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.

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I. SAFETY/DECALS

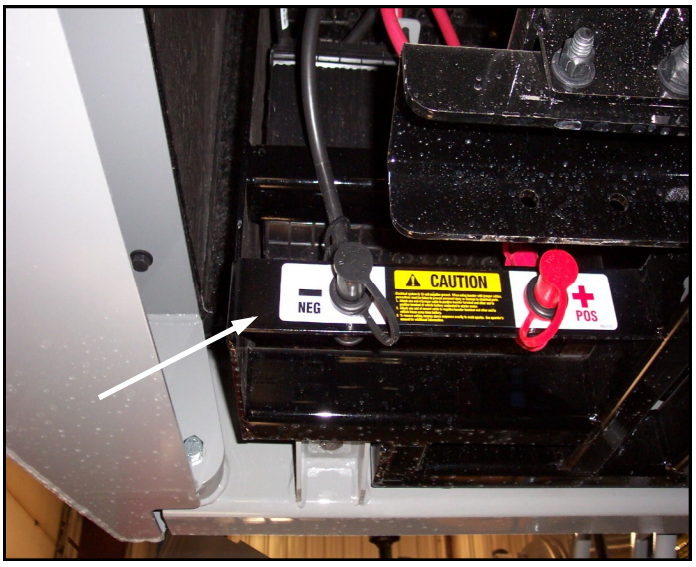
WARNING DECALS

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.

650113

Right side glass in cab.

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 12 Parts Manual.)

Lights

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

CAB AND INSTRUMENTS

Cab

General cab	Tilt steering Windshield wiper/washer Power 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

FIG 4.15

Lift

To raise and lower the transom/boom assembly, depress the “Square Rocker”(UP) or the “Square Rocker” (DOWN) buttons on the hydrostatic drive handle (fig. 4.16 item 1). While depressed, either button activates the transom lift cylinders (fig. 4.15).

FIG 4.16

NOTE:

See your spray tip manufacturer’s guide for information regarding spray tip height (fig. 4.17).

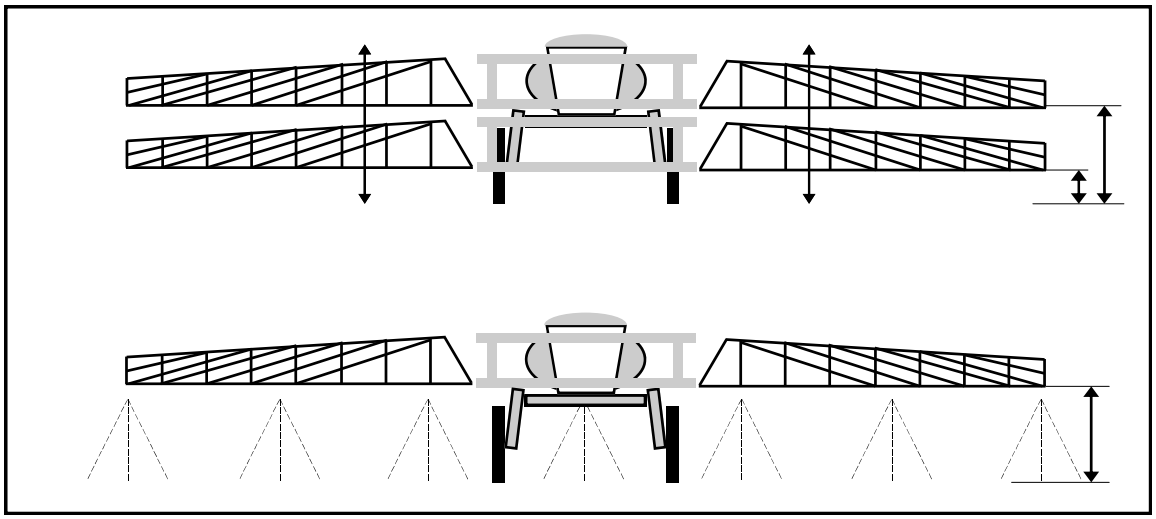


FIG 4.17

IV. OPERATING INFORMATION

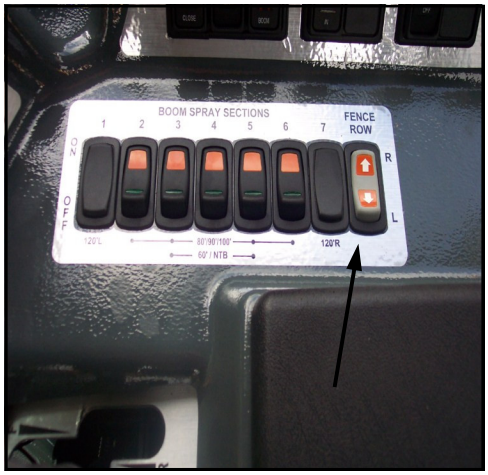


FIG 4.41

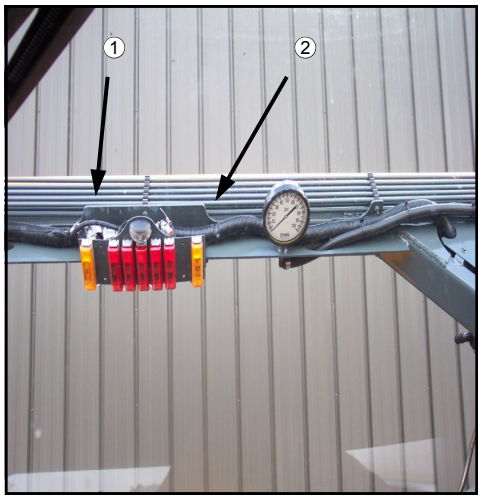


FIG 4.42

Fence Row Applicator

To operate the fence row nozzle, locate the fence row switch on the switch control panel (fig. 4.41). If you wish to turn on the right fence row nozzle, depress the top side of the fence row switch. If you wish to turn on the left fence row nozzle, depress the bottom side of the fence row switch. To turn either fence row nozzle off, return the fence row switch back to the center (“OFF”) position.

As you engage either fence row nozzle you may notice a drop in solution pressure.

A set of amber L.E.D. lights mounted on the transom on either side of the boom solution valve L.E.D. lights will inform the operator of fence row status. If the left fence row nozzle is on, the left amber L.E.D. light is lit (fig. 4.42, item 1). If the right fence row nozzle is on, the right amber L.E.D. light is lit (fig. 4.42, item 2). If neither amber L.E.D. light is lit, no solution is being applied through the fence row nozzles.

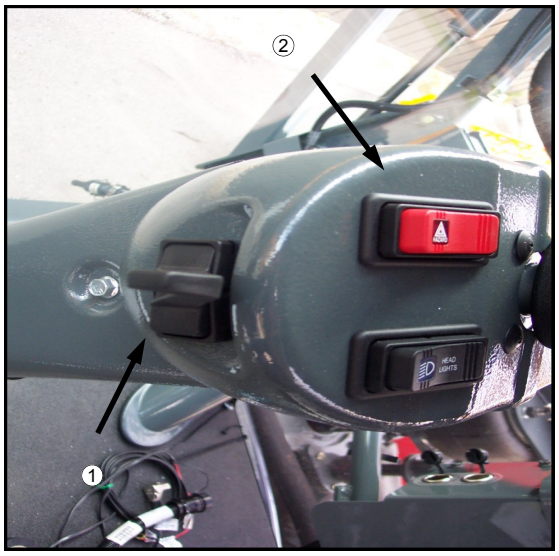


FIG 4.65

FIG 4.66

Turn Signals

To activate the front (fig. 4.66) and rear turning signals (fig. 4.67, item 2), move the turn signal lever (fig. 4.65, item 1) forward to turn right and back to turn left. Steering column-mounted turn signal indicators will correspondingly flash when either side of the turn signals is activated. The turn signal lever is not a self-centering switch; you must return it to the "OFF" position by hand after completing your turn.

Hazard/Warning Lights

To activate the flashing hazard/warning lights (fig. 4.66 & 4.67, item 1), depress the "FLASHER" switch (fig. 4.65, item 2). Activate the hazard/warning lights anytime traveling on a public road, day or night, unless prohibited by law.

Running Lights

Activating the highway (see page 46) will also turn on the "RED" running lights on the rear of the machine (fig. 4.67, item 2).

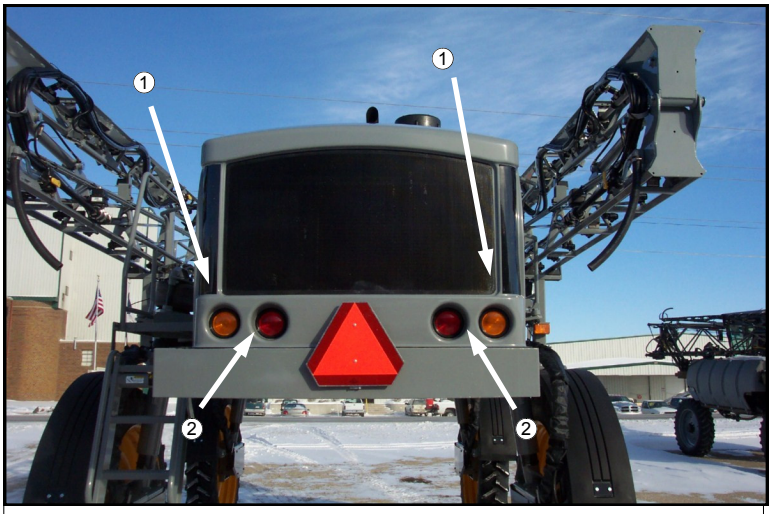


FIG 4.67

VII. SERVICE AND MAINTENANCE

SERVICE INTERVALS

Initial checks after receiving machine

IMMEDIATELY 

then 

1) Check lug nut torque, then every 50 hours (page 74)

FIRST 50 HOURS 

then 

or 

1) Change Torque Hub® oil, then every 500 hours (page 62)
2) Change hydrostatic charge and suction filter, then every 250 hours (page 67)

Daily 

1) Check engine oil (page 61)
2) Drain fuel filter (water separator) (page 69)
3) Check radiator coolant level (page 63)
4) Check engine drive belt (page 73)
5) Check Filter Minder® (page 66)
6) Check hydraulic oil reservoir level (page 61)
7) Check solution line strainer (page 68)
8) Drain wet tank (page 78)
9) Check batteries (page 71)

FILTERS CONTINUED

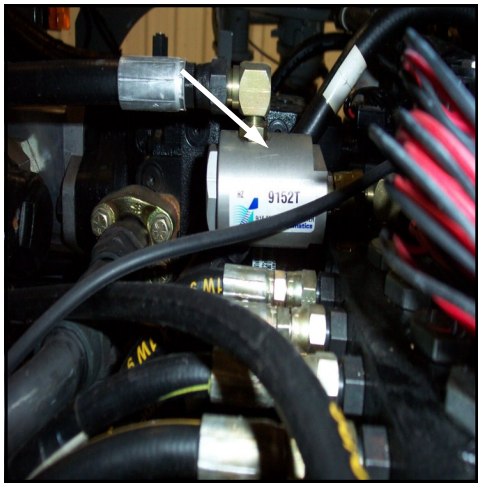


FIG 7.17

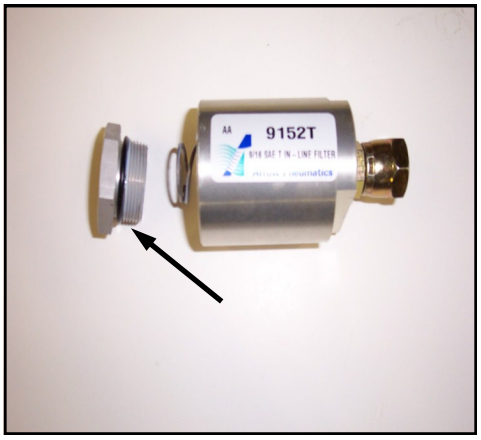


FIG. 7.18

FIG 7.19

High Pressure In-line Filter

The valves on the tread adjust circuit are protected by a 90 Micron in-line sintered bronze filter (fig. 7.17). When the filter element is removed for cleaning, caution should be taken so the gasket is in the proper place when re-installing (fig. 7.18). Also, re-install filter paying attention to direction of flow so the end marked “OUT” is oriented correctly.

Solution Line Strainer

To help maintain consistent application rates, check the solution line strainer (fig. 7.19) daily for blockage. Clean the strainer screen as required. Be sure to wear the appropriate clothing while removing and cleaning the line strainer screen. Confirm the gasket is in place before re-installing the screen.

VII. SERVICE AND MAINTENANCE

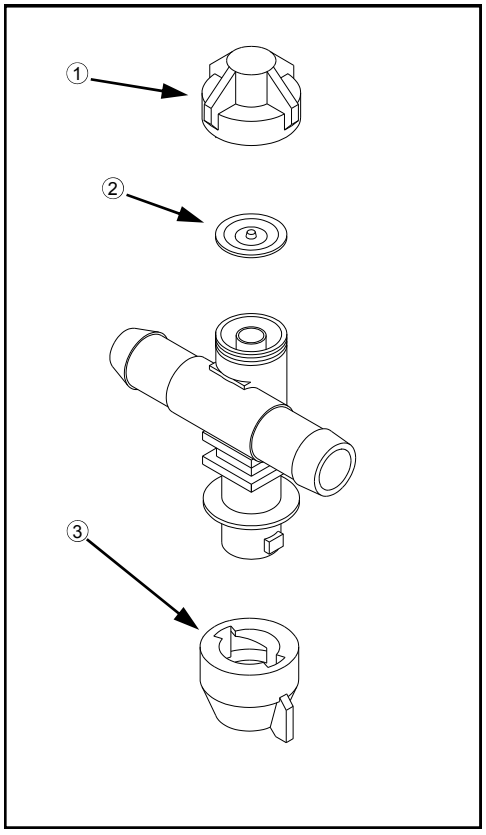


FIG 7.43

FIG 7.44

SPRAY SYSTEM

Spray Tips

At the beginning of each season, or as required, remove a random sample of spray tip caps (fig. 7.43, item 3) and inspect the nozzle tips. If they are plugged or worn, clean or replace them.

Nozzle Diaphragms

At the beginning of each spray season, remove each nozzle body cap (fig. 7.43, item 1) and inspect the diaphragm for wear or fit (fig. 7.43, item 2). Replace if necessary. Refer to accompanying manual containing nozzle information.

Calibration

See pages 53-54 on spray system calibration.

Winter Storage

See page 82 on cold weather storage of spray system.

FOAM MARKER SYSTEM

Wet Tank

To prevent system condensation from contaminating the engine air compressor, remove moisture from the wet tanks daily by pulling on its drain cord (fig. 7.44).

Winter Storage

See page 82 on storage of foamer system.

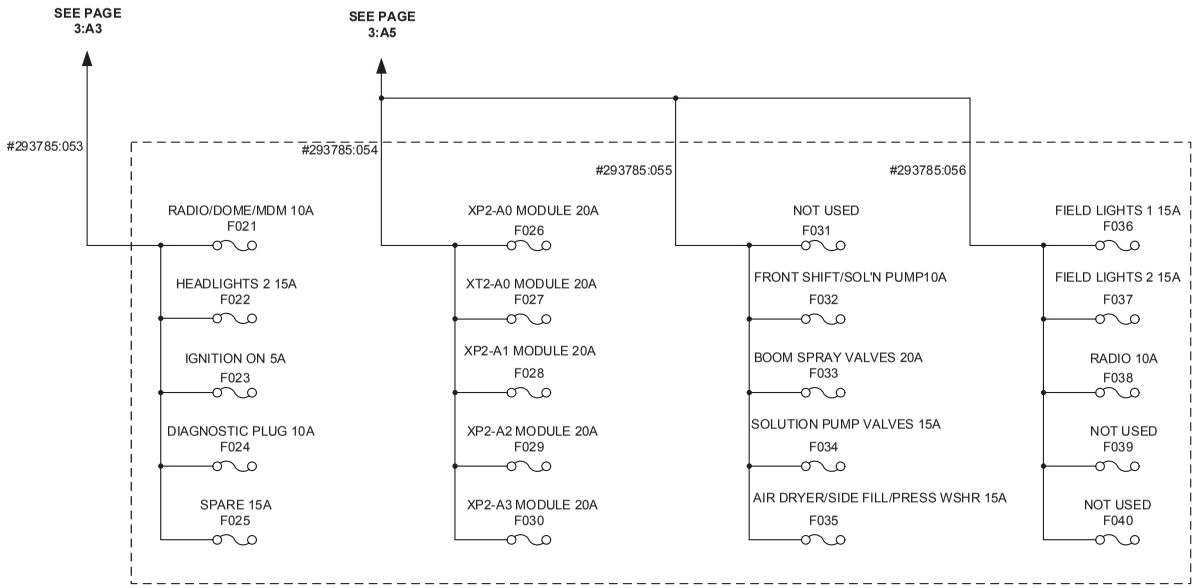
IX. TROUBLE SHOOTING

HYDROSTATIC SYSTEM CONTINUED

PROBLEM	POSSIBLE CAUSE	SUGGESTED REMEDY
Hydrostatic system responding slowly	Engine speed too low	Set engine at operating RPM before trying to move machine
	Oil level in reservoir low	Fill reservoir to proper level with approved oil; see section on Service and Maintenance
	Cold oil	Allow for adequate warm-up period
	Plugged filter	Check and replace filter
	Partially restricted suction line	Inspect for collapsed suction hose
	Internal damage	Replace hydrostatic pump or motor
Noisy hydrostatic system	Cold oil	Allow for adequate warm-up period
	Low engine speed	Increase engine speed
	Oil level in reservoir low	Fill reservoir to proper level with approved oil; see section on Service and Maintenance
	Air in system	Inspect and tighten all fittings on suction line
	Internal damage to pump	Replace pump
External oil leaks	Loose or faulty fittings	Tighten or replace
	Damaged O-ring	Inspect; if damaged replace
	Faulty hose	Replace hose

Table 7-6. Fault Codes for QSB and QSC (Continued)

Fault Code/ Lamp	SID(S) PID(S) FMI	SPN(S) FMI	Reason	Effect (Only when fault code is Active)	Application
241 Yellow	P084 2	084 2	Vehicle speed signal on pin Nos. 8 and 18 of the OEM harness has been lost.	Engine speed limited to "Max. Engine Speed without VSS". Cruise control, gear-down protection and the road speed governor will not work. Trip information data that is based on mileage will be incorrect.	ISB, QSB, ISC, QSC, ISL, QS9
242 Yellow	P084 10	084 10	Invalid or inappropriate vehicle speed signal indicated on pins No. 8 and 18 of the OEM harness indicating an intermittent connection or possible tampering.	Engine speed limited to "Max. Engine Speed without VSS". Cruise control, gear-down protection and the road speed governor will not work. Trip information data that is based on mileage will be incorrect.	ISB, QSB, ISC, QSC, ISL, QS9
243	P121 4	513 4	Error detected in exhaust brake relay enable circuit at pin 42 of the engine harness.	Exhaust brake will not work.	ISB, QSB, ISC, QSC, ISL, QS9
245	S033 4	647 4	Error detected in fan clutch relay enable circuit at pin 31 (ISB,QSB) and pin 41 (ISC,QSC) of the engine harness.	Electronic control module (ECM) cannot control the engine cooling fan. Fan will remain on or off.	ISB, QSB, ISC, QSC, ISL, QS9
261* Yellow	P174 0	174 0	VP44 Fuel Pump Control Module indicates the fuel temperature has exceeded the pump protection limit.	Power derate.	ISB, QSB
263	P174 3	174 3	High voltage detected at fuel temperature signal pin No. 35 of the engine harness.	Default value used for fuel temperature. Possible low power.	ISC, QSC, ISL, QS9
264 Yellow	P174 2	174 2	High or low voltage detected at the fuel temperature sensor signal circuit inside the VP44 pump controller.	Default value used for fuel temperature. Possible low power.	ISB, QSB
265	P174 4	174 4	Low voltage detected at fuel temperature signal pin No. 35 of the engine harness.	Default value used for fuel temperature. Possible low power.	ISC, QSC, ISL, QS9
268* Yellow	P094 2	94 2	Fuel pressure in the accumulator is not changing with engine operating conditions.	Power derate. Engine may run rough.	ISC, QSC, ISL, QS9
271 Yellow	S151 5	1347 5	Low or no current detected on front pumping control valve return pin No. 21. (Set only during control valve click test)	Low power. Poor performance	ISC, QSC, ISL, QS9
272 Yellow	S151 6	1347 6	High current detected on front pumping control valve return pin No. 21.	Low power. Poor performance. Possible damage to the ECM.	ISC, QSC, ISL, QS9
273 Yellow	S152 5	1348 5	Low or no current detected on rear pumping control valve return pin No. 15. (Set only during control valve click test)	Low power. Poor performance.	ISC, QSC, ISL, QS9
274 Yellow	S152 6	1348 6	High current detected on rear pumping control valve return pin No. 15.	Low power. Poor performance. Possible damage to the ECM.	ISC, QSC, ISL, QS9



CAB FUSE MODULE 2

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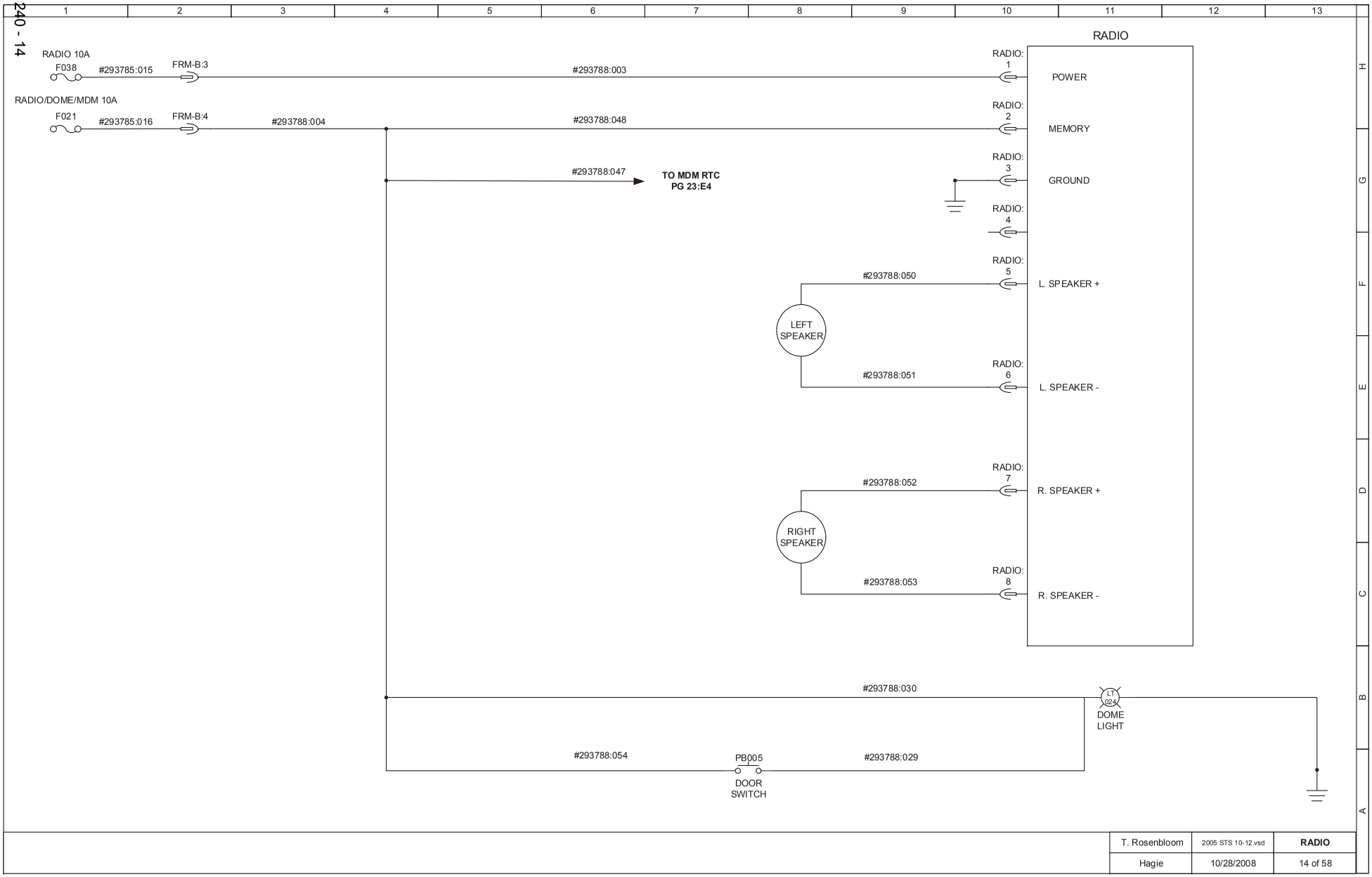
Hagie	10/28/2008	4 of 58



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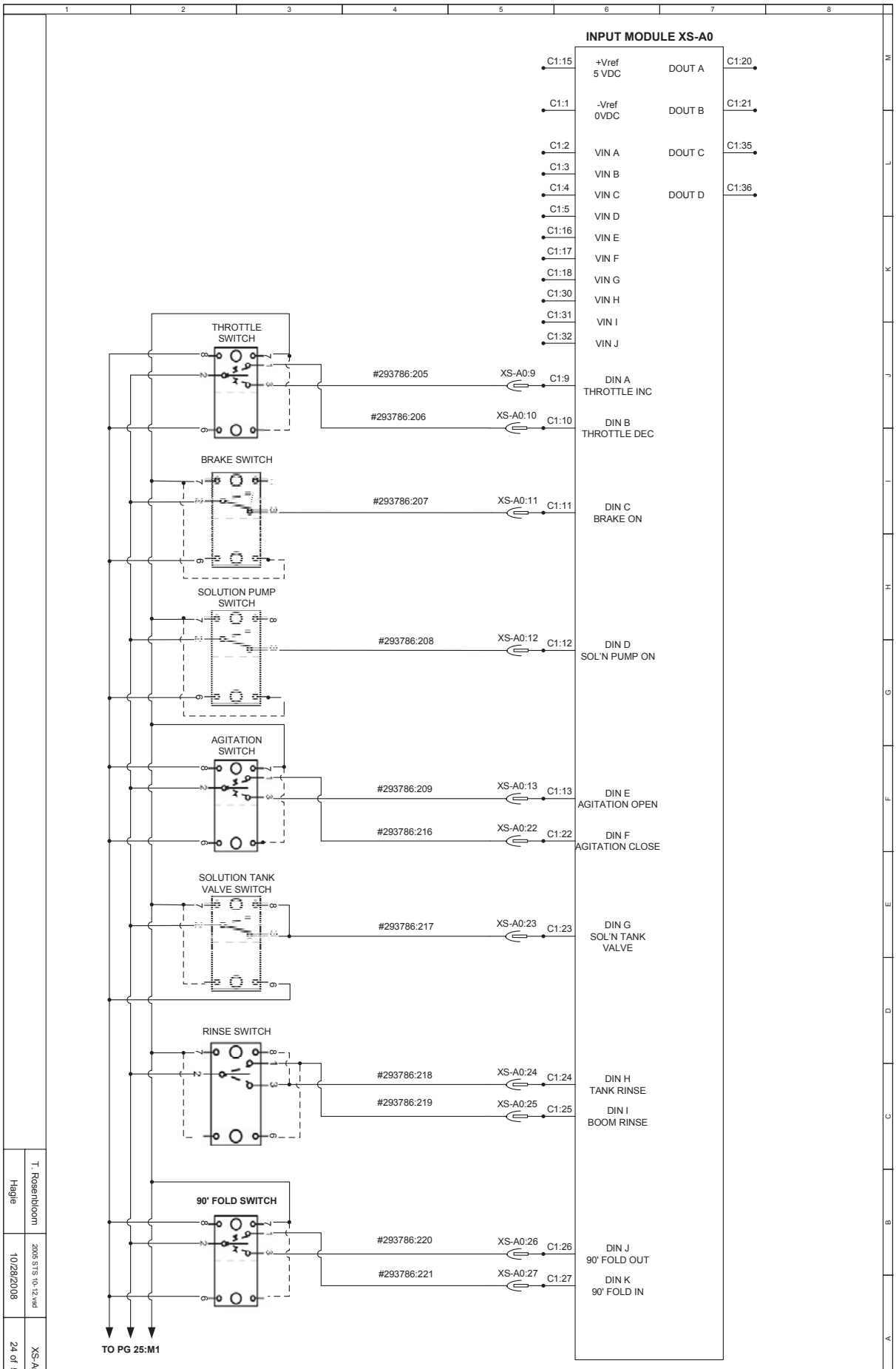
Hagie	10/28/2008	14 of 58



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10/28/2008	2005 STS 10-12.vsd
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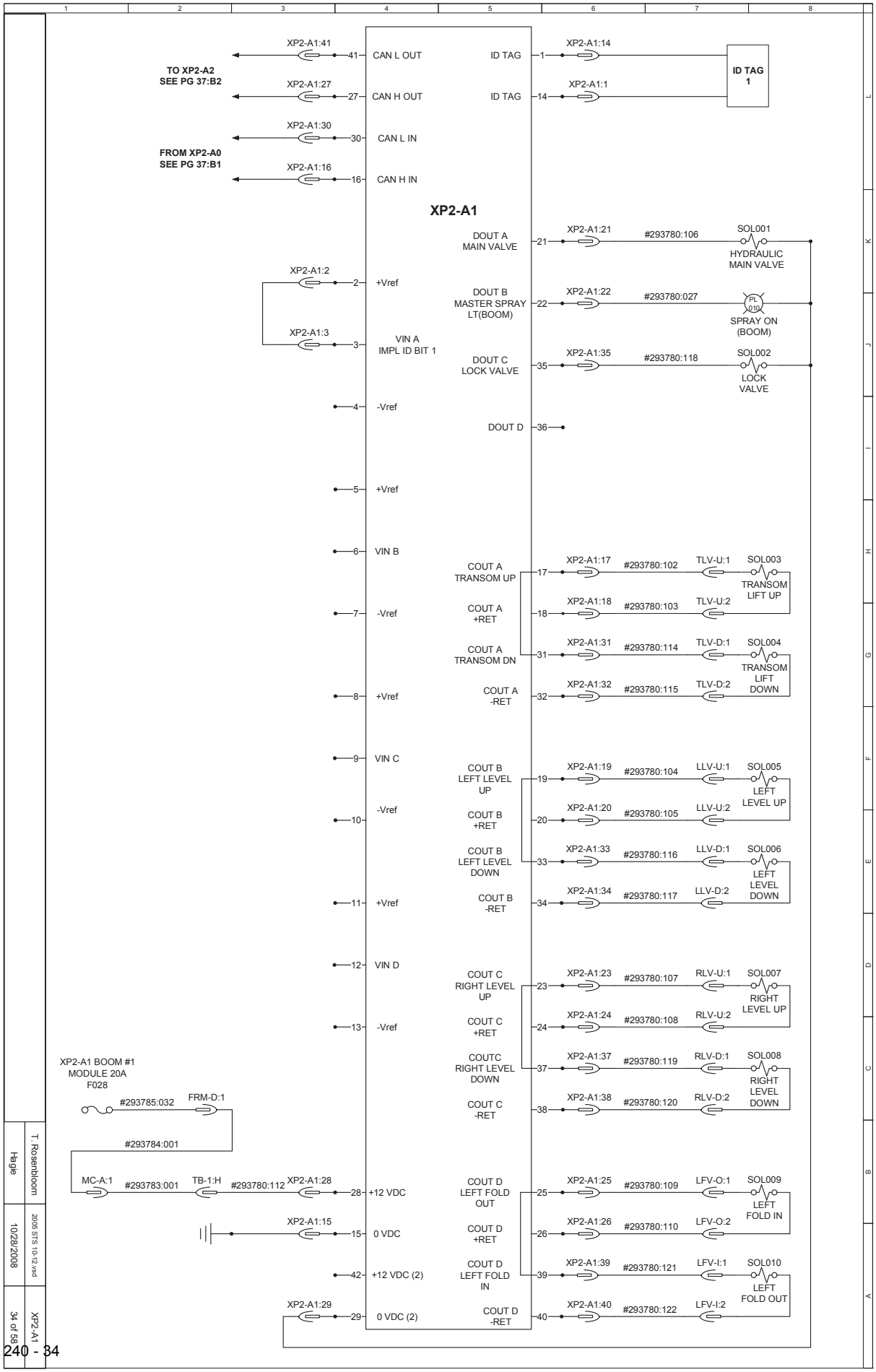
XP2-A1
XP2-A1:41
41
CAN L OUT
TO XP2-A2
SEE PG 37:B2
XP2-A1:27
27
CAN H OUT
XP2-A1:30
30
CAN L IN
FROM XP2-A0
SEE PG 37:B1
XP2-A1:16
16
CAN H IN
ID TAG
1
XP2-A1:14
ID TAG 1
14
XP2-A1:1
XP2-A1:2
2
+Vref
XP2-A1:3
3
VIN A
IMPL ID BIT 1
4
-Vref
5
+Vref
6
VIN B
7
-Vref
8
+Vref
9
VIN C
10
-Vref
11
+Vref
12
VIN D
13
-Vref
28
+12 VDC
XP2-A1:15
15
0 VDC
42
+12 VDC (2)
XP2-A1:29
29
0 VDC (2)
DOUT A
MAIN VALVE
21
XP2-A1:21
#293780:106
SOL001
HYDRAULIC
MAIN VALVE
DOUT B
MASTER SPRAY
LT(BOOM)
22
XP2-A1:22
#293780:027
PL
010
SPRAY ON
(BOOM)
DOUT C
LOCK VALVE
35
XP2-A1:35
#293780:118
SOL002
LOCK
VALVE
DOUT D
36
COUT A
TRANSOM UP
17
XP2-A1:17
#293780:102
TLV-U:1
SOL003
TRANSOM
LIFT UP
COUT A
+RET
18
XP2-A1:18
#293780:103
TLV-U:2
COUT A
TRANSOM DN
31
XP2-A1:31
#293780:114
TLV-D:1
SOL004
TRANSOM
LIFT
DOWN
COUT A
-RET
32
XP2-A1:32
#293780:115
TLV-D:2
COUT B
LEFT LEVEL
UP
19
XP2-A1:19
#293780:104
LLV-U:1
SOL005
LEFT
LEVEL UP
COUT B
+RET
20
XP2-A1:20
#293780:105
LLV-U:2
COUT B
LEFT LEVEL
DOWN
33
XP2-A1:33
#293780:116
LLV-D:1
SOL006
LEFT
LEVEL
DOWN
COUT B
-RET
34
XP2-A1:34
#293780:117
LLV-D:2
COUT C
RIGHT LEVEL
UP
23
XP2-A1:23
#293780:107
RLV-U:1
SOL007
RIGHT
LEVEL UP
COUT C
+RET
24
XP2-A1:24
#293780:108
RLV-U:2
COUTC
RIGHT LEVEL
DOWN
37
XP2-A1:37
#293780:119
RLV-D:1
SOL008
RIGHT
LEVEL
DOWN
COUT C
-RET
38
XP2-A1:38
#293780:120
RLV-D:2
COUT D
LEFT FOLD
OUT
25
XP2-A1:25
#293780:109
LFV-O:1
SOL009
LEFT
FOLD IN
COUT D
+RET
26
XP2-A1:26
#293780:110
LFV-O:2
COUT D
LEFT FOLD
IN
39
XP2-A1:39
#293780:121
LFV-I:1
SOL010
LEFT
FOLD OUT
COUT D
-RET
40
XP2-A1:40
#293780:122
LFV-I:2
XP2-A1 BOOM #1
MODULE 20A
F028
#293785:032
FRM-D:1
#293784:001
MC-A:1
#293783:001
TB-1:H
#293780:112
XP2-A1:28
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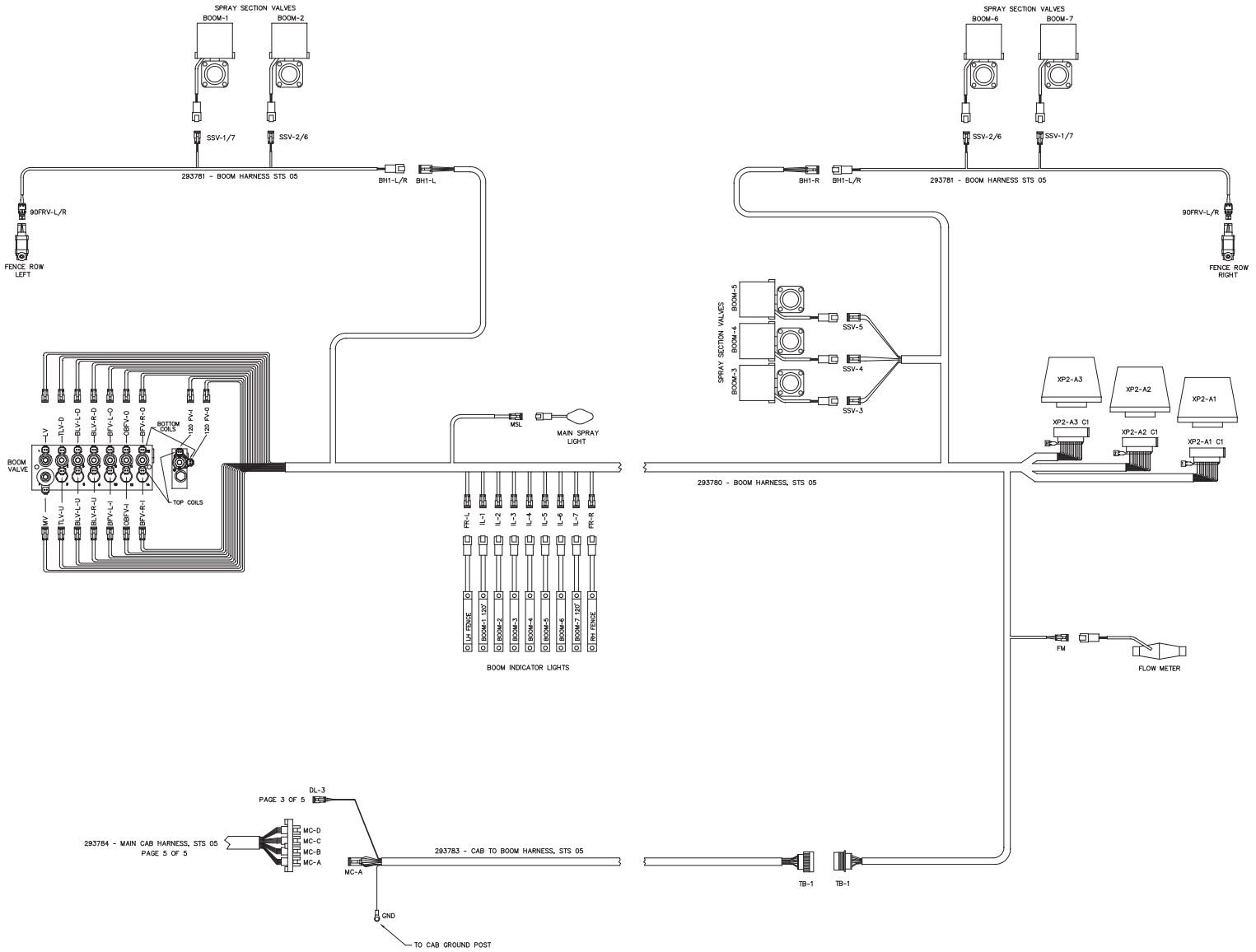
XP2-A1

Reference	Description	Master	Location
F028	XP2-A1 MODULE 20A	FUSE	P4.D5
F028	XP2-A1 BOOM #1 MODULE 20A	FUSE	P34.C1
F029	XP2-A2 MODULE 20A	FUSE	P4.D5
F029	XP2-A2 BOOM #2 MODULE 20A	FUSE	P35.C1
F030	XP2-A3 MODULE 20A	FUSE	P4.C5
F030	XP2-A3 BOOM #3 MODULE 20A	FUSE	P36.C1
F031	NOT USED	FUSE	P4.E7
F032	FRONT SHIFT/SOL'N PUMP10A	FUSE	P4.E7
F032	FRONT SHIFT/SOL'N PUMP 10A	FUSE	P30.L3
F032	FRONT SHIFT/SOL'N PUMP 10A	FUSE	P20.H2
F033	BOOM SPRAY VALVES 20A	FUSE	P4.D7
F033	BOOM SPRAY VALVES 20A	FUSE	P22.G1
F034	SOLUTION PUMP VALVES 15A	FUSE	P4.D7
F034	SOL'N PUMP VALVES 15A	FUSE	P30.F3
F035	AIR DRYER/SIDE FILL/PRESS WSHR 15A	FUSE	P4.C7
F035	AIR DRYER/SIDE FILL/PRESS. WSHR 15A	FUSE	P15.H1
F036	FIELD LIGHTS 1 15A	FUSE	P4.E9
F036	FIELD LIGHTS 1 15A	FUSE	P10.D1
F037	FIELD LIGHTS 2 15A	FUSE	P4.E9
F037	FIELD LIGHTS 2 15A	FUSE	P10.B1
F038	RADIO 10A	FUSE	P4.D9
F038	RADIO 10A	FUSE	P14.H1
F039	NOT USED	FUSE	P4.D9
F040	NOT USED	FUSE	P4.C9
F041	HEADLIGHTS 1 15A	FUSE	P9.H1
F041	HEADLIGHTS 1 15A	FUSE	P3.H3
F042	WORK LIGHTS 1 15A	FUSE	P3.H3
F042	WORK LIGHTS 1 15A	FUSE	P10.H1
F043	WORK LIGHTS 2 15A	FUSE	P3.G3
F043	WORK LIGHTS 2 15A	FUSE	P10.F1
F044	TURN/FLASHER MODULE 15A	FUSE	P3.G3
F044	TURN/FLASHER MODULE 15A	FUSE	P11.C1
F045	CUMMINS ECM PWR 10A	FUSE	P6.F1
F045	CUMMINS ECM PWR 10A	FUSE	P2.E4
F046	CUMMINS ECM PWR 10A	FUSE	P6.E1
F046	CUMMINS ECM PWR 10A	FUSE	P2.E4
F047	SPARE	FUSE	P2.D4
F048	SPARE	FUSE	P2.D4
F049	START/INTAKE HTR RELAY PWR 20 A	FUSE	P5.C1
F049	START/ENG HTR RELAY PWR 20A	FUSE	P2.C4
F050	CUMMINS ECM PWR 7.5A	FUSE	P6.G1
F050	CUMMINS ECM PWR 7.5A	FUSE	P2.C4
F051	CUMMINS ECM PWR 7.5A	FUSE	P6.G1
F051	CUMMINS ECM PWR 7.5A	FUSE	P2.B4
F052	CUMMINS ECM PWR 7.5A	FUSE	P6.F1
F052	CUMMINS ECM PWR 7.5A	FUSE	P2.B4
F053	INTAKE HEATER 1 125A	FUSE	P7.C1
F053	INTAKE HEATER 1 125A	FUSE	P2.F4
F054	INTAKE HEATER 2 125A	FUSE	P7.B1
F054	INTAKE HEATER 2 125A	FUSE	P2.F4
D001	1N5408	Diode	P32.H7
	PUMP VALVE MOTOR	DC Motor	P20.H11
	STARTER MOTOR	DC Motor	P2.G4
	SEAT AIR PUMP	DC Motor	P16.D10
	MOTOR	DC Motor	P12.H11
	MOTOR	DC Motor	P12.E11
EDP-A		CONNECTOR PIN	P38.H8
EDP-B		CONNECTOR PIN	P38.H9
EDP-C		CONNECTOR PIN	P38.H9
EDP-D		CONNECTOR PIN	P38.H9
EDP-E		CONNECTOR PIN	P38.H9
EDP-F		CONNECTOR PIN	P38.H9
EDP-G		CONNECTOR PIN	P38.H10
EDP-H		CONNECTOR PIN	P38.H10
EDP-I		CONNECTOR PIN	P38.H10
120FV-I:1		CONNECTOR	P35.C7
120FV-I:2		CONNECTOR	P35.C7
120FV-O:1		CONNECTOR	P35.D7
120FV-O:2		CONNECTOR	P35.D7
5VDC:1		CONNECTOR	P31.K3
5VDC:11		CONNECTOR	P31.K2
5VDC:12		CONNECTOR	P31.K2
5VDC:2		CONNECTOR	P31.K2
5VDC:3		CONNECTOR	P31.L2
5VDC:4		CONNECTOR	P31.K3
5VDC:5		CONNECTOR	P31.K2
90FV-I:1		CONNECTOR	P35.E7
90FV-I:2		CONNECTOR	P35.E7
90FV-O:1		CONNECTOR	P35.F7
90FV-O:2		CONNECTOR	P35.F7
AD:A		CONNECTOR	P15.H10
AD:B		CONNECTOR	P15.H12
AV:1		CONNECTOR	P27.L7
AV:2		CONNECTOR	P27.K6
AV:3		CONNECTOR	P27.L6
AV:4		CONNECTOR	P27.K6
BFV-R-I:1		CONNECTOR	P35.G7
BFV-R-I:2		CONNECTOR	P35.G7
BFV-R-O:1		CONNECTOR	P35.H7
BFV-R-O:2		CONNECTOR	P35.H7



07-15-04 TLM

STS 12 WIRING DIAGRAM 05

SHEET 1 OF 5
REVISION DATE: 09-26-05

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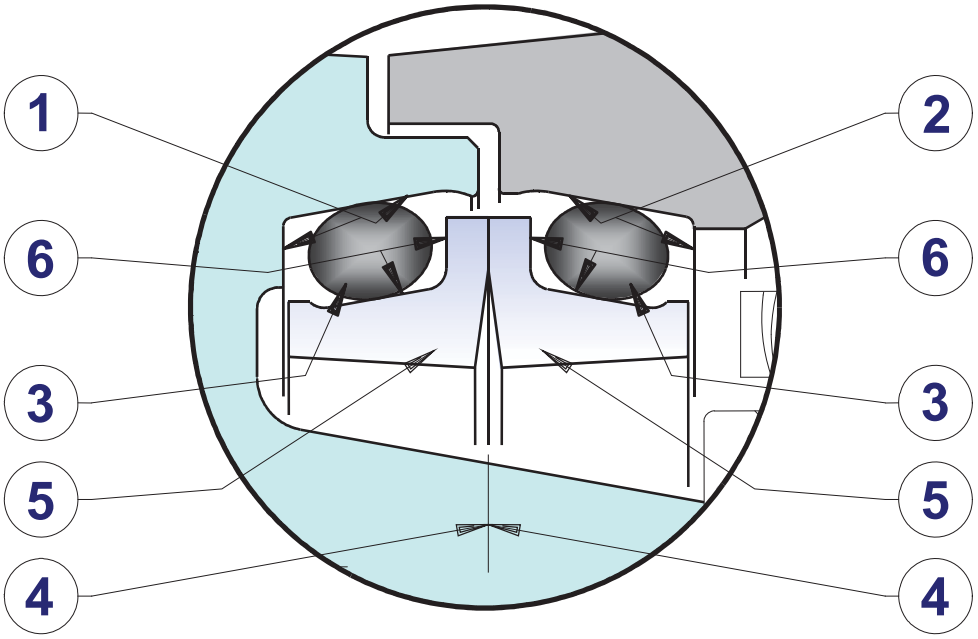
9.2 Rimontaggio riduttore — *9.2 Gearbox Reassembly*



Particolare di tenuta frontale - Lifetime seal detail

Preparazione della tenuta frontale

Per ottenere una perfetta tenuta, e' necessario procedere al montaggio degli anelli nel seguente modo:

1. Effettuare una accurata pulizia degli alloggiamenti "1" e "2" facendo uso, se necessario, di spazzole metalliche o solventi (le superfici a contatto con gli anelli di gomma "3" devono essere perfettamente pulite ed asciutte).
2. Assicurarsi che le superfici di tenuta "4" degli anelli "5" siano esenti da qualsiasi rigatura, ammaccatura o corpi estranei e che le superfici "6" degli stessi anelli siano perfettamente pulite ed asciutte.
3. Togliere dalle superfici lappate "4" degli anelli "5" ogni traccia di polvere o impronte digitali e umettarle poi con un leggero strato di olio, avendo cura di non ungere le rimanenti parti.

Makeready of the lifetime seal

Instructions to properly assemble the lifetime seal:

1. *Carefully clean the seats "1" and "2" using, if necessary, metal brushes or solvent (surfaces in contact with or "3" must be perfectly clean and dry).*
2. *Make sure that sealing surfaces "4" of metal rings "5" are free from scratches, dinges or foreign substances; metal ring surfaces must be perfectly clean and dry.*
3. *Carefully clean the lapped surface "4" of metal rings "5" and remove dust or fingerprints. Then lubrificate them with a thin oil film, taking care not to oil the other components.*

3.

Montare una semitenuta frontale (18) sull' attrezzo **(ATZ.04.005.0)**.

*Assemble an half seal (18) on the tool **(ATZ.04.005.0)**.*

ORDERING INFORMATION *(continued)*

EDCs ordered separate from the pump must have mounting kits ordered separately:

30/55 cc PUMP KIT (KIT NUMBER KK11655)
Comprised of one K07652 gasket and six 9007314-0611 bolts

75/100/130 cc PUMP KIT (KIT NUMBER KK11675)
Comprised of one K07653 gasket and six 9007314-0611 bolts

42 cc PUMP KIT (KIT NUMBER KK11642)
Comprised of one K07652 gasket, six 9007314-0611 bolts and one K09123 washer

180/250 cc PUMP KIT (KIT NUMBER KK11618)
Comprised of one K07653 gasket, six 9007314-0611 bolts and one K09123 washer

TECHNICAL DATA

ELECTRICAL

FULL STROKE CURRENT
A (Configuration) 18 ± 1.5 mA (single coil)
S (Configuration) 18 ± 2.0 mA (single coil)
B & E (Configuration) 85 ± 11.3 mA (dual coil)
42 ± 5.6 mA (series coils)
85 ± 11.3 mA (parallel coils)
See Electrical Characteristics for complete range of currents

THRESHOLD CURRENT
A (Configuration) 5 ± 1.0 mA
S (Configuration) 6 ± 1.5 mA
B & E (Configuration) 14 ± 3.0 mA

NOMINAL INPUT IMPEDANCE
A (Configuration) 650 ohms for A/B coil
B & E (Configuration) 20.0 ohms for A/B coil
16.0 ohms for C/D coil
S (Configuration) 110 ohms for A/B coil

NOTE: The EDC is designed to be controlled from a dc current source or voltage source. Pulse width modulation (PWM) is not required. But, if a PMW signal is used use a carrie frequency ≥ 200 Hz. Do not use a pulse current of more than 120% of that required for full output.

HYDRAULIC

FILTRATION
The system hydraulics must have 10 micron or better filtration. The pump will contain screen filters near the interface to the EDC at the charge port and control port locations. The pilot will have a screen filter at its input port and internal output control ports screen.

FLUID
Automatic transmission fluid or hydraulic oil, such as Mobil DTE 24 or equivalent. Fluid cleanliness is ISO 4406 code 18/15 or better.

OIL VISCOSITY
40-6000 SSU

OIL TEMPERATURE
-40° C (-40° F) minimum; 104° C (220° F) maximum

OPERATING SUPPLY PRESSURE
Typically 300-400 psi above case pressure

RATINGS

SCALE FACTOR
A (Configuration) 6.2 psid/mA (single coil)
B & E (Configuration) 1.15 psi/mA (single coil)
2.3 psi/mA (coils in series)
1.15 psi/mA (coils in parallel)
S (Configuration) 5.5 psid/mA (single coil)

TEMPERATURE
The valve will meet all specifications over the range of 21° to 82° C (70° to 180° F)

MOUNTING

WARNING

Exercise care when placing the valve on a surface before mounting on a transmission. Dropping or otherwise forcefully setting the valve down may damage the pin.

Before mounting the KVEB, remove the manual control or the blanking plate that comes with the pump. First thoroughly clean all external surfaces of the pump with steam or solvent. Then remove the six hex head cap screws from the housing using a 5 mm internal hex wrench. Lift the manual control or plate from the pump.

Before the new control is installed it is recommended that a new mounting gasket be installed. If going from a manual control to an EDC the same mounting bolts can be used. If going from a blanking plate to an EDC new mounting bolts are required because of the different lengths. To help avoid a mounting problem it may be necessary to order an EDC mounting kit. See Ordering Information.

WARNING

The KVEB EDC cannot be hydraulically connected with another device through the servo ports (X1 and X2). Do not disconnect the SAE servo port fittings for this purpose. Doing so may cause the EDC to go on stroke. The fittings are to be used only for troubleshooting purposes. When hydraulic connections are required, such as for a staging function, the MCV114S must be used. Also an orifice (Sauer-Danfoss orifice fitting part number 9002875-0039) must be located in each of the hydraulic connections. See Ames Bulletin No. 9104 for details.

TO INSTALL THE NEW CONTROL

1. Place a new gasket on the pump housing. If a charge pressure control orifice is used ensure that the orifice and spring are in the proper position in the control.

2. While setting the control into position, engage the pin on the control linkage into the mating hole in the link attached to the pump swashplate.

3. With the control in position against the pump housing, pin engagement can be check by one of two methods:
   a. Move control assembly left and right from center position, slight resistance will be noted if properly engaged.
   b. Place a finger under the control connector and lift away form pump housing.

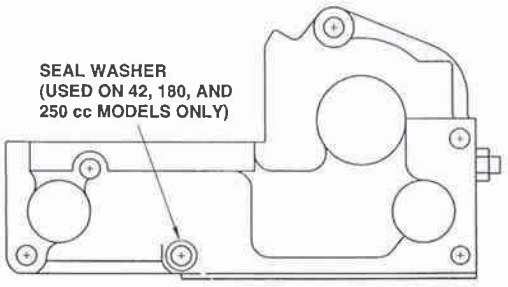
   If control tilts away more than approximately 1/4 to 3/8 of an inch,, the pin is not engaged.

4. Repeat steps 2 and 3 in case of non engagement.

WARNING

Ensure positive pin engagement. Failure to do so may result in pump output, and the vehicle may move.

5. After control pin is engaged align the gasket and install the cap screws (on 42 cc and 180/250 cc pumps use the included seal washer per the Seal Washer Location drawing) and torque to 16 Nm 10-12 ft•lbs.



1396

Location of Seal Washer on 42, 180, and 250 cc Pump EDCs.

Contents

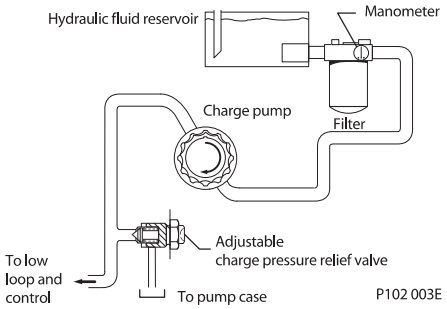
FILTRATION OPTIONS

Series 90 pumps may have either suction or charge pressure filtration to filter the fluid entering the circuit.

Suction filtration – option S

The suction filter is in the circuit between the reservoir and the inlet to the charge pump, as shown below. The use of a filter contamination monitor is recommended.

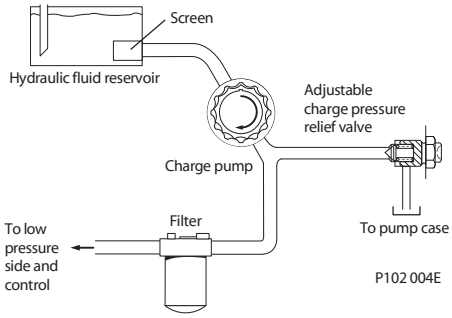
Suction filtration



Charge pressure filtration – option R, T, P, and L

The pressure filter can be mounted on the pump or remotely for ease of servicing. You will typically find a 100-125 µm mesh screen, in the reservoir or the charge inlet. This system requires a filter capable of withstanding charge pressure (reference to atmosphere - add case pressure).

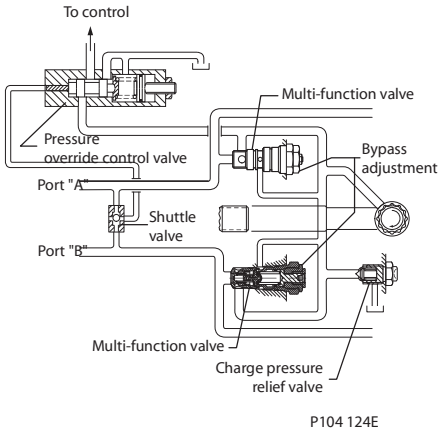
Charge pressure filtration



PRESSURE OVERRIDE (POR) – 180 FRAME SIZE ONLY

The Pressure OverRide valve (POR) modulates control pressure to maintain a pump displacement which produces a system pressure level less than or equal to the POR setting. For unusually rapid load application, the high pressure relief valve function of the multi-function valves is available to also limit the pressure level.

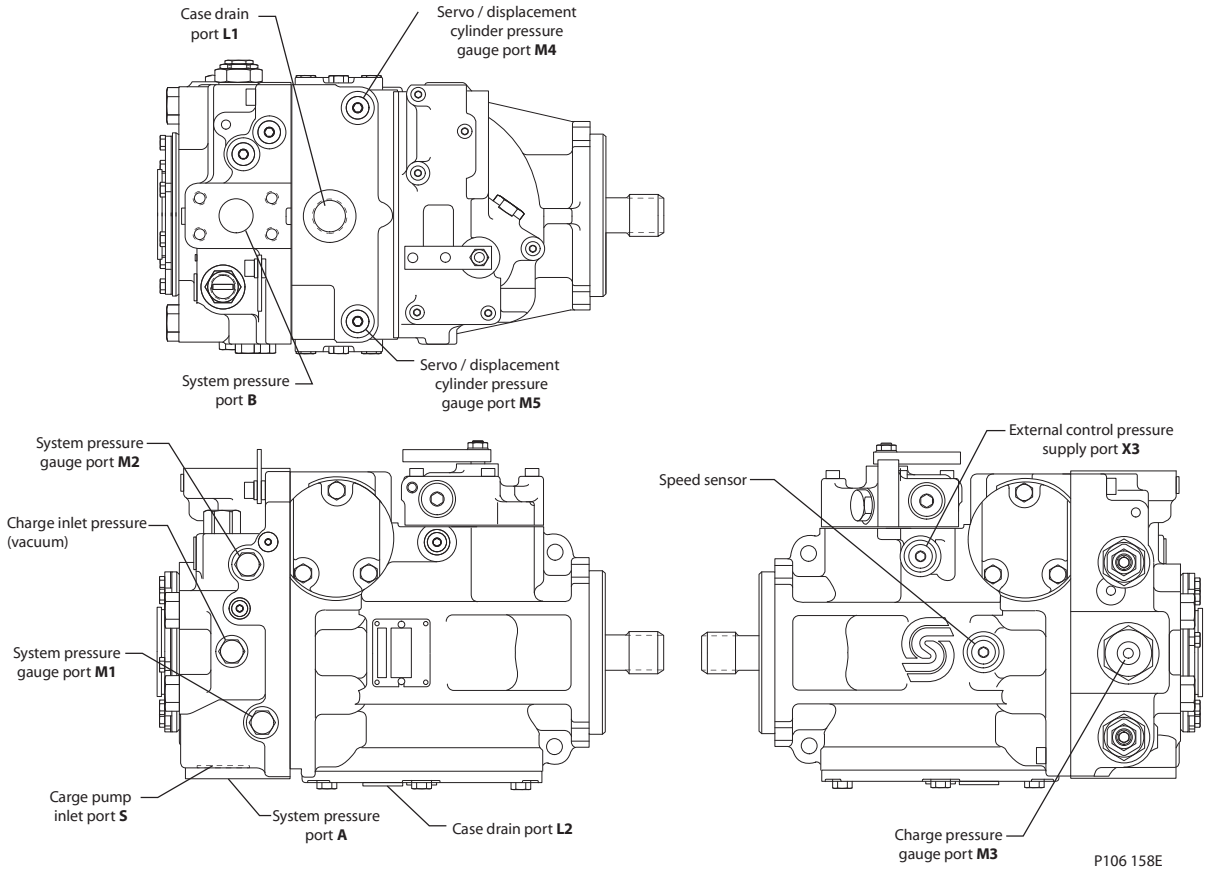
POR-Valve (180 frame size only)



The pressure override consists of a three-way normally open valve which operates in series with the pump displacement control. Control supply pressure normally ports through the POR valve to the displacement control valve. If the system demands a pressure above the override setting, the POR valve overrides the control by reducing the pressure to the displacement control. As the control pressure reduces, the internal forces rotating the swashplate overcome the force of the servo pistons and decreases the pump's displacement.

PORT LOCATIONS AND GAUGE INSTALLATION (continued)

Pump with side port end cap and manual displacement control



MULTI-FUNCTION VALVE PRESSURE ADJUSTMENT (continued)

5. The model code shows the factory preset pressure limiter setting. It is referenced to charge pressure, so the pressure limiter setting is the difference between the high and low pressure sides of the system loop. Activate or move the control input so that pressure increases in the high pressure side of the closed circuit to the pressure limiter pressure setting. The pressure limiter setting is reached when the pressure stops increasing and remains steady at a given pressure level (as shown on the gauges).

6. Return the pump to its neutral (zero flow) position and adjust the pressure limiter setting by rotating the pressure adjusting screw with an internal hex wrench.

   Clockwise rotation of the pressure adjustment screw increases the pressure setting, and counterclockwise rotation decreases the pressure setting. Each complete rotation of the pressure adjusting screw changes the pressure as shown in the following table.

Pressure limiter adjustment data

Frame size	Lock nut wrench size and torque	Adjusting screw size	Approximate pressure change per revolution of adjusting screw
early 042-100	10 mm 3 N•m [26 lbf•in]	3 mm	80 bar [1157 psi]
030-100	19 mm 20 N•m [15 lbf•ft]	5 mm	90 bar [1300 psi]
early 130	13 mm 20 N•m [15 lbf•ft]	4 mm	80 bar [1157 psi]
130-250	24 mm 40 N•m [30 lbf•ft]	8 mm	80 bar [1157 psi]

7. To verify the actual pressure setting, actuate or move the control input so that the pump again develops pressure in the high pressure circuit to the newly adjusted pressure limiter pressure setting: then read the high pressure gauge. Allow the pump to return to its neutral position. The pressure in the high pressure circuit should return to the charge pressure setting.

8. While holding the pressure adjusting screw stationary, tighten the pressure adjusting screw lock nut. Torque as shown in the table.

Do not overtorque.

9. Shut down the prime mover, remove the gauges and install the gauge port plugs. Replace the plastic dust plugs (if used).

Use the same procedure for setting the pressure limit of the other multi-function valve. Move or activate the control input signal in the opposite direction so that high pressure develops in the opposite side of the closed circuit.

CHECKING SWITCH CONTINUITY

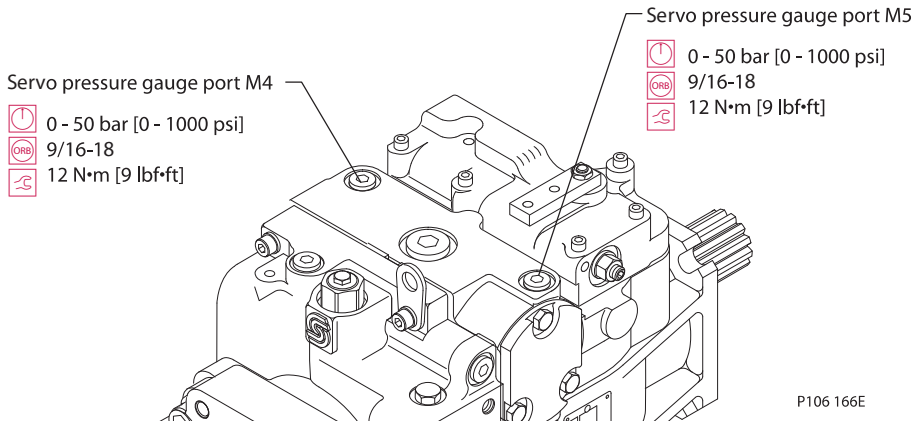
⚠ Warning

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

Recheck switch continuity to determine whether additional adjustment of the eccentric plug is necessary. ⚠

1. Install a 50 bar [1000 psi] gauge in each of the two servo cylinder gauge ports (M4 and M5). Attach a continuity checker to the terminals of the neutral start switch.

Checking switch continuity



2. Energize the starter circuit, and start the prime mover.

3. While operating at normal speed and with the pump in its neutral (zero flow) position, note the pressure reading on the gauges. Note this reading as the base pressure.

4. Slowly move the control handle in one direction while observing the pressure gauges and the continuity checker. The switch must open before the pressure on either gauge increases more than 1 bar [14.5 psi] from the base pressure obtained at neutral.

5. Slowly move the control handle in the opposite direction. Again, The switch must open before the gauge pressure increases more than 1 bar [14.5 psi] from base pressure.

6. Verify continuity again when the control is returned to neutral.

7. If the switch does not open at base pressure plus 0 to 1 bar [0 to 14.5 psi] in either direction, stop the prime mover and readjust the eccentric plug as described in the previous section. If the pressure difference is equal in each direction but greater than 1 bar [14.5 psi], loosen the switch lock nut and turn the switch clockwise 1/12 turn (30°) to increase the sensitivity. Retighten the lock nut and recheck pressure differences and continuity.

8. After verifying proper control and switch operation, stop the prime mover. Remove the continuity checker and pressure gauges. Reinstall the servo pressure port plugs and reconnect the electrical leads from the machine starter circuit to the NSS. Install and adjust, the external control linkage if necessary.

CLICK HERE TO DOWNLOAD THE COMPLETE MANUAL

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CHARGE PRESSURE RELIEF VALVE

The charge pressure relief valve is shim adjustable (early models) or screw adjustable (late models). Screw adjustable charge relief valve is shown.

Removal

1. Remove the shim adjustable charge relief valve plug with a 1 inch hex wrench.

   Before removing the screw adjustable relief valve plug, mark the plug (K90), lock nut (K10), and housing to approximately maintain the original adjustment when assembling. Remove the screw adjustable charge relief valve plug by loosening the lock nut with a hex wrench corresponding to the table.

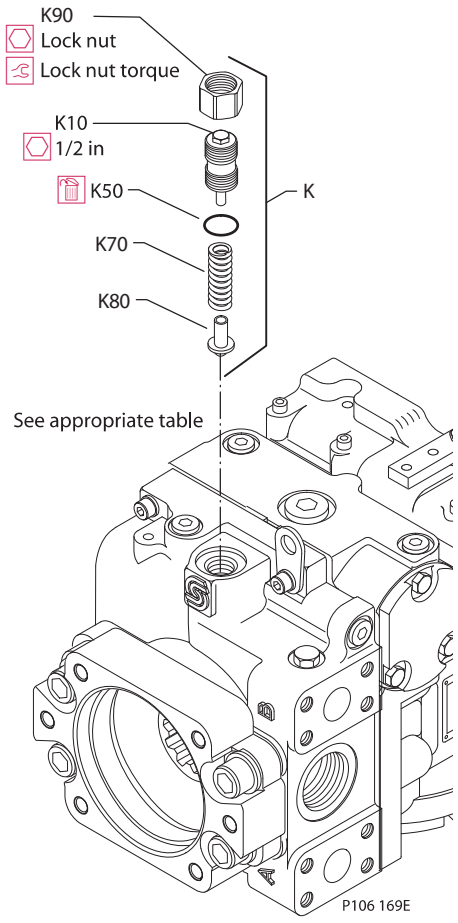
   Unscrew the plug using a large screwdriver or 1/2 inch hex wrench. Remove and discard the O-ring (K50).

2. Remove the spring (K70) and relief valve poppet (K80).

Lock nut wrench size

Frame size	Wrench size
030 – 100	1-1/16 inch
130 – 250	1-5/8 inch

Charge pressure relief valve



Inspection

3. Inspect the poppet (K80) and mating seat in the endcap for damage or foreign material.

   When inspecting shim adjustable valves, do not alter the shims or interchange parts.

Reassembly

4. Install the poppet (K80) and spring (K70). For shim adjustable valves, install the shims and plug, torque to 68 N•m [50 lbf•ft]. For screw adjustable valves, install the plug with its lock nut, aligning the marks made at disassembly, and torque the lock nut to 52 N•m [38 lbf•ft].

   Check the charge pressure and adjust, if necessary. Refer to *Charge pressure adjustments* (page 31).

SOLENOID OVERRIDE VALVE FOR MDC WITH PRESSURE RELEASED BRAKE

Removal

1. Thoroughly clean external surfaces prior to removal of valve.

2. Using a 4 mm internal hex wrench, remove the four solenoid valve mounting screws (M92). Remove the solenoid valve (M9) (with O-rings) from the adapter plate. Discard the O-rings.

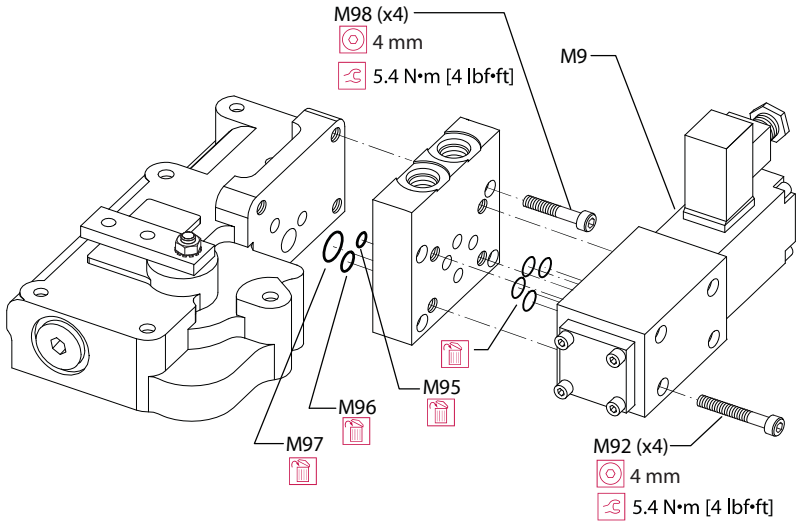
3. Using a 4 mm internal hex wrench, remove the four adapter plate mounting screws (M98). Remove the adapter plate and O-rings (M95, M96, and M97) from the control housing. Discard the O-rings.

Reassembly

4. Using petroleum jelly to retain them, install new O-rings (M96, M96, M97) on the adapter plate. Place the adapter plate into position and install the screws (M98). Torque the screws to 5.4 N•m [4 lbf•ft].

5. Using petroleum jelly to retain them, install new O-rings onto the solenoid valve assembly (M9) and install the solenoid valve onto the adapter plate. Install the screws (M92) and torque to 5.4 N•m [4 lbf•ft].

Solenoid override valve removal/installation



HISTORY OF REVISIONS

Table of Revisions

Date	Page	Changed	Rev.
July 2007	Various	Minor edits and dimension changes	FB
March 2004	-	Revision F	F

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FLUID AND FILTRATION

To prevent premature wear, it is imperative that only clean fluid enter the hydrostatic transmission circuit. A filter capable of controlling the fluid cleanliness to ISO 4406 class 22/18/13 (SAE J1165) or better under normal operating conditions is recommended.

The filter may be located either on the inlet (suction filtration) or discharge (charge pressure filtration) side of the charge pump. The selection of a filter depends on a number of factors including the contaminant ingression rate, the generation of contaminants in the system, the required fluid cleanliness, and the desired maintenance interval. Filters are selected to meet the above requirements using rating parameters of efficiency and capacity.

Filter efficiency may be measured with a Beta ratio[1] (β_x). For simple suction-filtered closed circuit transmissions and open circuit transmissions with return line filtration, a filter with a β-ratio within the range of $\beta_{35\text{-}45} = 75$ ($\beta_{10} \geq 2$) or better has been found to be satisfactory. For some open circuit systems, and closed circuits with cylinders being supplied from the same reservoir, a considerably higher filter efficiency is recommended. This also applies to systems with gears or clutches using a common reservoir. For these systems, a charge pressure or return filtration system with a filter β-ratio in the range of $\beta_{15\text{-}20} = 75$ ($\beta_{10} \geq 10$) or better is typically required.

Because each system is unique, only a thorough testing and evaluation program can fully validate the filtration system. Please see *Design Guidelines for Hydraulic Fluid Cleanliness*, 520L0467, for more information.

CHARGE PRESSURE

The charge pressure setting listed in the model code is based on the charge flow across the charge pressure relief valve at fluid temperature of 50 °C [120 °F].

INDEPENDENT BRAKING SYSTEM

⚠ Warning

Unintended vehicle or machine movement hazard.

The loss of hydrostatic drive line power, in any mode of operation (forward, neutral, or reverse) may cause the system to lose hydrostatic braking capacity. You must provide a braking system, redundant to the hydrostatic transmission, sufficient to stop and hold the vehicle or machine in the event of hydrostatic drive power loss.

RESERVOIR

The reservoir should be designed to accommodate maximum volume changes during all system operating modes and to promote de-aeration of the fluid as it passes through the tank.

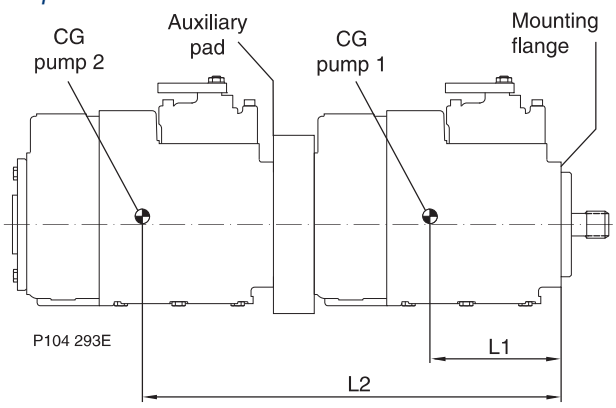
A suggested minimum total reservoir volume is 5/8 of the maximum charge pump flow per minute with a minimum fluid volume equal to 1/2 of the maximum charge pump flow per minute. This allows 30 seconds fluid dwell for removing entrained air at the maximum return flow. This is usually adequate to allow for a closed reservoir (no breather) in most applications.

[1] Filter β_x-ratio is a measure of filter efficiency defined by ISO 4572. It is defined as the ratio of the number of particles greater than a given diameter ("x" in microns) upstream of the filter to the number of these particles downstream of the filter.

MOUNTING FLANGE LOADS

Adding tandem mounted auxiliary pumps and/or subjecting pumps to high shock loads may result in excessive loading of the mounting flange. The overhung load moment for multiple pump mounting may be estimated as shown in the accompanying figure.

Overhung load example



Estimating overhung load moments

W = Weight of pump (kg)
L = Distance from mounting flange to pump center of gravity (m) (refer to pump installation drawings)

$$M_R = G_R (W_1L_1 + W_2L_2 + ... + W_nL_n)$$
$$M_S = G_S (W_1L_1 + W_2L_2 + ... + W_nL_n)$$

Where:

M_R = Rated load moment (N•m)
M_S = Shock load moment (N•m)
G_R = Rated (vibratory) acceleration (G's) * (m/sec²)
G_S = Maximum shock acceleration (G's) * (m/sec²)

* Calculations will be carried out by multiplying the gravity (g = 9.81 m/sec²) with a given factor. This factor depends on the application.

Allowable overhung load moment values are shown in the accompanying table. Exceeding these values requires additional pump support.

Allowable overhung load moments

Frame size	Rated moment (M_R)		Shock load moment (M_S)	
	N•m	lbf•in	N•m	lbf•in
042	860	7600	3020	26 700
055	1580	14 000	5650	50 000
075	1580	14 000	5650	50 000
100	1580	14 000	5650	50 000
130	3160	28 000	10 730	95 000
180	6070	54 000	20 600	182 000
250	6070	54 000	20 600	182 000

NON FEEDBACK PROPORTIONAL ELECTRIC CONTROL (NFPE)

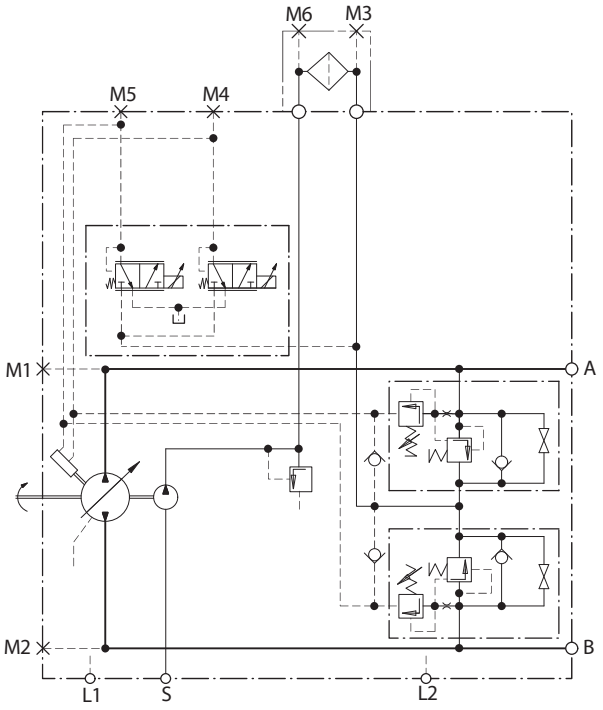
The Non Feedback Proportional Electric (NFPE) control is an electrical automotive control in which an electrical input signal activates one of two proportional solenoids that port charge pressure to either side of the pump servo cylinder. The NFPE control has no mechanical feedback mechanism.

The pump displacement is proportional to the solenoid signal current, but it also depends upon pump input speed and system pressure. This characteristic also provides a power limiting function by reducing the pump swashplate angle as system pressure increases. A typical response characteristic is shown in the accompanying graph.

Resistance Table

Supply Voltage	Coil Resistance
12 V	5.4 Ohms
24 V	21.6 Ohms

NFPE Schematic

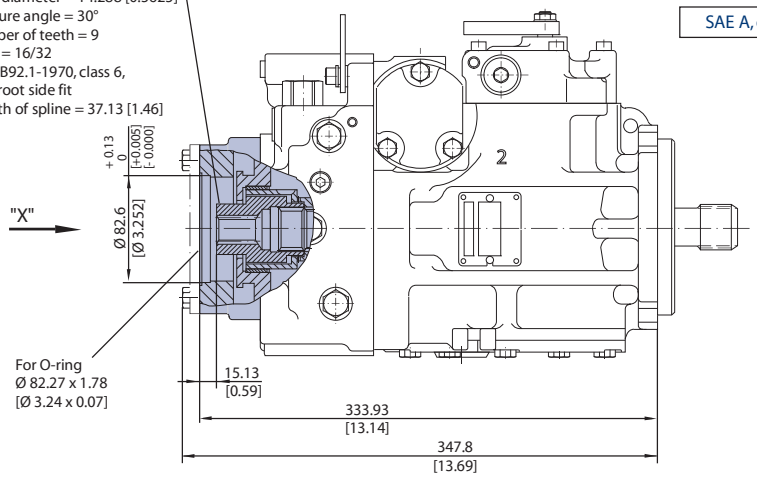


mm [in]

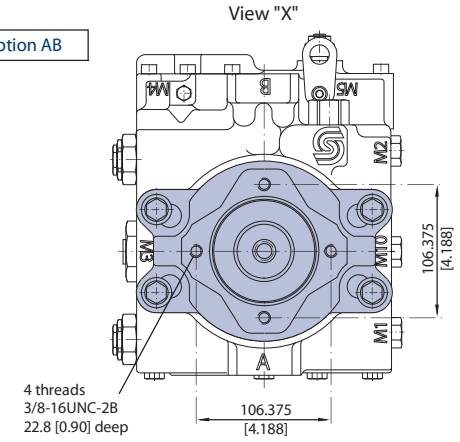
FRAME SIZE 075 (continued)

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

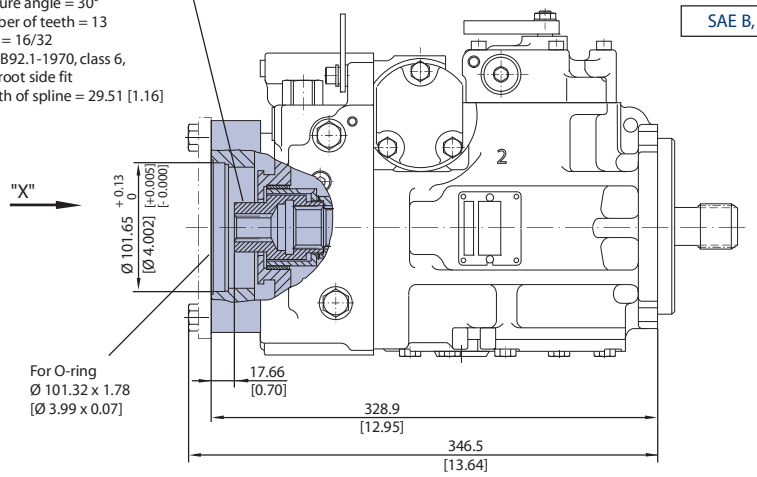
Coupling spline data:
Pitch diameter = 14.288 [0.5625]
Pressure angle = 30°
Number of teeth = 9
Pitch = 16/32
ANSI B92.1-1970, class 6,
fillet root side fit
Length of spline = 37.13 [1.46]



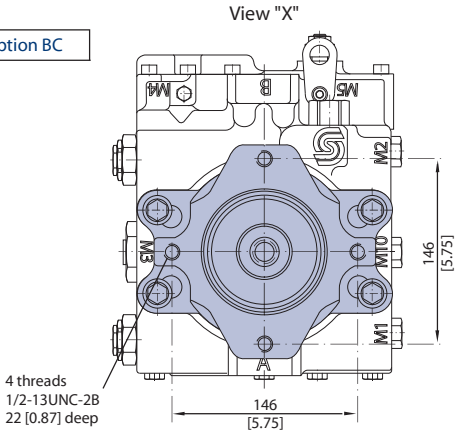
SAE A, option AB



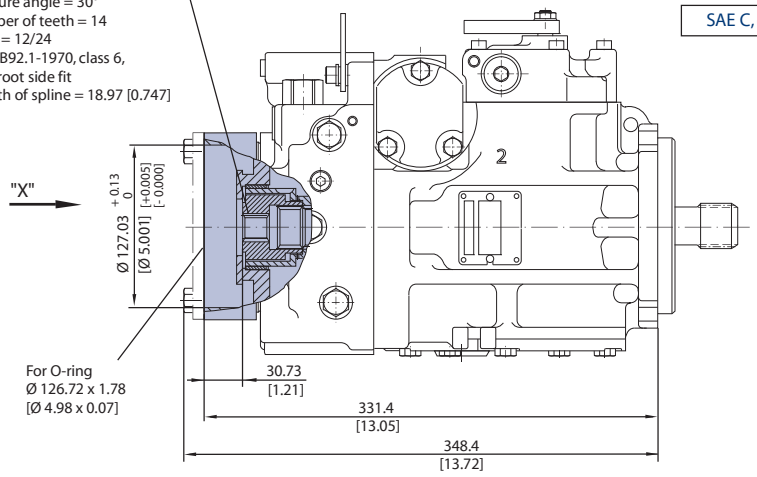
Coupling spline data:
Pitch diameter = 20.6375 [0.8125]
Pressure angle = 30°
Number of teeth = 13
Pitch = 16/32
ANSI B92.1-1970, class 6,
fillet root side fit
Length of spline = 29.51 [1.16]



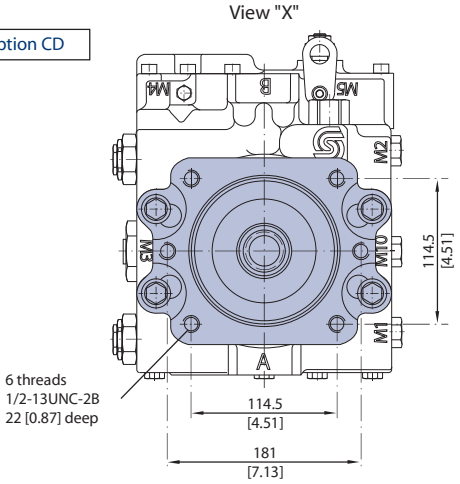
SAE B, option BC



Coupling spline data:
Pitch diameter = 29.6333 [1.167]
Pressure angle = 30°
Number of teeth = 14
Pitch = 12/24
ANSI B92.1-1970, class 6,
fillet root side fit
Length of spline = 18.97 [0.747]



SAE C, option CD

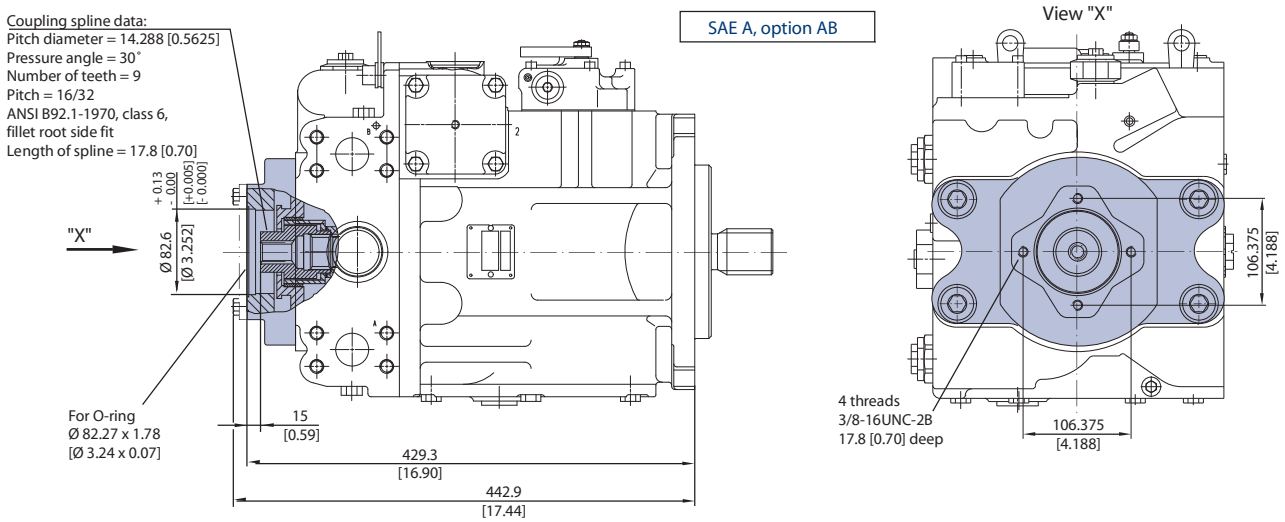


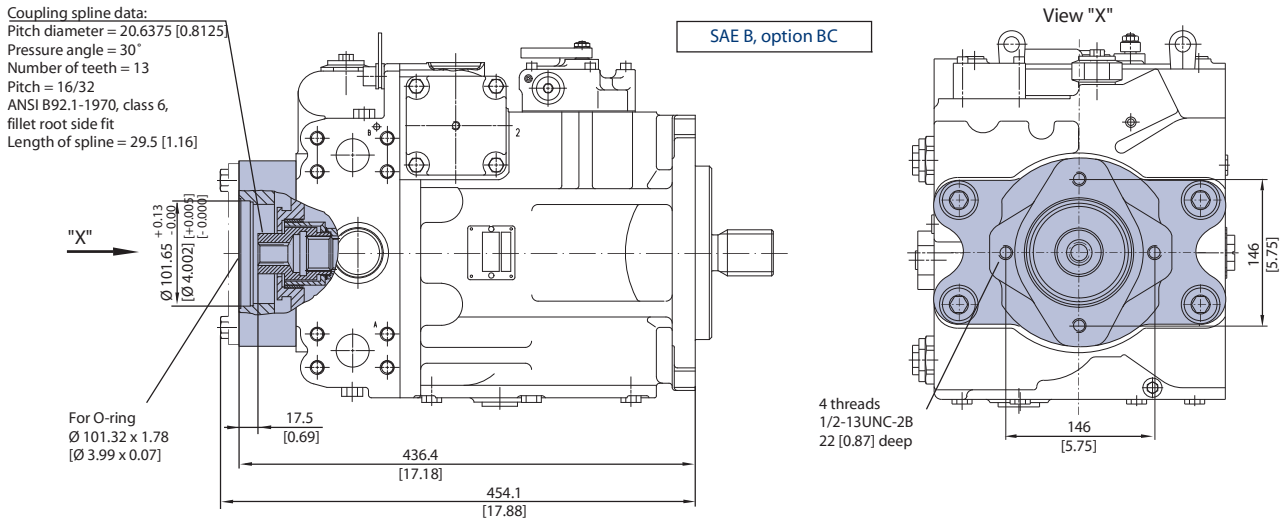
P102 048

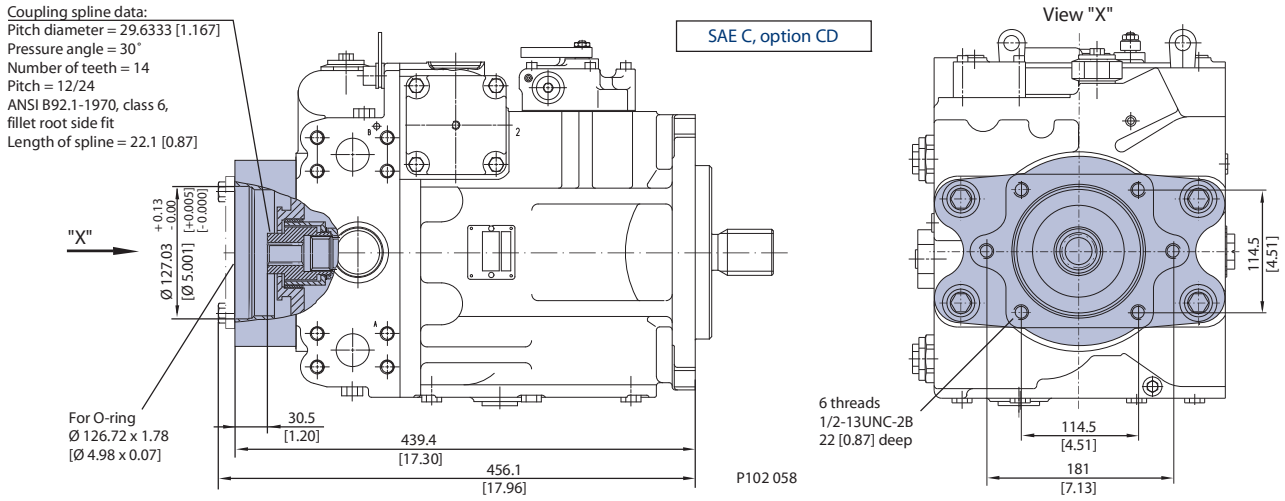
mm [in]

FRAME SIZE 180 (continued)

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

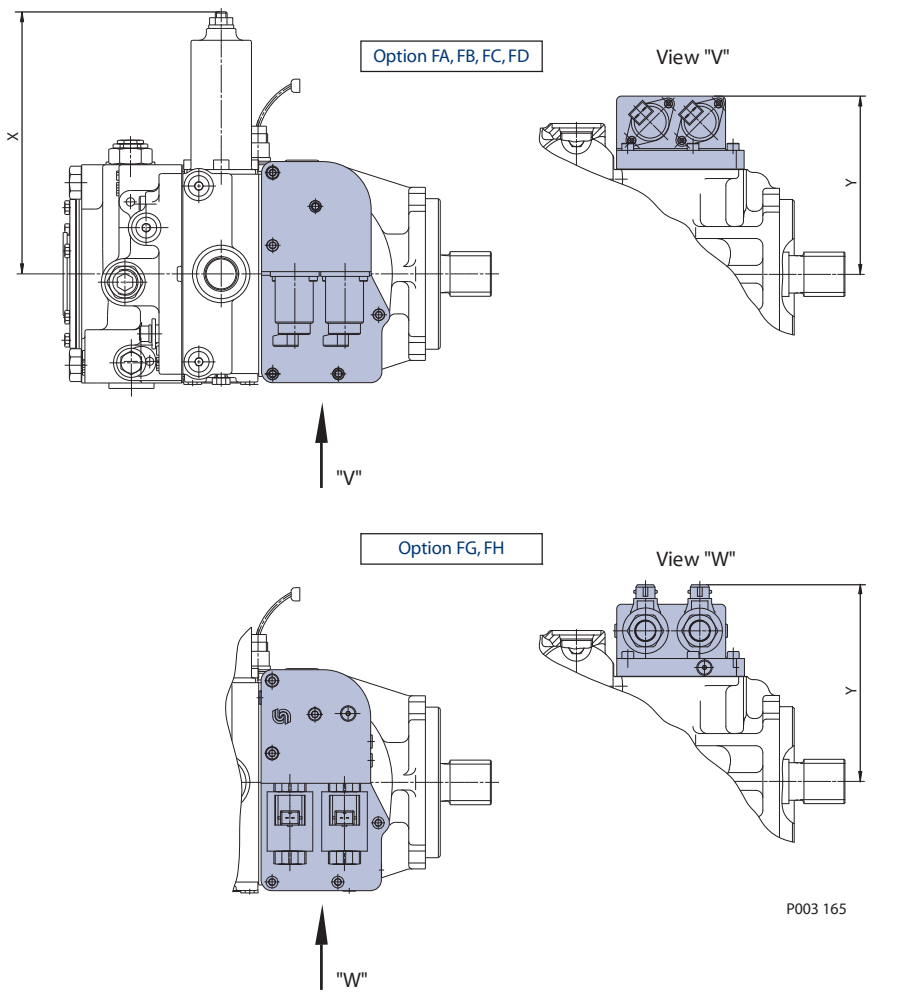






ELECTROHYDRAULIC DISPLACEMENT CONTROL (NFPE) (EXCEPT 075 NFPE)

mm [in]



Dimensions

Frame Size	Option	"X"	"Y"
042	FA, FB, FC, FD	169.30 [6.67]	140.00 [5.51]
055	FA, FB, FC, FD	207.00 [8.15]	145.00 [5.71]
075	Special version see page 63		
100	FA, FB, FC, FD	235.00 [9.25]	161.10 [6.34]
100	FG, FH		176.60 [6.95]
130	FG, FH	244.10 [9.61]	195.50 [7.70]
180	FG, FH	290.00 [11.42]	213.00 [8.39]
250	—	—	—

Excessive Noise and/or Vibration

Check	Description	Action
1. Oil in reservoir.	Insufficient hydraulic fluid will lead to cavitation.	Fill reservoir to proper level.
2. Air in system.	Air bubbles will lead to cavitation.	Look for foam in reservoir. Check for leaks on inlet side of system loop. Afterwards, let reservoir settle until bubbles are gone. Run system at low speed to move system fluid to reservoir. Repeat.
3. Pump inlet vacuum.	High inlet vacuum will create noise. A dirty filter will increase the inlet vacuum.	Inspect and replace filter as necessary. Check for proper suction line size.
4. Shaft couplings.	A loose shaft coupling will cause excessive noise.	Replace loose shaft coupling in charge pump or replace pump or motor.
5. Shaft alignment.	Unaligned shafts will create excessive frictional noise.	Align shafts.

If the above actions do not remedy the problem
contact a SAUER-SUNDSTRAND Authorized Service Center.

System Response is Sluggish

Check	Description	Action
1. Oil level in reservoir.	Insufficient hydraulic fluid will reduce output pressure.	Fill reservoir to proper level.
2. Multi-function valves' pressure settings.	Incorrect pressure settings will affect system reaction time.	Adjust or replace multi-function valves.
3. Pump inlet vacuum.	High pump inlet vacuum will reduce system pressure.	Measure charge inlet vacuum. If high replace inlet filter.
4. Prime mover speed.	Low engine speed will reduce system performance.	Adjust engine speed.
5. Charge and control pressures.	Incorrect charge or control pressures will affect system performance.	Measure charge and control pressures and correct if necessary.
6. System internal leakage.	Internal leakage will reduce system pressure.	Check for leakage in O-rings, gaskets, and other fittings.

If the above actions do not remedy the problem
contact a SAUER-SUNDSTRAND Authorized Service Center.

10. If reading of PT4 is not within specification for pressure limiter setting, check pressure transducer to make sure it is reading correctly.
11. If pressure limiter requires adjustment, refer to Appendix H: Series 90 pump pressure limiter adjustment procedure. Repeat steps 1-9.

    After adjustment, record the pressure limiter setting value from the PT4 reading on the calibration data sheet.

12. Disconnect the electrical connection for DP1 and re-connect the connection for DP2 to check the forward pressure limiter setting for DP2.
13. Repeat steps 1-11, monitoring PT6 instead of PT4.
    Record the pressure limiter setting value from the PT6 reading on the calibration data sheet.

Checking reverse pressure limiter settings

- The following conditions are necessary before proceeding with this check:
  - Machine should be running at low idle and hydraulic oil temperature should be a minimum of 60 deg F.
  - Machine should be on level ground
  - All four wheels should be chocked for the direction being tested.
  - ***There must be a minimum of 100' of unobstructed space in all directions.***

1. Disconnect the electrical connection to drive pump 2 (DP2).
2. Disconnect the electrical connection to the brake valve.
3. Turn the cruise potentiometer to 0% (clockwise-CW).

4. Make sure ***road*** mode is selected on the MD3. If field is selected, press F1 button to toggle to ***road***.

5. Move control handle out of neutral in reverse. ***The machine should not move nor should you notice the drive pumps or engine "loading up".***

   Note: *It is not necessary to push the handle all the way forward, just enough so it is no longer in neutral and will stay in that position.*

6. Use shift buttons on control handle to shift up into 4th range.
7. Use the MD3 display to monitor the drive system pressure transducers in the drive pump measure group (see Procedure 3, steps 1 & 2).

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Procedure 9: Documenting calibration

Goal: To document calibration values in a consistent manner and to save the information in both the Service Tech Machine Information folder and Customer Service Departments records for future reference.

1. Calibration data sheet is shown below.

date			Calibration Pressures							
model			Drive pump output							
year										
serial number							DP1 A port	DP1 B port	DP2 A port	DP2 B port
hours										
speed range 1 (MPH)										
speed range 2 (MPH)										
speed range 3 (MPH)										
speed range 4 (MPH)										
speed range 5 (MPH)										
speed range 6 (MPH)										
speed range 7 (MPH)										
speed range 8 (MPH)										
speed range 9 (MPH)										
speed range 10 (MPH)										
	DP1	DP2								
charge pressure-idle (PSI)										
charge pressure-full throttle (PSI)										
neutral set (Y/N)										
max pressure forward (PSI)										
Initial										
Final										
max pressure reverse (PSI)										
Initial										
Final										
Forward										
initial min current (mA)										
final min current (mA)										
initial max current (mA)										
final max current (mA)										
Reverse										
initial min current (mA)										
final min current (mA)										
initial max current (mA)										
final max current (mA)										

2. When completed, this should be saved in two places
    a. Machine information folder (See Appendix I).
    b. Attached to Service call report.

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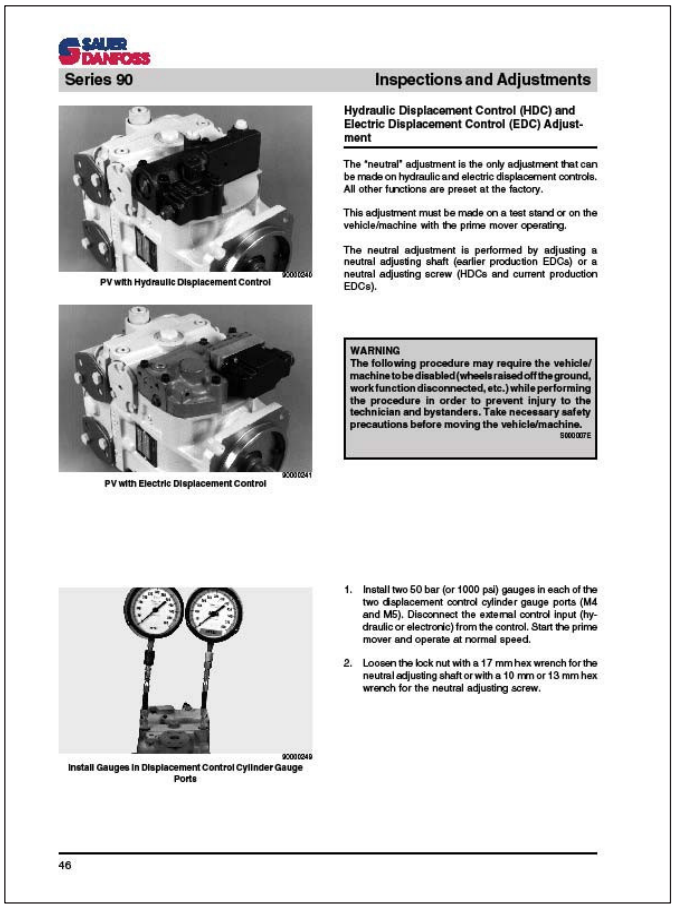
Appendix G: Series 90 pump neutral set procedure



SAUER DANFOSS

Series 90 Inspections and Adjustments

PV with Hydraulic Displacement Control

Hydraulic Displacement Control (HDC) and Electric Displacement Control (EDC) Adjustment

The "neutral" adjustment is the only adjustment that can be made on hydraulic and electric displacement controls. All other functions are preset at the factory.

This adjustment must be made on a test stand or on the vehicle/machine with the prime mover operating.

The neutral adjustment is performed by adjusting a neutral adjusting shaft (earlier production EDCs) or a neutral adjusting screw (HDCs and current production EDCs).

PV with Electric Displacement Control

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

Install Gauges in Displacement Control Cylinder Gauge Ports

1. Install two 50 bar (or 1000 psi) gauges in each of the two displacement control cylinder gauge ports (M4 and M5). Disconnect the external control input (hydraulic or electronic) from the control. Start the prime mover and operate at normal speed.
2. Loosen the lock nut with a 17 mm hex wrench for the neutral adjusting shaft or with a 10 mm or 13 mm hex wrench for the neutral adjusting screw.

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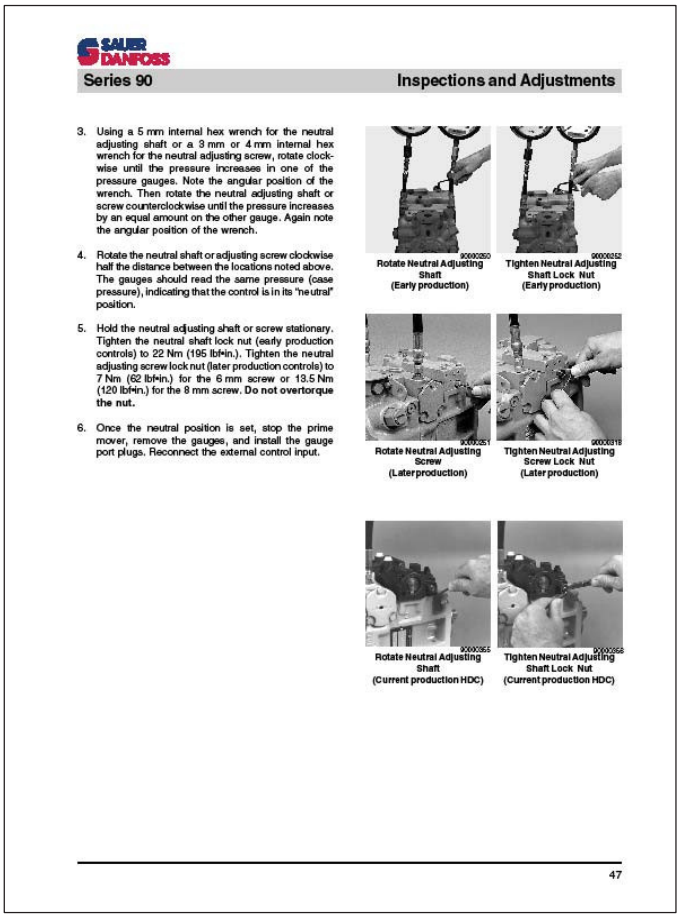

SAUER DANFOSS

Series 90 Inspections and Adjustments

3. Using a 5 mm internal hex wrench for the neutral adjusting shaft or a 3 mm or 4 mm internal hex wrench for the neutral adjusting screw, rotate clockwise until the pressure increases in one of the pressure gauges. Note the angular position of the wrench. Then rotate the neutral adjusting shaft or screw counterclockwise until the pressure increases by an equal amount on the other gauge. Again note the angular position of the wrench.
4. Rotate the neutral shaft or adjusting screw clockwise half the distance between the locations noted above. The gauges should read the same pressure (case pressure), indicating that the control is in its "neutral" position.
5. Hold the neutral adjusting shaft or screw stationary. Tighten the neutral shaft lock nut (early production controls) to 22 Nm (195 lbf•in.). Tighten the neutral adjusting screw lock nut (later production controls) to 7 Nm (62 lbf•in.) for the 6 mm screw or 13.5 Nm (120 lbf•in.) for the 8 mm screw. **Do not overtorque the nut.**
6. Once the neutral position is set, stop the prime mover, remove the gauges, and install the gauge port plugs. Reconnect the external control input.

Rotate Neutral Adjusting Shaft (Early production)

Tighten Neutral Adjusting Shaft Lock Nut (Early production)

Rotate Neutral Adjusting Screw (Later production)

Tighten Neutral Adjusting Screw Lock Nut (Later production)

Rotate Neutral Adjusting Shaft (Current production HDC)

Tighten Neutral Adjusting Shaft Lock Nut (Current production HDC)

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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

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GENERAL INSTRUCTIONS

Keep it clean

You can complete many repairs or adjustments without removing the unit from the machine, *if* the unit is accessible and you can thoroughly clean it before beginning any procedures.

Cleanliness is a primary means of assuring satisfactory motor life on either new or repaired units. *Clean the outside of the motor thoroughly before disassembly.* Take care to avoid contamination of the system ports. Cleaning parts with a clean solvent wash and air drying is usually adequate.

As with any precision equipment, keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material. Cap all hoses after removal, and plug all open ports. Cover any unattended parts with a protective layer of plastic.

Inspect for system contamination

Inspect the motor for signs of system contamination. If you find contamination, fully disassemble, clean and inspect all components of the motor.

Replace the O-rings and gaskets

Replace all O-rings and gaskets. Discard them only after you make certain that you have the correct replacement parts. Lightly lubricate all O-rings with clean petroleum jelly before assembly.

Lubricate all moving parts

During reassembly, coat all moving parts with a film of clean hydraulic oil. This helps lubricate the surfaces during start-up.

For fluid quality requirements, refer to **520L0463** *Hydraulic Fluids and Lubricants, Technical Information*.

Torque procedure

During reassembly, cross torque all retaining screws to the given value. Do not overtorque.

MINOR REPAIR (continued)

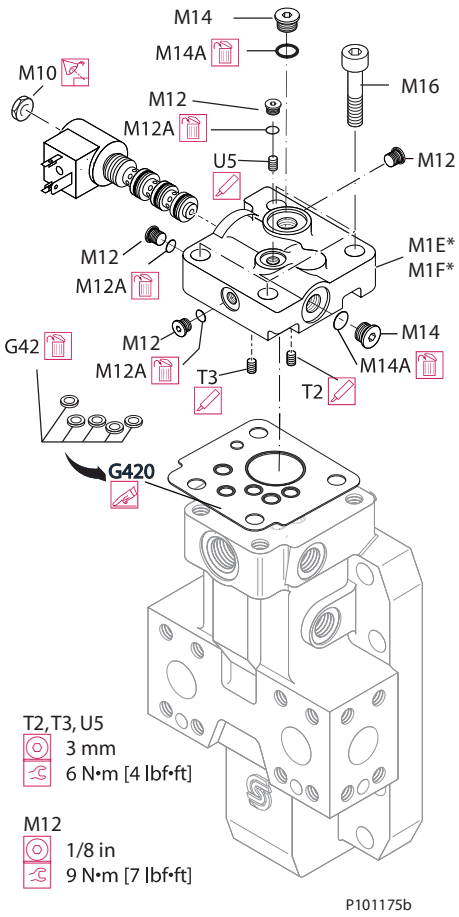
Inspection

Clean and inspect all parts for damage. Check orifices and passages in control housing for foreign material.

Assembly

1. If removed, install orifices (T2, T3, and U5) in 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 (M14A) on to the plugs (M14). Using a 1/4-inch internal hex wrench torque the plugs (M14) to 37 N•m [28 lbf•ft]
3. Lubricate and install new O-rings (M12A) on to the plugs (M12). Using a 1/8-inch internal hex wrench torque the plugs to 9 N•m [7 lbf•ft].
4. Using clean petroleum jelly to retain them, install new interface O-rings (G42) or new control gasket (G420) on the endcap.
5. Install the control housing (M1E*/ M1F*) to the endcap.
6. Install the retaining screws (M16). Using an 8mm internal hex wrench, torque the screws to 78 N•m [58 lbf•ft].
7. Lubricate and install new O-rings and backup rings onto the solenoid cartridge.
8. Using a 7/8-inch wrench install the solenoid cartridge into the control housing. Torque the cartridge to 30 N•m [22 lbf•ft]. Do not overtorque.
9. Slide the solenoid coil over the valve stem.
10. Install the solenoid coil nut. Using a 1 inch wrench, torque the coil nut to 6 N•m [4 lbf•ft]. Do not overtorque.

E/F* control assembly*



T2, T3, U5
3 mm
6 N•m [4 lbf•ft]

M12
1/8 in
9 N•m [7 lbf•ft]

M14
1/4 in
37 N•m [28 lbf•ft]

M10 - coil nut
1 in
6 N•m [4 lbf•ft]

M10 - cartridge
7/8 in
30 N•m [22 lbf•ft]

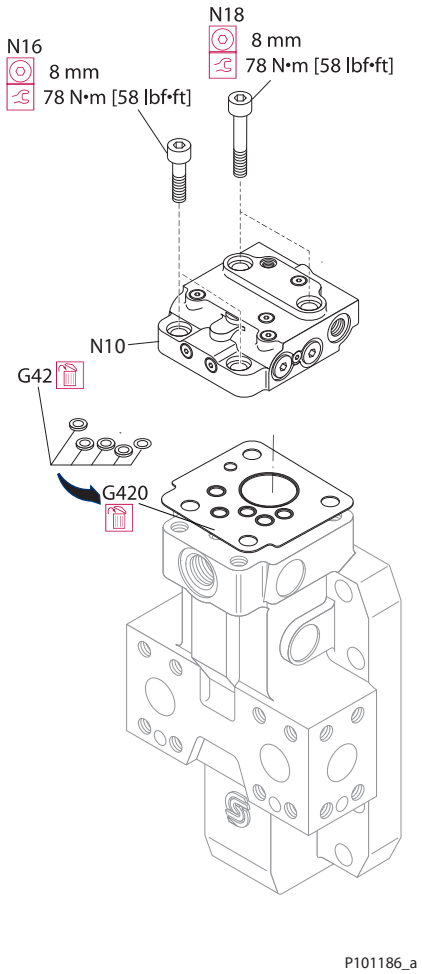
MINOR REPAIR

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

Control housing

1. Thoroughly clean all external surfaces before disassembly.
2. Using an 8mm internal hex wrench remove the 4 screws (N16 and N18) retaining the control housing to the endcap.
3. Lift the control housing (N10) from the endcap.
4. Remove the interface O-rings (G42) or the gasket (G420). Remove and discard the O-rings or gasket.
5. Make necessary repairs., see pages 28-46 for options.
6. Using clean petroleum jelly to retain them during assembly, install the new interface O-rings (G42) or the gasket (G420) to the endcap, .
7. Install the control housing (N10) to the endcap.
8. Align the holes and install the four retaining screws (N16 and N18).
9. Using an 8mm internal hex wrench torque the four retaining screws (N16 and N18) to 78 N•m [58 lbf•ft].

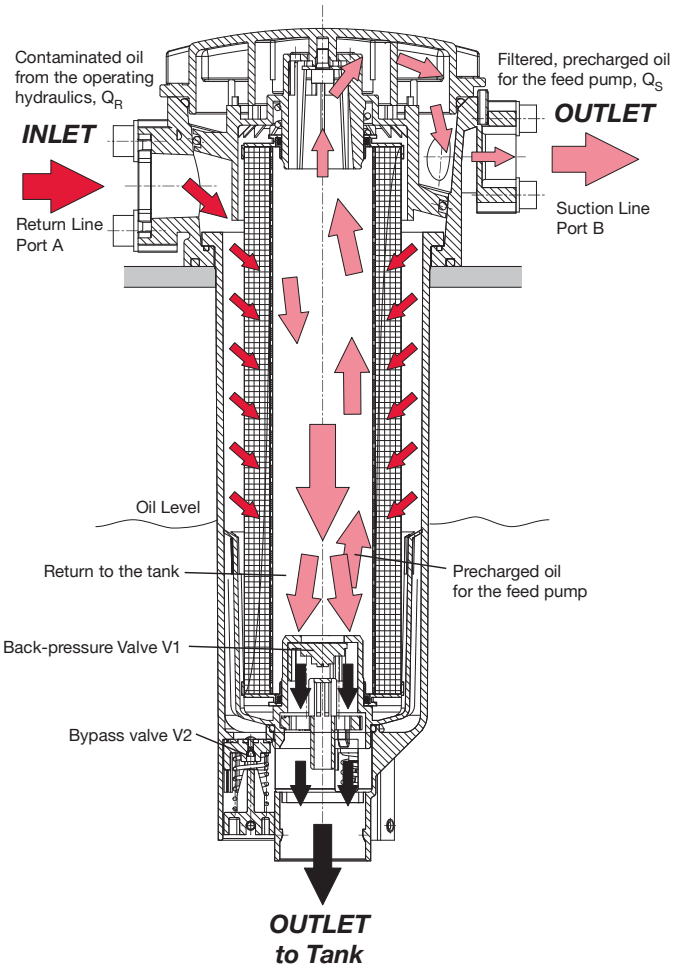
*Control housing T**



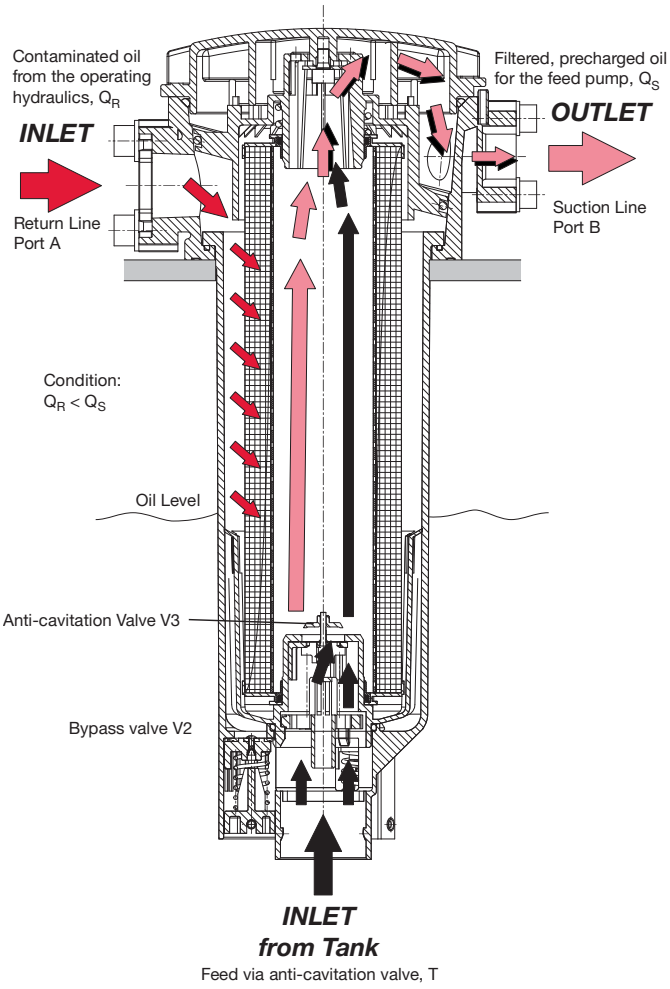
Hagie Part Number	Sauer-Danfoss Part Number	Model Code	Description	Machine Applicability
606972	~~**181.25.693.00**~~		**Tandem Gear Pump**	**STS 12**
SNP1 rear pump replaced TFP100 rear pump	Replaced by S/D 181.25.773.00 April 2003 Reference S/D PIB 2003-08		**PRB 33 + 2.2 D SC 37 E**	Service
			Front Pump	
606984	**211.25.217.0C**	SNP3	Group 3 Gear Pump	
		33	33cc/rev (2.02 cu in) displacement	
		D	CW Rotation	
		SC	Splined Shaft, 13T 16/32 P	
		07	SAE “B”2-Bolt Flange, O-Ring Ports	
		E	SAE O-Ring Boss Ports	
606987	**115.10.493.00**		**Rear Pump**	
		TFP	Group 1 Gear Pump	
		2.2	2.09 cc/rev (0.128 cu in/rev)	
		D	CW Rotation	
		E	SAE O-Ring Boss Ports	

606972	**181.25.773.00**		**Tandem Gear Pump**	**STS 12**
	In Production April 2003		**PRT 33 + 2.2 D SC 37 E**	**STS 10**
			Front Pump	
606984	**211.25.217.0C**	SNP3	Group 3 Gear Pump	
		33	33cc/rev (2.02 cu in) displacement	
		D	CW Rotation	
		SC	Splined Shaft, 13T 16/32 P	
		07	SAE “B”2-Bolt Flange, O-Ring Ports	
		E	SAE O-Ring Boss Ports	
			Rear Pump	
??????	**111.10.136.00**		**SNP1/2.2 DSC01.E**	
		SNP1	Standard Group 1 Gear Pump	
		2.2	2.09 cc/rev (.128 cu in/rev)	
		D	CW Rotation	
		SC01	DIN Splined Shaft/European 4-bolt Flange	
		E	SAE O-Ring Boss Ports	

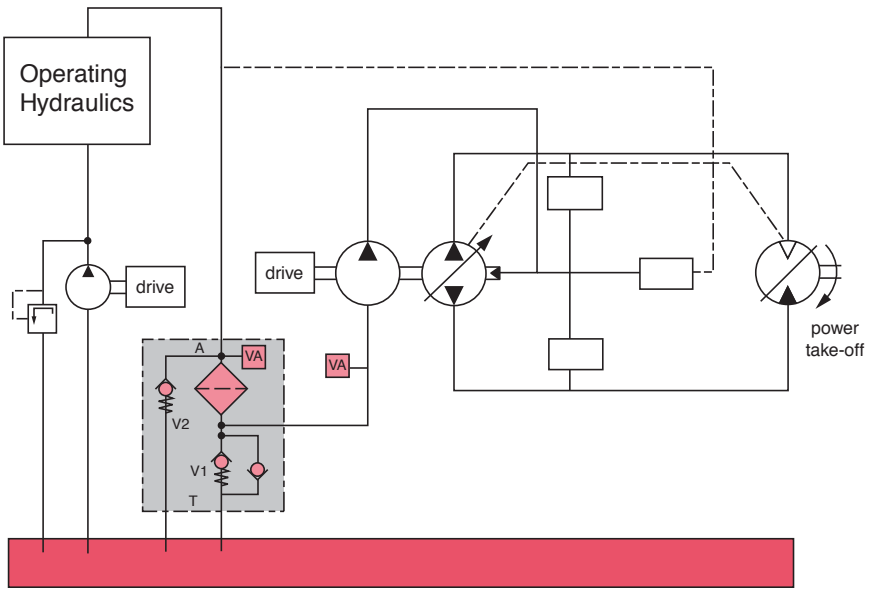
Function Diagram



Anti-cavitation



Circuit Example:



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11/00

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APPENDIXES

EXAMPLE: Assume DISTANCE reads 5000 [980].

$$\text{Corrected SPEED CAL} = \frac{\text{Old SPEED CAL} \times 5280}{\text{DISTANCE}}$$

ENGLISH UNITS:

$$= \frac{598 \times 5280}{5000} = 631.48$$

METRIC UNITS:

$$= \frac{[152] \times [1000]}{[980]} = [155]$$

The number to enter for SPEED CAL is 631 [155].

5) Enter the number calculated for SPEED CAL.

6) Recheck the new SPEED CAL derived in Step 5 by repeating Steps 2 thru 5.

3. CALCULATING "METER CAL"

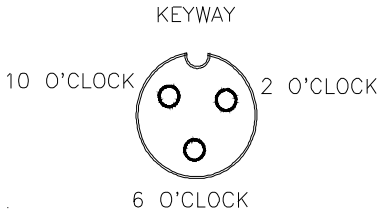
The Flow Meter calibration number is stamped on the tag attached to each Flow Meter. Write down this number for future reference when programming the Console.

DISPLAY	DESCRIPTION
FIELD REF 0	Allows user to enter up to a four-digit number to represent a field. Field reference is included in field begin and field end pages and the data logger time/date string.
BAUD RATE 9600	Used in GPS mode and data logging mode. Selectable between 1200 or 9600 baud.
DATA LOG TRIGGER VALUE 0	Used in data logging mode. The trigger determines how often actual rate data string (See Appendix 10 for Data Communication String Formats) is sent to the serial port. The trigger may be either feet [meters] or seconds.
DATA LOG TRIGGER UNITS FEET	Used in data logging mode. The trigger unit is selectable between feet [meters] or seconds.
DATA LOG OFF	Turns data logger ON or OFF.
PRESS ENTER TO CAL PRESSURE	Used to set the zero point of the pressure transducer for pressure display.
OFF RATE PERCENT 30	Used to set the percent of off target value. Alarm sounds when the actual rate is off from the target rate by a specified percent. The off target value is preset to 30%, but may be changed to a different number.
HIGH PWM OFFSET 253	Used to set the maximum desired RPM or hydraulic output of Pulse Width Modulated control valve.
LOW PWM OFFSET 1	Used to set the minimum desired RPM or hydraulic output of control valve. Used to set the zero point or shut-off point of Pulse Width Modulated control valve.
PWM FREQUENCY 122	Enter the coil frequency of the PWM type valve being used (default is 122 Hz).
PRESS ENTER FOR DATA-LOCK	Sequence to activate DATA-LOCK CODE (feature prohibits the entry of data without first entering the DATA-LOCK CODE). Enter 4-digit code within 15 seconds.

		2) Remove one red magnet and one black magnet from the wheel. (Reposition remaining red and black magnets directly across from each other). Enter a SPEED CAL number in the Console twice as large as the correct SPEED CAL number. Run speed check on hard surface road. Remove these two magnets and replace with other two. Run speed check. If SPEED is in accurate with only one set of magnets, replace the bad set. If SPEED is inaccurate with both sets, replace Speed Sensor Assembly.
		NOTE: Re-enter original SPEED CAL number after testing is complete.
12)	SPEED INACCURATE OR UNSTABLE (SPEEDOMETER DRIVE SPEED SENSOR).	1) Wiggle cable at the Speed Sensor connector. If speed is displayed, tighten connector or replace Transducer Assembly. 2) Check Speedometer Cable Adapter, Key, and Transducer Assembly for proper connections and engagement. 3) Check for kinks or sharp bends in speedometer cable. 4) Replace Speedometer Transducer Assembly.
13)	RATE READS "0000".	1) Verify SPEED is registering accurately. If SPEED is zero, refer to Troubleshooting Problem 10. 2) Verify TOTAL VOLUME is registering flow. If not, refer to Troubleshooting Problem 17.
14)	RATE INACCURATE OR UNSTABLE.	1) Verify that all numbers "keyed in" Console are correct. Verify SPEED is registering accurately. If SPEED is inaccurate, refer to Trouble-shooting Problem 11 or 12. 2) In MAN (manual) operation, verify that RATE display (GPA) holds constant. If not, refer to Troubleshooting Problem 18. 3) In MAN (manual) operation, check low end and high end pressure range. Pressure range must be per initial system set-up on page 27. If pressure cannot be adjusted manually, refer to Troubleshooting Problem 17. (Cont. next page)

APPENDIX 5
PROCEDURE TO TEST FLOW METER CABLES

Disconnect cable from Flow Sensor. Hold Flow Sensor cable so that the keyway is pointing in the 12 o'clock position:



PIN DESIGNATIONS
2 o'clock socket location is ground.
10 o'clock socket location is power.
6 o'clock socket location is signal.

VOLTAGE READINGS
1) 2 o'clock socket to 6 o'clock socket = +5 VDC.
2) 2 o'clock socket to 10 o'clock socket = +5 VDC.

If a +5 VDC voltage reading is not present, disconnect the Speed Sensor cable. If the Flow reading is restored, Test the Speed Sensor cable per Appendix "PROCEDURE TO TEST SPEED SENSOR EXTENSION CABLES".

PROCEDURE TO CHECK CABLE:

1) Enter a METER CAL number of one (1) in key labelled METER CAL 5

2) Depress key labelled TOTAL VOLUME

3) Place BOOM switches to ON.

4) With small jumper wire (or paper clip), short between the 2 o'clock and 6 o'clock sockets with a "short-no short" motion. Each time a contact is made, the TOTAL VOLUME should increase by increments of 1 or more counts.

5) If TOTAL VOLUME does not increase, remove the section of cable and repeat test at connector next closest to Console. Replace defective cable as required.

6) Perform above voltage checks.

7) If all cables test good, replace Flow Sensor.

NOTE: After testing is complete, re-enter correct METER CAL numbers before application.

create if it were installed in the inlet line. Ensure that the proper strainer size and screen mesh are used to limit the pressure drop and achieve the best filtration. Line strainers can also be installed in the tank fill line to filter liquid as it is loaded into the tank as well as in the boom lines to further filter the solution prior to the spray tips. Tank baskets can also be used to filter material added through the tank lid.

Agitation

The centrifugal pump control contains a manual agitation control valve that can be adjusted to provide the right amount of flow to the jet agitators in the tank to ensure proper mixing within the tank.

Flowmeter

To eliminate the mechanical problems of a turbine flowmeter, we recommend that an electromagnetic flowmeter be used. These flowmeters have no moving parts to wear out and will provide a more consistent and accurate flow reading. They can be input into just about any electronic rate controller or switch box.

Boom Section Valves

For rapid response and reliability, we recommend electric plunger valves be used for boom control. The valves should be sized accordingly to minimize the pressure drop and maximize the flow rate. The boom tubing or hose should be sized accordingly to ensure that a pressure drop in the lines does not occur, causing inconsistent pressures at the nozzles.

Nozzle Bodies

Nozzle bodies with shut-off check valves are recommended to eliminate dripping from the spray tips when the boom valves are shut down.

Hooking Up the Hydraulic Motor to the Tractor Hydraulic System

Hypro Series 9300HMC hydraulic motor-driven pumps can be mounted on either the tractor or sprayer. When hooking up, make sure that no dirt or liquid gets into the hydraulic motor. **Keep all hydraulic connections clean.** Be sure to connect the hydraulic motor into the system correctly by putting the pressure line to the Pressure Port Adapter and return line to the Tank Port Adapter. The port adapters on the hydraulic motor are sized to accommodate 1/2" NPT fittings. For maximum performance, the hydraulic lines should also be at least 1/2" [12.7 mm] in size. For lines longer than 8 feet [2.44 m] or for the HM3C models, hydraulic line size should be at least 3/4" [19.05 mm] in order to reduce heat generation.

The tank (**OUT**) port adapter with a built-in check valve assembly will guard against reverse operation — allowing you to reverse oil flow to operate other equipment. **This adapter must not be removed.** On HM2C and HM4C model pumps, the pressure (**IN**) port adapter is a two-piece assembly consisting of an open (unrestricted) adapter with three orifices packed loose with the pump. (See the Operations Section.)

When using the HM2C or HM4C unit on any flow-compensated (load sensing) closed center system, or any small open center system with a maximum flow of 8 gpm [30.28 lpm] for HM2C or 10 gpm [37.85 lpm] for HM4C, the metering orifice should be removed from the pressure port adapter. When using these units on flow-compensated systems, connect to the motor priority circuit if your tractor has one.

Standard spool valves, which are found on all tractor hydraulic systems, may cause potentially damaging high peak pressures in the hydraulic system when closed because of abrupt shut-off of oil flow in both the supply and return lines. When shutting off the pump, move the selector to the **FLOAT** position to allow the centrifugal pump to come to a stop gradually.

For further information regarding Hypro products, contact your local dealer or Hypro directly at www.hypropumps.com or by calling 1-800-424-9776.

Operation

Open Center Systems— All Models
Adjusting Centrifugal Pump Output

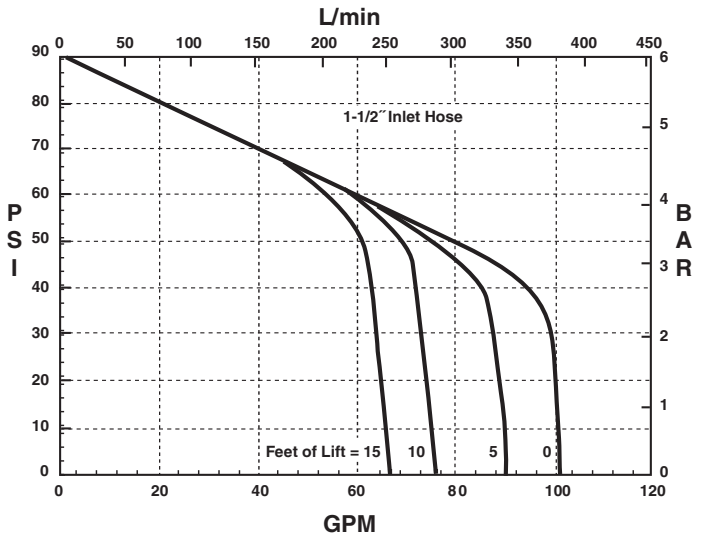
NOTE

HM1C, HM3C & HM5C motors have bypass screw fully closed from the factory. HM2C & HM4C motors have bypass screw set at 1-1/2 turns from fully closed from the factory.

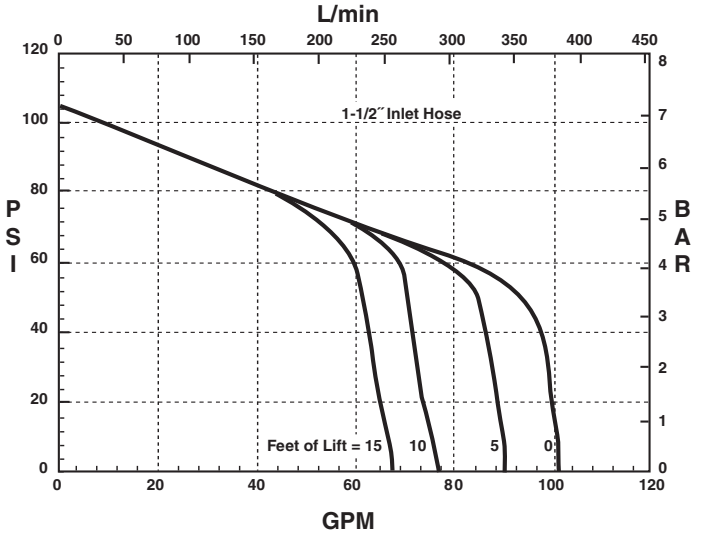
1. Open the bypass adjustment screw 2-1/2 turns from fully closed. Turn the bypass screw in to achieve the flow for the desired gpm and psi.
2. Start the tractor. Leave the directional valve in the neutral position and allow hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
3. Prime the centrifugal pump with all valves open (See the Installation Instructions and System Configuration Diagram).
4. Close the agitation line valve and keep the control valve and the boom shut-off valve open. Note the spray pressure.
5. Open the agitation line valve until you have desired circulation in the tank. Recheck the spray pressure. If it is too low, close down the agitation line valve until the desired spray pressure is reached. If the spray pressure is too high, throttle the centrifugal pump by closing down the control valve.

Performance Graphs

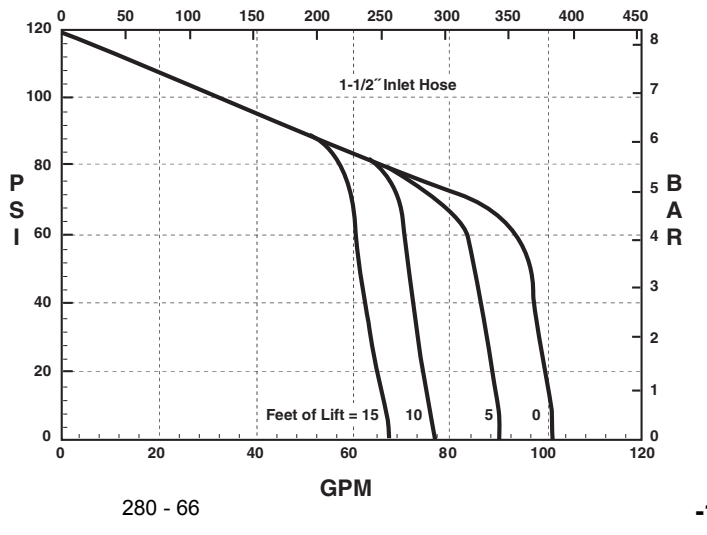
9303 9303C-HM5C-SP Performance at 13 GPM



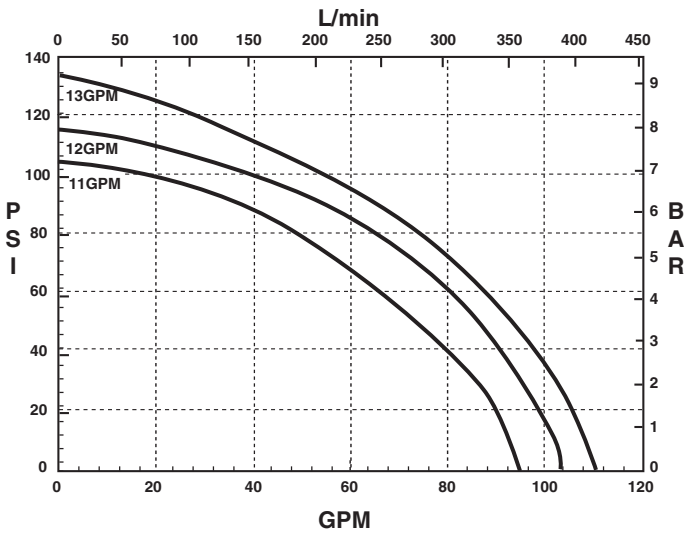
9303C-HM5C-SP Performance at 14 GPM



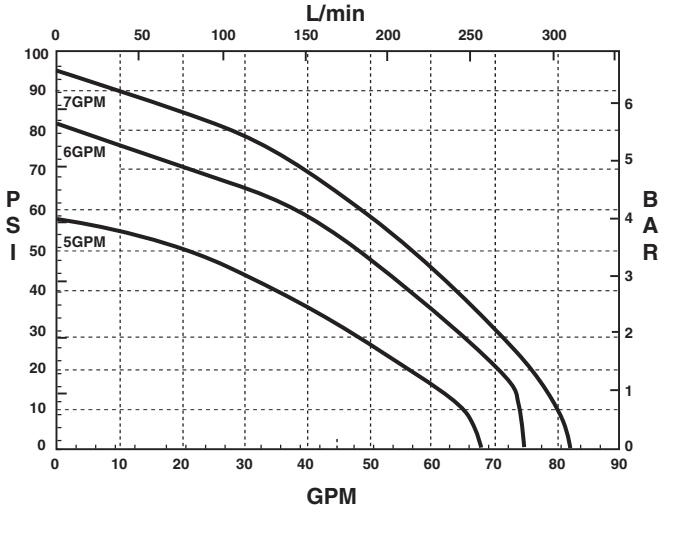
9303C-HM5C-SP Performance at 15 GPM



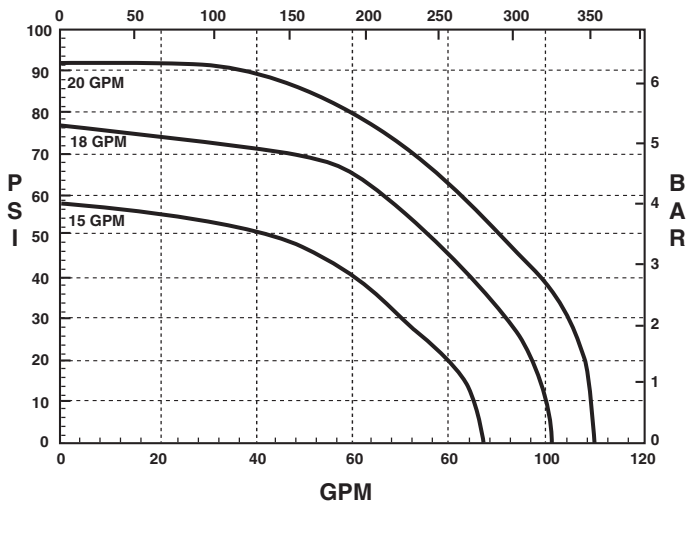
9303 9303P-HM1C



9303P-HM2C



9303P-HM3C



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