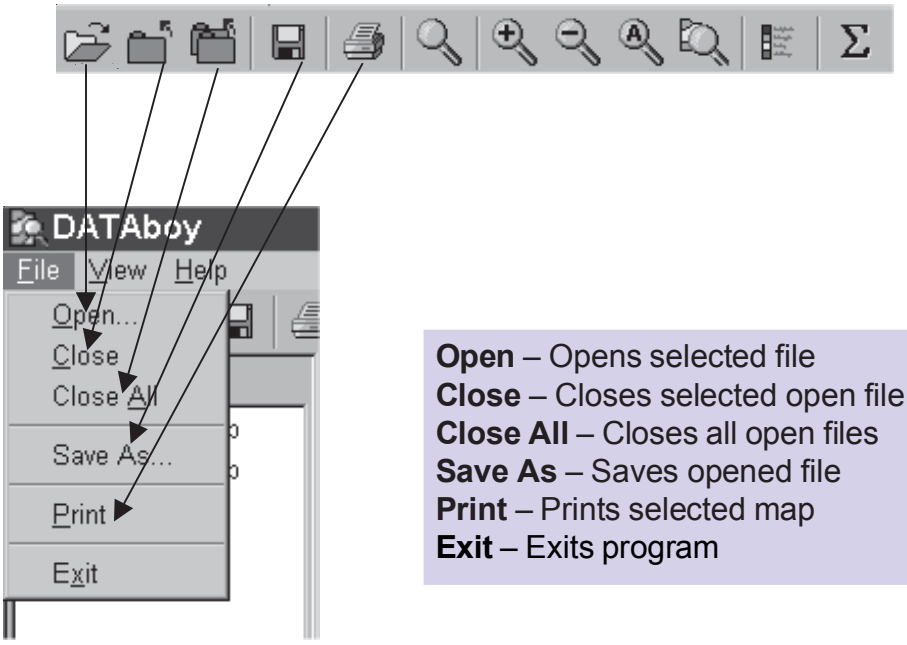
METRIC UNITS:

$$= \frac{[190] \times [984]}{[946]} = [198]$$

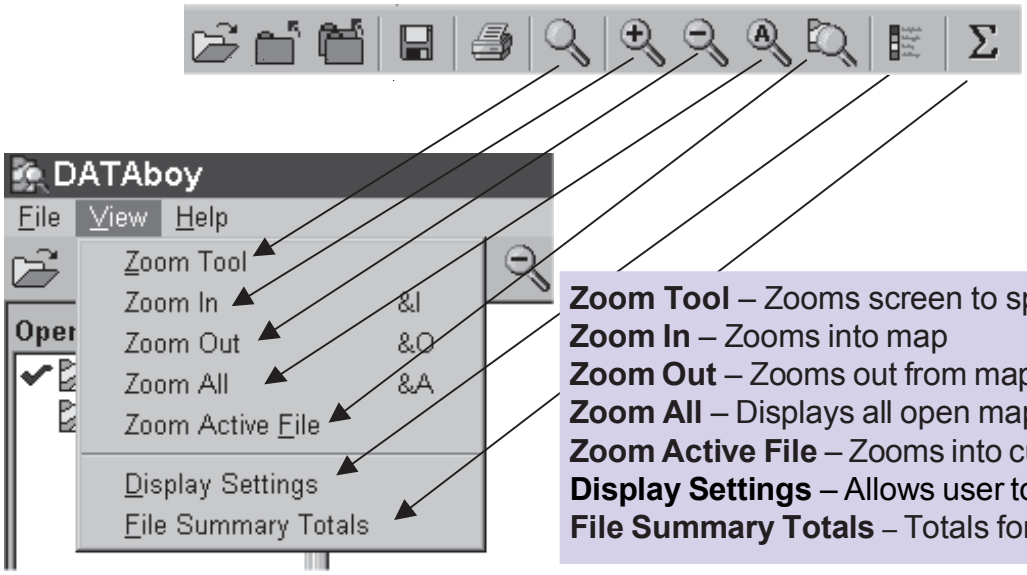
Corrected METER CAL = 749 [198]

9) Enter corrected METER CAL before resuming application.

MENU AND TOOLBAR DESCRIPTIONS



Open – Opens selected file
Close – Closes selected open file
Close All – Closes all open files
Save As – Saves opened file
Print – Prints selected map
Exit – Exits program



Zoom Tool – Zooms screen to specified selection
Zoom In – Zooms into map
Zoom Out – Zooms out from map
Zoom All – Displays all open maps
Zoom Active File – Zooms into currently selected map
Display Settings – Allows user to change current settings
File Summary Totals – Totals for all open files

About – Displays software title and version number

OPERATION

CAUTION

-Do not attempt to operate machine without covers in place.
-Never operate machine while unattended.
-Inspect machine for damage after use.
-Close supervision is necessary when this product is operated near children or invalids.
-Never allow children to operate this machine.
-Wear safety goggles and all proper clothing when operating, servicing or refilling this machine.
-Agricultural chemical mist or liquid can cause permanent eye, skin or lung damage or death.
-Always read and follow manufacturer recommendations when handling any chemical.
-Never operate this product in or near explosive atmospheres or where aerosol products are being used.
-Do not use air compressor to pump anything other than atmospheric air.
-Do not pump combustible liquids or vapors with this product or use in or near an area where flammable or explosive liquids or vapors may exist.
-Do not use this product near flames.
-The foam tank is pressurized with air from the compressor. Do not attempt, for any reason, to remove tank cap while machine is turned on.
-After machine is turned off pressure remains in the system. Remove tank cap slowly to allow pressure to exhaust.

COMPRESSOR CHECK

After checking all wiring for accuracy, turn switch box to the “on” position and check that air is flowing out of the compressor.

FILLING THE TANK

CAUTION

-Do not attempt, for any reason, to remove tank cap assembly while unit is in operation.
-After machine is turned off, pressure may remain in the system.
-Remove tank cap slowly to allow pressure to exhaust.
-Wear safety goggles and all proper clothing when operating, servicing or refilling this machine.
-Always read and follow manufacturers recommendations when handling any chemical.
-Do not pump combustible liquids or vapors with this product.

1. BE SURE POWER UNIT IS TURNED OFF. Remove the cap from the top of the tank.

CAUTION! Remove tank cap slowly, to exhaust any pressure that may be present.

2. Fill tank with 100% foam concentrate. Note: For an increase in foam variablity, the manufacturer suggests mixing the foam concentrate with water at a rate of 50%.

3. Replace cap at the top of the tank.