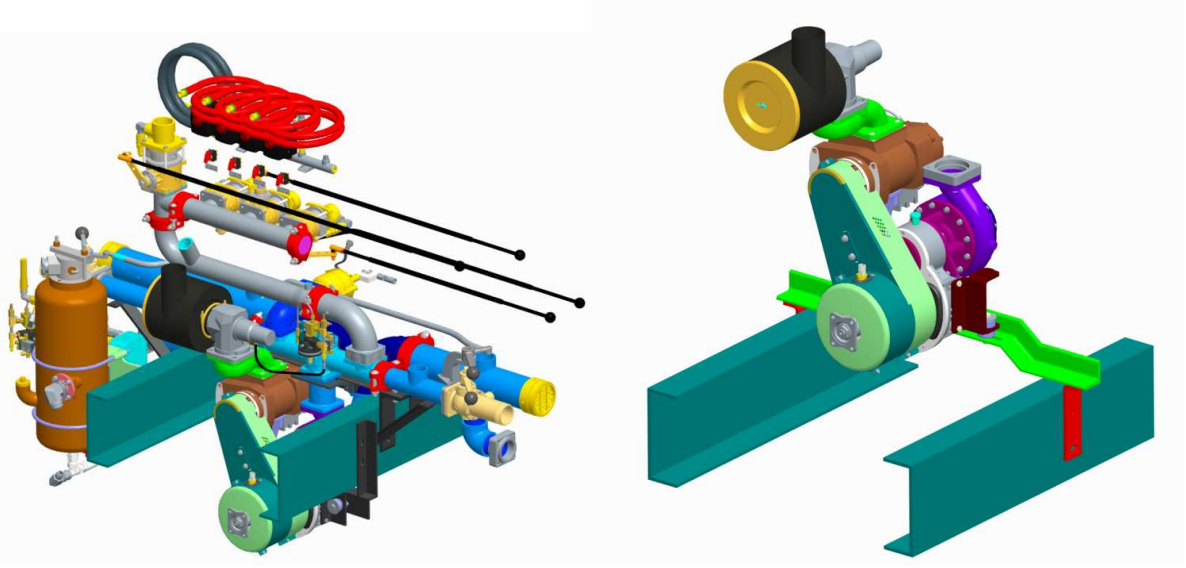
DARLEY AutoCAFS II
Compressed Air Foam System

OPERATING, MAINTENANCE, REPAIR AND TROUBLESHOOTING INSTRUCTIONS FOR THE

HMBC 500/220 Fire Pump with

THE AUTOCAFS COMMANDER CONTROL SYSTEM



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100 YEARS Darley

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WWW.DARLEY.COM

This manual is for DARLEY FIRE PUMP:
Model: **HMBC** Pump Serial Number: _____

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev. Date: 01/31/12
1200625.doc

Introduction

This manual provides information for the correct operation, use, and maintenance, of the Darley HMBC AutoCAFS II compressed air foam system including the new AutoCAFS Commander Control. Please read and understand these instructions thoroughly before putting the system in service. Doing so will ensure optimal performance and long life of your CAFS equipped apparatus.

The manual is divided into 6 sections plus an appendix. Each section details the operation, use, and maintenance of the individual CAFS components that comprise the HMBC compressed air foam system. The appendix includes supplementary information.

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
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Type HMBC Fire Pump

ALL DOCUMENTS ARE FOUND IN THIS MANUAL IN THE ORDER THEY ARE LISTED (left to right and top to bottom)

Related Drawings ----------

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Horizontal Air Inlet Valve - 5204803
Offset Air Inlet Valve, Horizontal Air Cleaner - DCM1300
Optional Remote Air Cleaner Mount - DCM1400
Heat Exchanger - DCM0116
Belt Cover Assembly - DCM0507
Air/Oil Receiver Tank – DCM0806
Pressure Control Head - DCM1002
Air/Oil Receiver Tank, Heat Exchanger, Pressure Control Head – DCM1901
Air/Oil Receiver Tank Mounting Bracket - 4037950
Compressor Assembly - DCM0905
CAFS Compressor Schematic - DCS0504

SECTION 4 – AutoCAFS Commander Control Module

Description, Operation & Installation Ref. ----------

---------- (Vendor/Manufacturer Supplied Commander Manual/Instructions) **1200625**

SECTION 5 – Foam Proportioner

Description, Operation & Maintenance ---------- (Apparatus Manufacturer Supplied Proportioner Manuals)

SECTION 6 – Operation of Apparatus Compressed Air Foam System

Description and Operation---------- **1200625**

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Fast CAFS Schematic - DCS0201
Fast CAFS Instruction - 1205510
CAFS Compressor Schematic - DCS0504
1 ½" CAFS Check Valve Assembly - DCM0300
2" & 2 ½" CAFS Check Valve Assembly - DCM0301
4" CAFS Check Valve Assembly - DCM0302

Trouble-shooting---------- **1200625**

Class A Foam References---------- **1200625**

Appendix

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Air Distribution Manifold Assembly – DCM1701
1/2" Air Distribution Valve Assembly – DCM1801

Prepared by: RJG
Approved by: MCR
Revised by: RJG

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Section 1

Definition of Symbols and Immediate Safety Information

IMPORTANT

Throughout this manual will find Caution, Warning and Danger symbols. Please pay close attention to these symbols as they are for your safety.

⚠ DANGER - Signifies an imminently hazardous situation that could result in death or serious injury.

⚠ WARNING - Signifies a potentially hazardous situation that could result in death or serious injury.

⚠ CAUTION - Signifies a potentially hazardous situation that might result in minor or moderate injury.

CAUTION - Signifies a potentially hazardous situation that might result in property damage.

Intentionally ignoring any of these identified hazards is not recommended. W.S. Darley does not advise such actions or take responsibility for the actions of any operator of this unit.

SAFETY

Always read safety instructions indicated by any of the above symbols.

WARNING **When using *Compressed Air Foam*, the initial reaction force of opening the hose nozzle, is much greater than the normal operating force. The hose nozzle operators should brace themselves as if opening a nozzle on a high-pressure water line. The force on the operator will drop off quickly, becoming much easier to handle than a typical water line.**

WARNING

1) **Open and close valves slowly**
2) **Do not run with just air/water**
3) **Shut off air when foam tank is empty**
4) **Be prepared for high nozzle reactions – open nozzle slowly**

WARNING

1) **Do not exceed system rated pressure, capacity or speed.**
2) **Observe local regulations on the use of hearing protection.**
3) **Use only hoses with pressure rating higher than their intended use.**
4) **Remove all pressure from hoses before disconnecting.**
5) **Do not blow pressurized air against the skin.**
6) **Shutdown and depressurize completely before attempting maintenance.**
7) **Compressor oil and components are very hot during operation. Do not touch during or immediately after use.**

CAUTION **Avoid immediate restart of Compressor after shutdown. Allow a 1-minute minimum time period between compressor shutdown and restart for system blow-down.**

If maximum compressor speed is exceeded, compressor is automatically disengaged. The compressor will automatically re-engage if engine speed is reduced to 900 rpm or lower and system blow-down is completed.

CAUTION

- **Do not over speed compressor - Input RPM should not exceed that required to produce rated air flow of 220 cfm at 150 psi maximum pressure.**
- **Disengage air compressor when service testing or performing UL test on CAFS equipped vehicle.**

Section 2

Pump Assembly

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Description of Pump Type

The Type HMBC pump is a high speed, single stage, UL rated, centrifugal Fire Fighting Pump with an integral belt driven rotary screw air compressor for compressed air foam generation.

Inherent characteristics of the HMBC are compactness, lightweight, high efficiency, and combined with Compressed Air Foam (CAFS) at an 8:1 expansion ratio, the discharge will be the volume equivalent of 1600 GPM

The HMBC pump is a midship or rear mounted pump and is powered via a transmission driven Power Take Off (PTO)

OPERATION AND MAINTENANCE OF TYPE HMBC FIRE PUMP

Operation of Pump

Right, left, front and rear locations are referred to from a position facing the pump suction inlet.

This pump is driven from a standard automotive power take-off with sliding gear engagement. This power take-off is shifted from the driver's seat. The truck clutch must always be disengaged to stop the rotation of the truck transmission main drive gear while shifting the PTO. Engage the PTO after the pump has been primed.

CAUTION

Never run the pump dry except momentarily and at low speeds.

CAUTION

Do not use this pump for hose testing.

CAUTION

Do not over speed the compressor - Input RPM should not exceed that required to produce rated air flow of 220 cfm at 150 psi maximum pressure.

Disengage air compressor when service testing or performing UL test on CAFS equipped vehicle

Pump Gear Case Lubrication

Maintain gear case oil level to be just below the oil level plug which is marked on the pump gear case.

Check the oil level every 25 hours or every three months, whichever comes first. Change the oil every 50 hours or 6 months, whichever comes first.

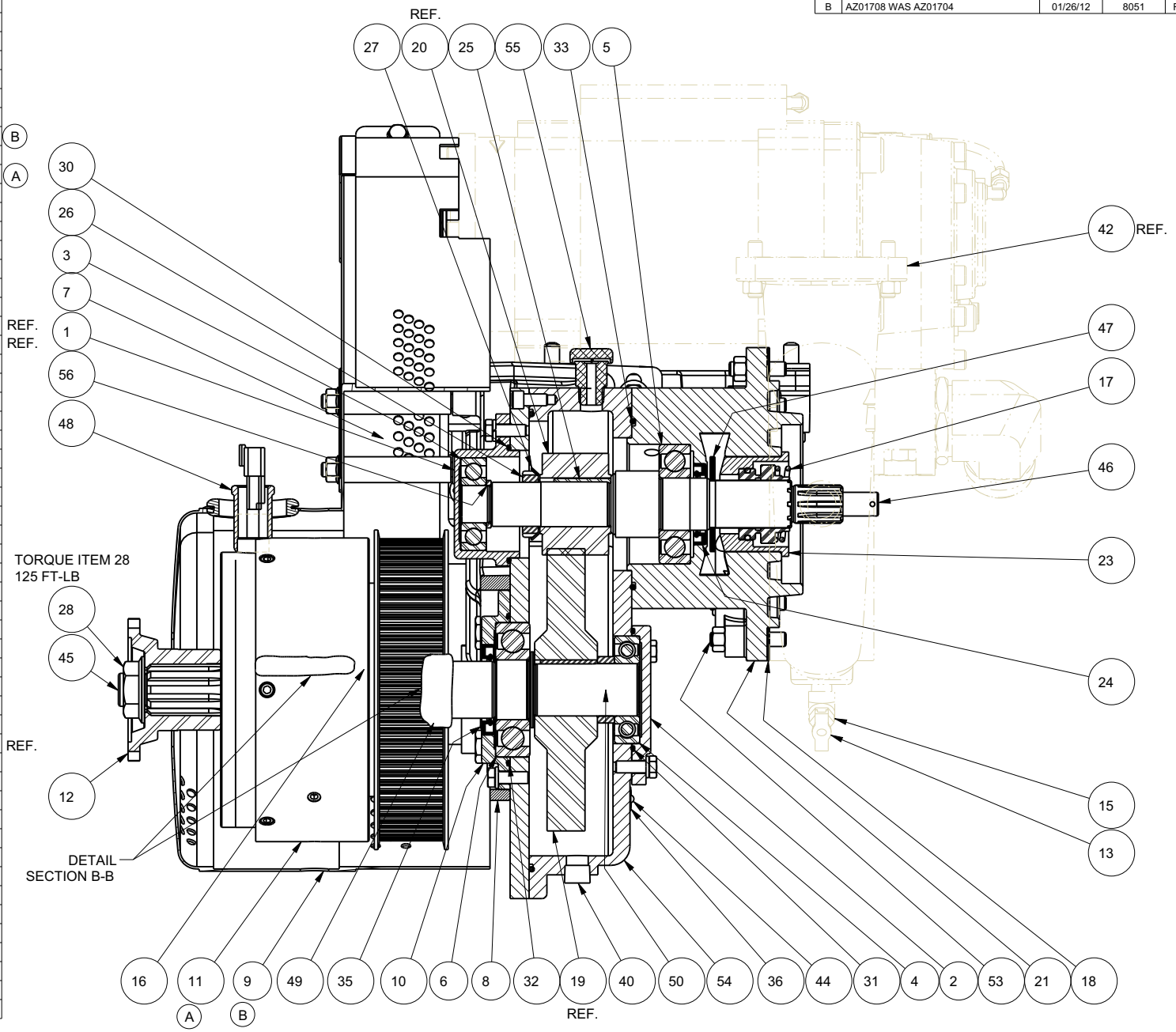
Service the pump transmission with SAE 80W/90, GL4/GL5 gear lubricant. Do not use grease.

CAUTION Do not overfill. Overfilling may cause excessive gear case operating temperatures.

Inject grease in zerk fittings on the driveline universal joints once a year.

NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING CAP	2300601	1
2	BEARING CAP	2301008	1
3	BEARING-BALL	1721702	1
4	BEARING-BALL, 207SF	1720103	1
5	BEARING-BALL, 307SF	1721903	1
6	BEARING-BALL, 308SF	1722001	1
7	BELT - GATESS POLY CHAIN CARBON	4210804	1
8	DWG - ASSEMBLY, MTG BRACKET	KM01501	1
9	CAFS - COVER ASSY, POLY CHAIN	AZ01708	1
10	CAP - BEARING, HMBC	2313800	1
11	CLUTCH - 12VDC, 600ft-lb, SEALED	4227402	1
12	COMP FLANGE - 1350/1410, 1.38"	4817807	1
13	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
14	DWG- ASSEMBLY, AIR END	AZ00407	1
15	ELBOW - PIPE, ST, 0.25, 45 DEG	1080803	1
16	KEY - RECT., 0.313 x .250 x 2.00	3602455	1
17	MECHANICAL SEAL - 1.25" WELD SPRING	1841205	1
18	GASKET - PUMP CASING, H	3809600	1
19	GEAR - DRIVE, H100, 12 DP	2713211	1
20	GEAR - PINION, H100, 12DP	2713911	1
21	HEAD - INBOARD, HM	2803609	1
22	HHCS - .313-18 x 0.88, GR5	5400019	13
23	HOUSING - MECHANICAL SEAL	1840600	1
24	OIL SEAL - 1.375 ID X 2.129 OD	3600545	1
25	KEY - SQ., 0.19X1.50 GR2	3602441	2
26	LOCKNUT - BEARING, NO6	3602106	1
27	LOCKWASHER - BEARING, WO6	3602126	1
28	NUT - FLANGE, 7/8-14	4814501	1
29	NUT - HEX, .375-16, GR2	5403002	16
30	O-RING - 2.88 x 3.06 X 0.09	3601126	1
31	O-RING - 3.00 x 3.19 X 0.09	3601125	1
32	O-RING - 3.75 x 3.94 X 0.09	3601133	1
33	O-RING - 4.25 x 4.50 X 0.12	3601239	1
35	OIL SEAL - 1.500 ID X 2.375 OD	3600532	1
36	PLATE - OIL LEVEL	1960400	2
37	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
38	PLUG - PIPE, 0.125, ZN SOC HD	1080537	3
39	PLUG - PIPE, 0.250, SST SOC HD	1080535	1
40	PLUG - PIPE, 0.375, MAG SOC HD	1080538	1
41	PLUG -1"-14	4402900	1
42	PUMP CASING - H, CAST IRON	2052700	1
43	QUAD RING - 3.25 x 3.62 x 0.19	3601610	1
44	SCREW - DRIVE, NO.4 X 0.25 AL	5402820	4
45	SHAFT - DRIVE, HMBC, NO TACH	5017010	1
46	SHAFT - IMPELLER, HH500, MECH	5004201	1
47	SLINGER - WATER, H500, 1.21 ID	3203204	1
48	POST - CLUTCH ANTI-ROTATION	4428800	1
49	SPACER - 1.38 X 1.75 X 0.15	3302005	1
50	SPACER - 1.38 X 1.75 X .448	3302010	1
52	STUD - 0.375-16 X 1.500, GR5	3606203	14
53	STUD - 0.375-16 X 2.000, GR5	3606206	2
54	TRANS - GEARCASE ASSY, HMBC	TG00326	1
55	VENT - GEARCASE	4401800	1
56	WASHER - .99 x 1.25 x .12 STL	3603018	1
57	WASHER - LOCK, 0.313 ID	3603502	13

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REDESIGNED WITH CJ CLUTCH	12/09/10	6842	RJG
B	AZ01708 WAS AZ01704	01/26/12	8051	RJG



SECTION A-A
DETAIL SECTION B-B

REMOVE SHARP EDGES

INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

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ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

MODEL NAME	MDL CREATED	SHEET	
DHC2330	03/11/10	1/4	C

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, BELT DRIVEN 225CFM COMP MECH., X-SEC, EXPLODED VIEW, CLUTCHED

DR'N RJG
CHKD MCR
TRCD

DATE 08-Mar-10
SCALE 1/2

DHC2330

NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING CAP	2300601	1
2	BEARING CAP	2301008	1
3	BEARING-BALL	1721702	1
4	BEARING-BALL, 207SF	1720103	1
5	BEARING-BALL, 307SF	1721903	1
6	BEARING-BALL, 308SF	1722001	1
8	DWG - ASSEMBLY, MTG BRACKET	KM01501	1
10	CAP - BEARING, HMBC	2313800	1
11	CLUTCH - 12VDC, 600ft-lb, SEALED	4227402	1
12	COMP FLANGE - 1350/1410, 1.38"	4817807	1
13	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
14	DWG- ASSEMBLY, AIR END	AZ00407	1
15	ELBOW - PIPE, ST, 0.25, 45 DEG	1080803	1
16	KEY - RECT., 0.313 x .250 x 2.00	3602455	1
17	MECHANICAL SEAL - 1.25" WELD SPRING	1841205	1
18	GASKET - PUMP CASING, H	3809600	1
19	GEAR - DRIVE, H100, 12 DP	2713211	1
20	GEAR - PINION, H100, 12DP	2713911	1
21	HEAD - INBOARD, HM	2803609	1
22	HHCS - .313-18 x 0.88, GR5	5400019	13
23	HOUSING - MECHANICAL SEAL	1840600	1
24	OIL SEAL - 1.375 ID X 2.129 OD	3600545	1
25	KEY - SQ., 0.19X1.50 GR2	3602441	2
26	LOCKNUT - BEARING, NO6	3602106	1
27	LOCKWASHER - BEARING, WO6	3602126	1
28	NUT - FLANGE, 7/8-14	4814501	1
29	NUT - HEX, .375-16, GR2	5403002	16
30	O-RING - 2.88 x 3.06 X 0.09	3601126	1
31	O-RING - 3.00 x 3.19 X 0.09	3601125	1
32	O-RING - 3.75 x 3.94 X 0.09	3601133	1
33	O-RING - 4.25 x 4.50 X 0.12	3601239	1
35	OIL SEAL - 1.500 ID X 2.375 OD	3600532	1
36	PLATE - OIL LEVEL	1960400	2
37	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
38	PLUG - PIPE, 0.125, ZN SOC HD	1080537	3
39	PLUG - PIPE, 0.250, SST SOC HD	1080535	1
40	PLUG - PIPE, 0.375, MAG SOC HD	1080538	1
41	PLUG -1"-14	4402900	1
42	PUMP CASING - H, CAST IRON	2052700	1
43	QUAD RING - 3.25 x 3.62 x 0.19	3601610	1
44	SCREW - DRIVE, NO.4 X 0.25 AL	5402820	4
45	SHAFT - DRIVE, HMBC, NO TACH	5017010	1
46	SHAFT - IMPELLER, HH500, MECH	5004201	1
47	SLINGER - WATER, H500, 1.21 ID	3203204	1
48	POST - CLUTCH ANTI-ROTATION	4428800	1
49	SPACER - 1.38 X 1.75 X 0.15	3302005	1
50	SPACER - 1.38 X 1.75 X .448	3302010	1
52	STUD - 0.375-16 X 1.500, GR5	3606203	14
53	STUD - 0.375-16 X 2.000, GR5	3606206	2
54	TRANS - GEARCASE ASSY, HMBC	TG00326	1
55	VENT - GEARCASE	4401800	1
56	WASHER - .99 x 1.25 x .12 STL	3603018	1
57	WASHER - LOCK, 0.313 ID	3603502	13

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
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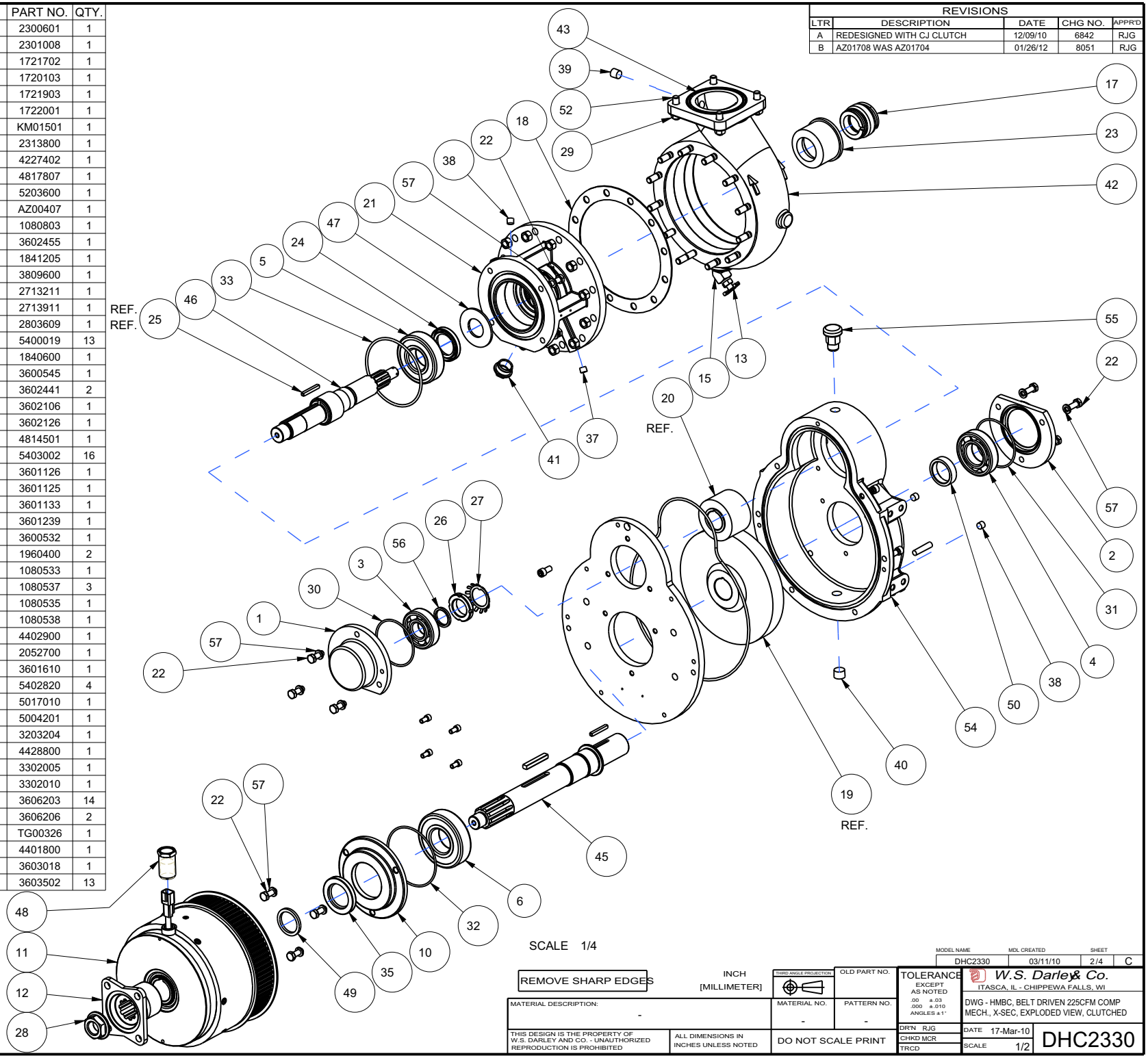

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

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MODEL NAME	MDL CREATED	SHEET	
DHC2330	03/11/10	2/4	C

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, BELT DRIVEN 225CFM COMP MECH., X-SEC, EXPLODED VIEW, CLUTCHED

DR'N RJG
CHKD MCR
TRCD

DATE 17-Mar-10
SCALE 1/2

DHC2330

NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING CAP	2300601	1
2	BEARING CAP	2301008	1
3	BEARING-BALL	1721702	1
4	BEARING-BALL, 207SF	1720103	1
5	BEARING-BALL, 307SF	1721903	1
6	BEARING-BALL, 308SF	1722001	1
7	BELT - GATESS POLY CHAIN CARBON	4210804	1
8	DWG - ASSEMBLY, MTG BRACKET	KM01501	1
9	CAFS - COVER ASSY, POLY CHAIN	AZ01708	1 B
10	CAP - BEARING, HMBC	2313800	1
11	CLUTCH - 12VDC, 600ft-lb, SEALED	4227402	1
12	COMP FLANGE - 1350/1410, 1.38"	4817807	1
13	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
14	DWG- ASSEMBLY, AIR END	AZ00407	1
15	ELBOW - PIPE, ST, 0.25, 45 DEG	1080803	1
16	KEY - RECT., 0.313 x .250 x 2.00	3602455	1
17	MECHANICAL SEAL - 1.25" WELD SPRING	1841205	1
18	GASKET - PUMP CASING, H	3809600	1
19	GEAR - DRIVE, H100, 12 DP	2713211	1 REF.
20	GEAR - PINION, H100, 12DP	2713911	1 REF.
21	HEAD - INBOARD, HM	2803609	1
22	HHCS - .313-18 x 0.88, GR5	5400019	13
23	HOUSING - MECHANICAL SEAL	1840600	1
24	OIL SEAL - 1.375 ID X 2.129 OD	3600545	1
25	KEY - SQ., 0.19X1.50 GR2	3602441	2
26	LOCKNUT - BEARING, NO6	3602106	1
27	LOCKWASHER - BEARING, WO6	3602126	1
28	NUT - FLANGE, 7/8-14	4814501	1
29	NUT - HEX, .375-16, GR2	5403002	16
30	O-RING - 2.88 x 3.06 X 0.09	3601126	1
31	O-RING - 3.00 x 3.19 X 0.09	3601125	1
32	O-RING - 3.75 x 3.94 X 0.09	3601133	1
33	O-RING - 4.25 x 4.50 X 0.12	3601239	1
35	OIL SEAL - 1.500 ID X 2.375 OD	3600532	1
36	PLATE - OIL LEVEL	1960400	2
37	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
38	PLUG - PIPE, 0.125, ZN SOC HD	1080537	3
39	PLUG - PIPE, 0.250, SST SOC HD	1080535	1
40	PLUG - PIPE, 0.375, MAG SOC HD	1080538	1
41	PLUG -1"-14	4402900	1
42	PUMP CASING - H, CAST IRON	2052700	1
43	QUAD RING - 3.25 x 3.62 x 0.19	3601610	1
44	SCREW - DRIVE, NO.4 X 0.25 AL	5402820	4
45	SHAFT - DRIVE, HMBC, NO TACH	5017010	1
46	SHAFT - IMPELLER, HH500, MECH	5004201	1
47	SLINGER - WATER, H500, 1.21 ID	3203204	1
48	POST - CLUTCH ANTI-ROTATION	4428800	1
49	SPACER - 1.38 X 1.75 X 0.15	3302005	1
50	SPACER - 1.38 X 1.75 X .448	3302010	1
52	STUD - 0.375-16 X 1.500, GR5	3606203	14
53	STUD - 0.375-16 X 2.000, GR5	3606206	2
54	TRANS - GEARCASE ASSY, HMBC	TG00326	1
55	VENT - GEARCASE	4401800	1
56	WASHER - .99 x 1.25 x .12 STL	3603018	1
57	WASHER - LOCK, 0.313 ID	3603502	13

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
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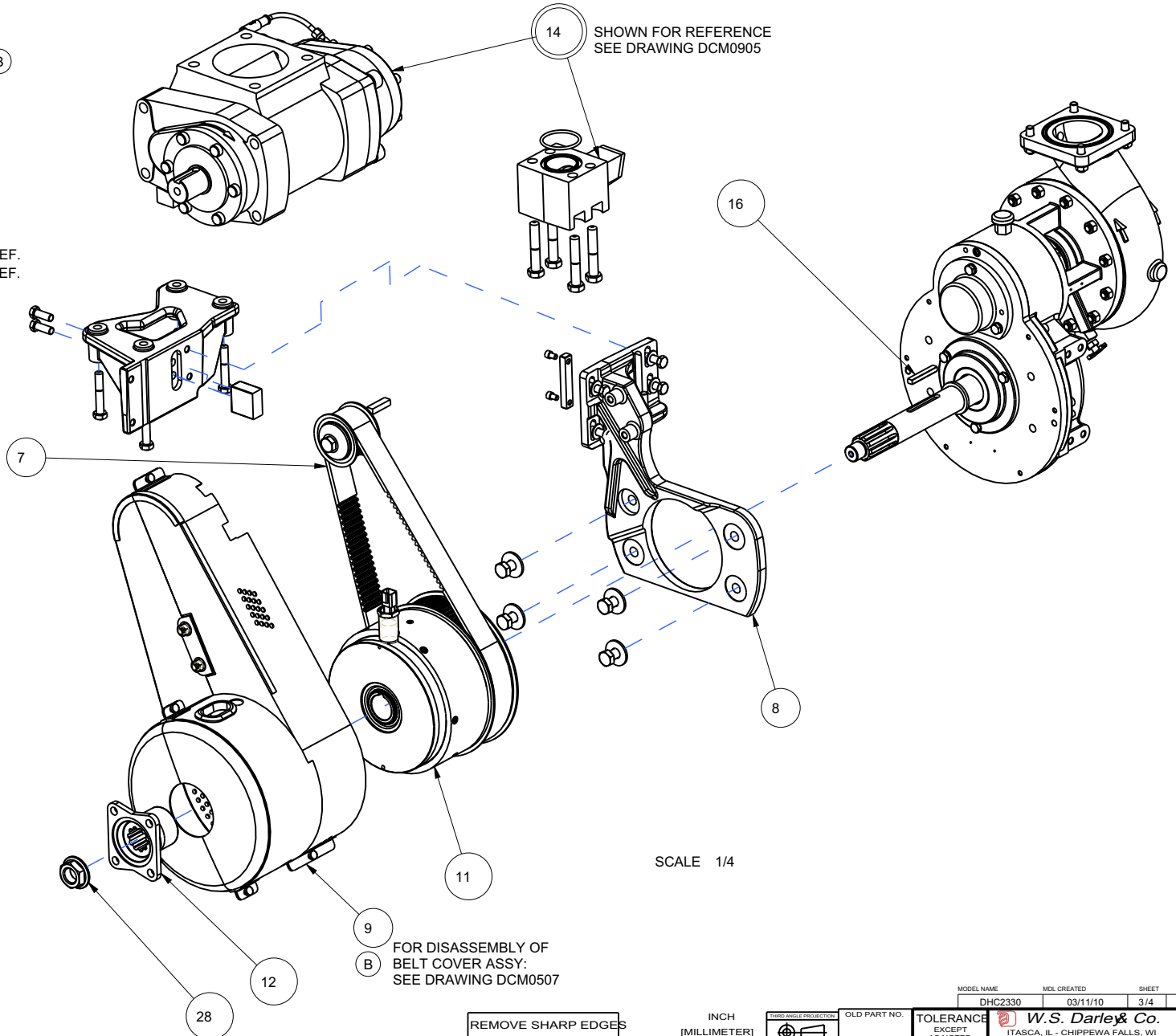
B	AZ01708 WAS AZ01704	01/26/12	8051	RJG



MODEL NAME	MDL CREATED	SHEET	
DHC2330	03/11/10	3/4	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, BELT DRIVEN 225CFM COMP MECH., X-SEC, EXPLODED VIEW, CLUTCHED

DR'N RJG | DATE 15-Mar-10 | CHKD MCR | SCALE 1/4 | TRCD

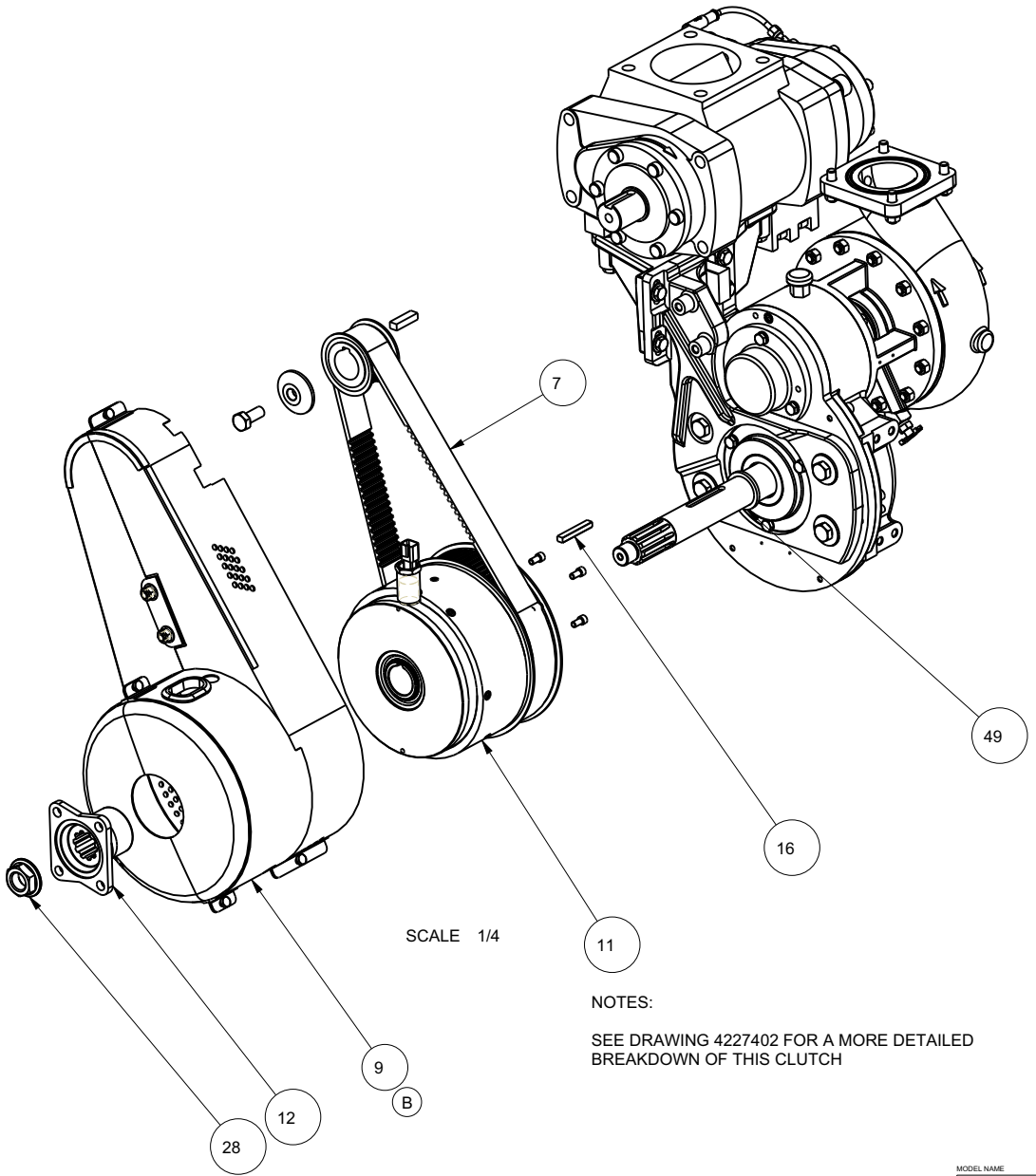
DHC2330

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.	
1	BEARING CAP	2300601	1	
2	BEARING CAP	2301008	1	
3	BEARING-BALL	1721702	1	
4	BEARING-BALL, 207SF	1720103	1	
5	BEARING-BALL, 307SF	1721903	1	
6	BEARING-BALL, 308SF	1722001	1	
7	BELT - GATESS POLY CHAIN CARBON	4210804	1	
8	DWG - ASSEMBLY, MTG BRACKET	KM01501	1	
9	CAFS - COVER ASSY, POLY CHAIN	AZ01708	1	B
10	CAP - BEARING, HMBC	2313800	1	
11	CLUTCH - 12VDC, 600ft-lb, SEALED	4227402	1	
12	COMP FLANGE - 1350/1410, 1.38"	4817807	1	
13	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1	
14	DWG- ASSEMBLY, AIR END	AZ00407	1	
15	ELBOW - PIPE, ST, 0.25, 45 DEG	1080803	1	
16	KEY - RECT., 0.313 x .250 x 2.00	3602455	1	
17	MECHANICAL SEAL - 1.25" WELD SPRING	1841205	1	
18	GASKET - PUMP CASING, H	3809600	1	
19	GEAR - DRIVE, H100, 12 DP	2713211	1	REF.
20	GEAR - PINION, H100, 12DP	2713911	1	REF.
21	HEAD - INBOARD, HM	2803609	1	
22	HHCS - .313-18 x 0.88, GR5	5400019	13	
23	HOUSING - MECHANICAL SEAL	1840600	1	
24	OIL SEAL - 1.375 ID X 2.129 OD	3600545	1	
25	KEY - SQ., 0.19X1.50 GR2	3602441	2	
26	LOCKNUT - BEARING, NO6	3602106	1	
27	LOCKWASHER - BEARING, WO6	3602126	1	
28	NUT - FLANGE, 7/8-14	4814501	1	
29	NUT - HEX, .375-16, GR2	5403002	16	
30	O-RING - 2.88 x 3.06 X 0.09	3601126	1	
31	O-RING - 3.00 x 3.19 X 0.09	3601125	1	
32	O-RING - 3.75 x 3.94 X 0.09	3601133	1	
33	O-RING - 4.25 x 4.50 X 0.12	3601239	1	
35	OIL SEAL - 1.500 ID X 2.375 OD	3600532	1	
36	PLATE - OIL LEVEL	1960400	2	
37	PLUG - PIPE, 0.125, SST SOC HD	1080533	1	
38	PLUG - PIPE, 0.125, ZN SOC HD	1080537	3	
39	PLUG - PIPE, 0.250, SST SOC HD	1080535	1	
40	PLUG - PIPE, 0.375, MAG SOC HD	1080538	1	
41	PLUG -1"-14	4402900	1	
42	PUMP CASING - H, CAST IRON	2052700	1	
43	QUAD RING - 3.25 x 3.62 x 0.19	3601610	1	
44	SCREW - DRIVE, NO.4 X 0.25 AL	5402820	4	
45	SHAFT - DRIVE, HMBC, NO TACH	5017010	1	
46	SHAFT - IMPELLER, HH500, MECH	5004201	1	
47	SLINGER - WATER, H500, 1.21 ID	3203204	1	
48	POST - CLUTCH ANTI-ROTATION	4428800	1	
49	SPACER - 1.38 X 1.75 X 0.15	3302005	1	
50	SPACER - 1.38 X 1.75 X .448	3302010	1	
52	STUD - 0.375-16 X 1.500, GR5	3606203	14	
53	STUD - 0.375-16 X 2.000, GR5	3606206	2	
54	TRANS - GEARCASE ASSY, HMBC	TG00326	1	
55	VENT - GEARCASE	4401800	1	
56	WASHER - .99 x 1.25 x .12 STL	3603018	1	
57	WASHER - LOCK, 0.313 ID	3603502	13	

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REDESIGNED WITH CJ CLUTCH	12/09/10	6842	RJG
B	AZ01708 WAS AZ01704	01/26/12	8051	RJG



SCALE 1/4

NOTES:

SEE DRAWING 4227402 FOR A MORE DETAILED BREAKDOWN OF THIS CLUTCH

TORQUE ITEM 28
125 FT-LB

MODEL NAME	MDL CREATED	SHEET	
DHC2330	03/11/10	4/4	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, BELT DRIVEN 225CFM COMP MECH., X-SEC, EXPLODED VIEW, CLUTCHED

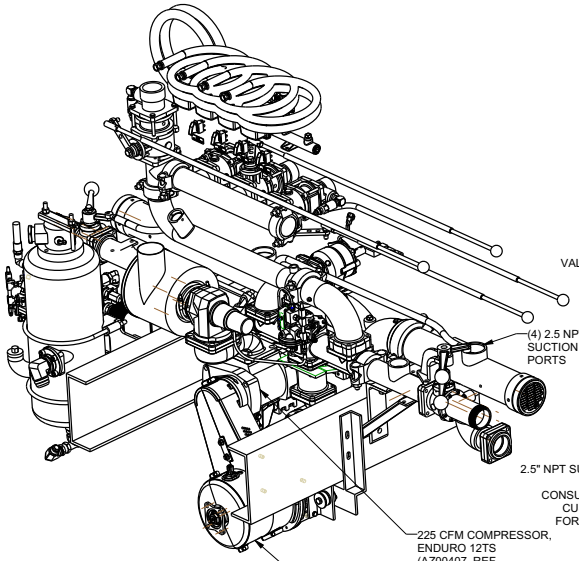
DR'N RJG | DATE 15-Mar-10 | CHKD MCR | SCALE 1/4 | TRCD

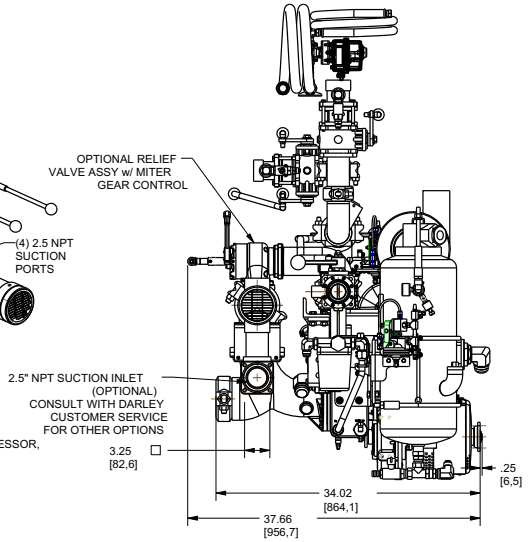
DHC2330

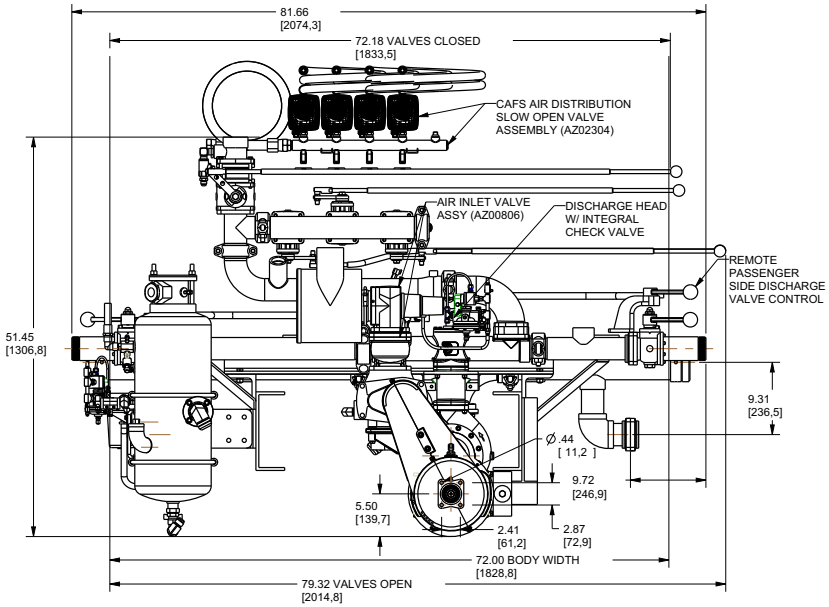
ALL DIMENSIONS IN INCHES UNLESS NOTED

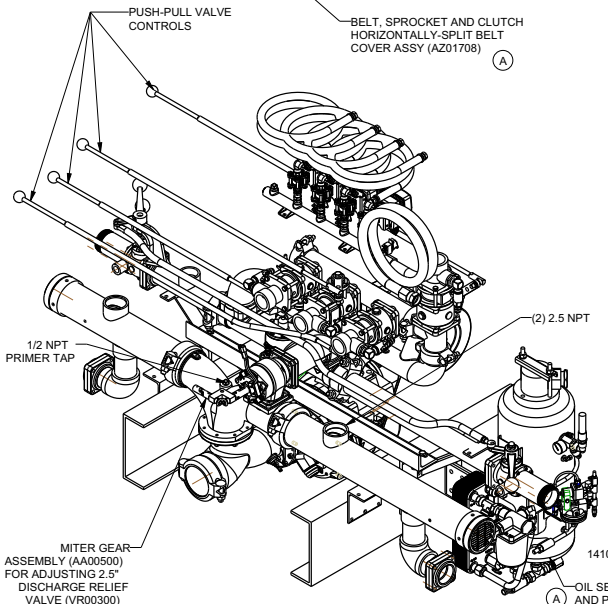
DO NOT SCALE PRINT

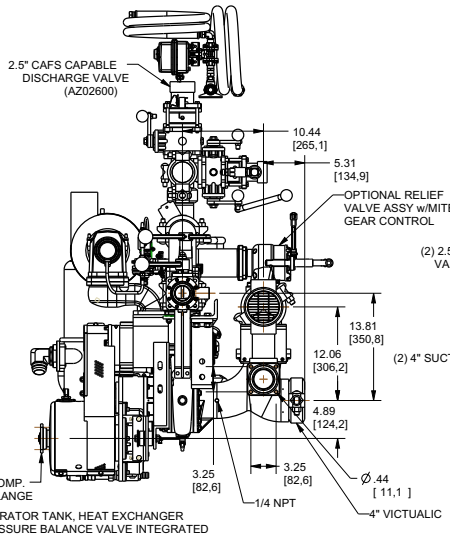
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD
A	AZ01708 WAS AZ01704. REPLACED INDIVIDUAL CAFS ASSY'S WITH INTEGRATED ASSY.	01/26/12	8051	RJG

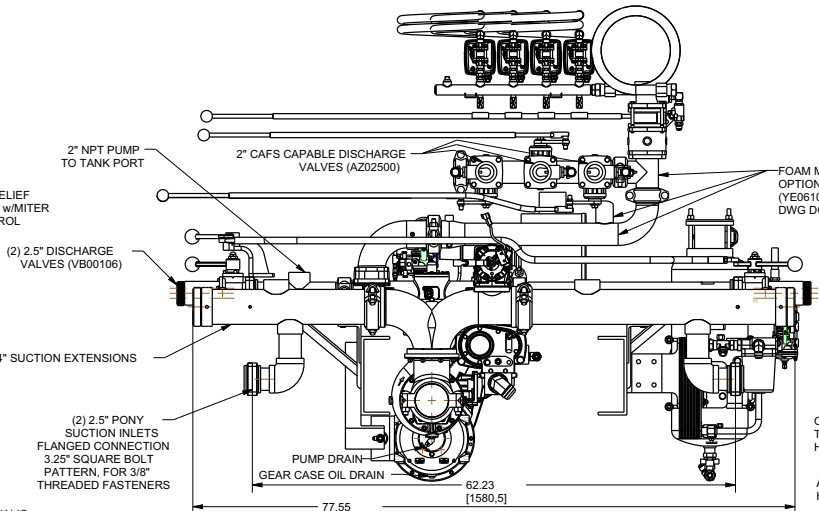












A OIL SEPARATOR TANK, HEAT EXCHANGER AND PRESSURE BALANCE VALVE INTEGRATED ASSY.
THIS ASSY CAN BE RELOCATED IN RELATION TO THE PUMP/COMPRESSOR UNIT. RECOMMENDED MOUNTING HEIGHT IS WHERE THE OIL SEPARATOR TANK OIL LEVEL IS AT OR BELOW THE COMPRESSOR ROTOR CENTERLINE.
(AZ03201, REF. DWG. DCM1901)

PTO DRIVE - ENGINE ROTATION ONLY

REMOVE SHARP EDGES | INCH [MILLIMETER] | OLD PART NO. | TOLERANCE EXCEPT AS NOTED .00 ± .03 .000 ± .010 ANGLES ± 1° | W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: - | MATERIAL NO. | PATTERN NO. | DWG - HMBC, 225 CFM INTEGRATED BELT COMP. DIM., TAMROTOR ENDURO 12TS, #4 ASSY

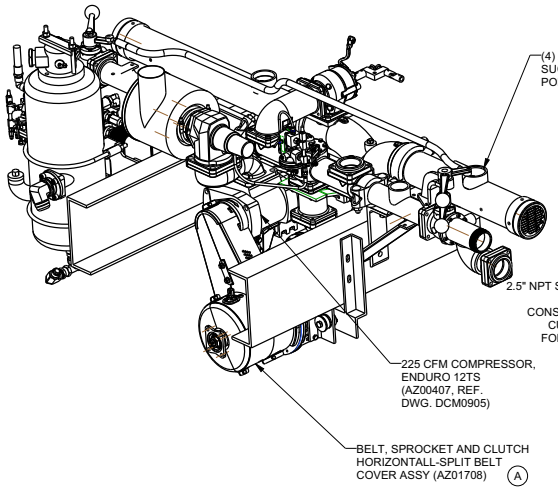
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

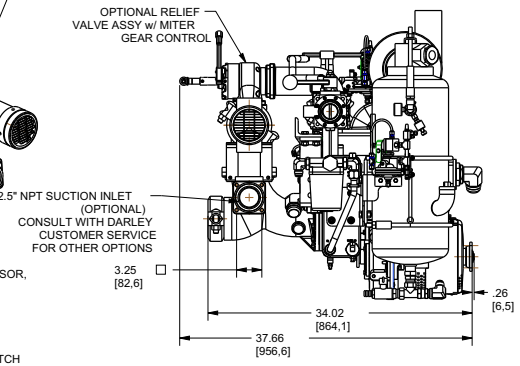
DRN RJG | CHKD MCR | TRCD | DATE 03/24/10 | SCALE 1/8

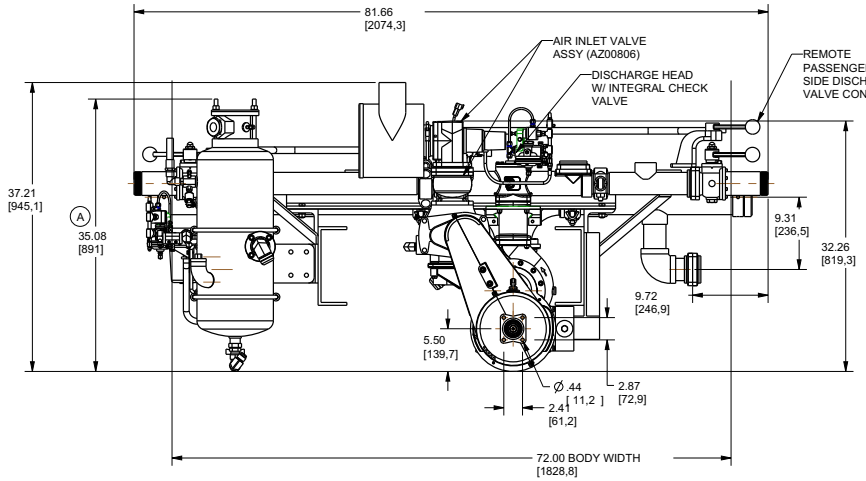
MODEL NAME	MDL CREATED	SHEET	
DHD2110	03/24/10	1/1	D

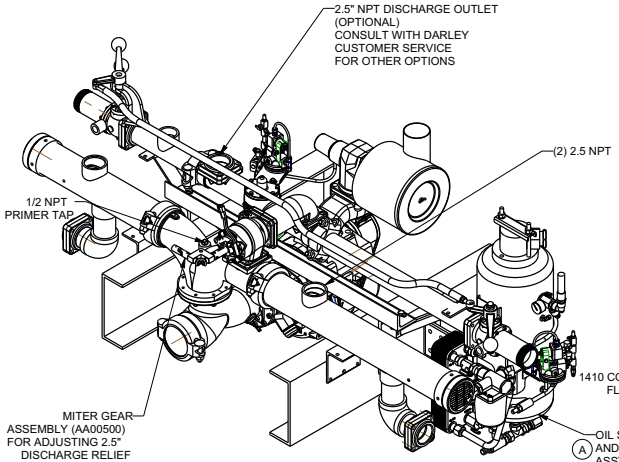
DHD2110

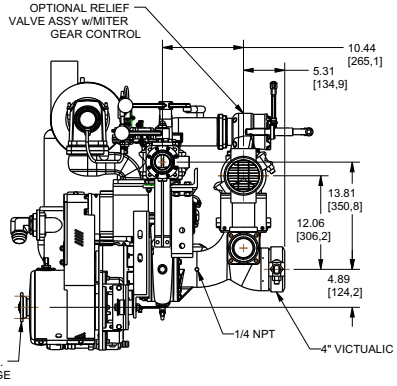
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD
A	AZ01708 WAS AZ01704. REPLACED INDIVIDUAL CAFS ASSY'S WITH INTEGRATED ASSY.	01/26/12	8051	RJG



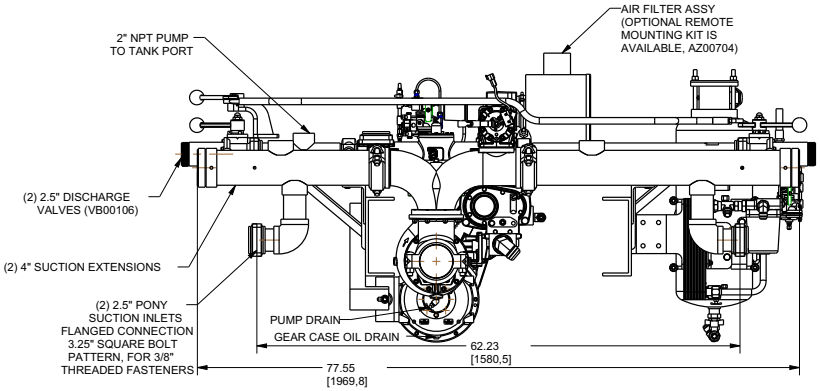








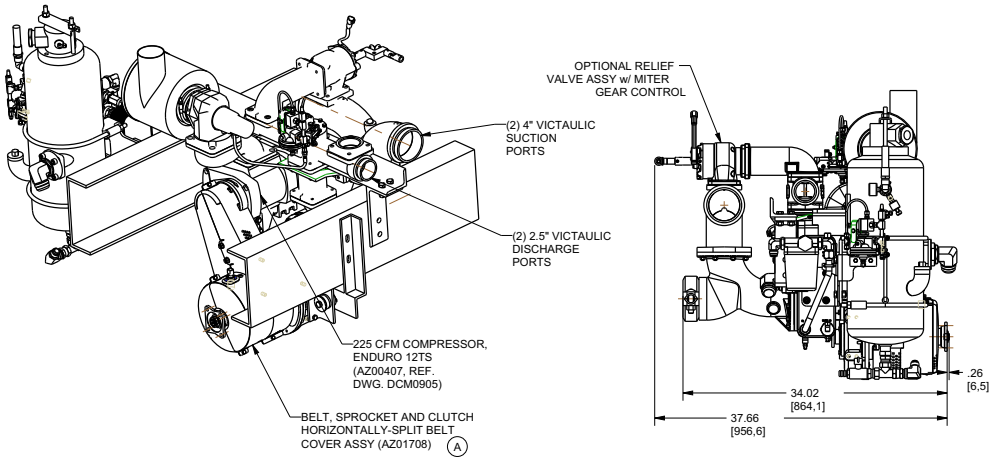
A OIL SEPARATOR TANK, HEAT EXCHANGER AND PRESSURE BALANCE VALVE INTEGRATED ASSY.
THIS ASSY CAN BE RELOCATED IN RELATION TO THE PUMP/COMPRESSOR UNIT. RECOMMENDED MOUNTING HEIGHT IS WHERE THE OIL SEPARATOR TANK OIL LEVEL IS AT OR BELOW THE COMPRESSOR ROTOR CENTERLINE.
(AZ03201, REF. DWG. DCM1901)

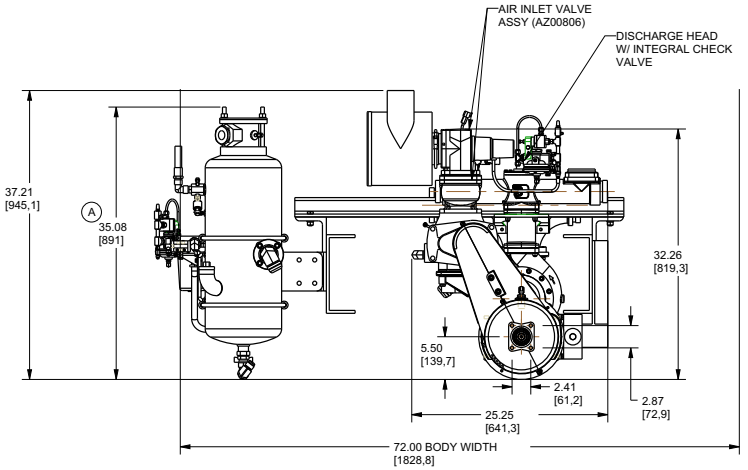


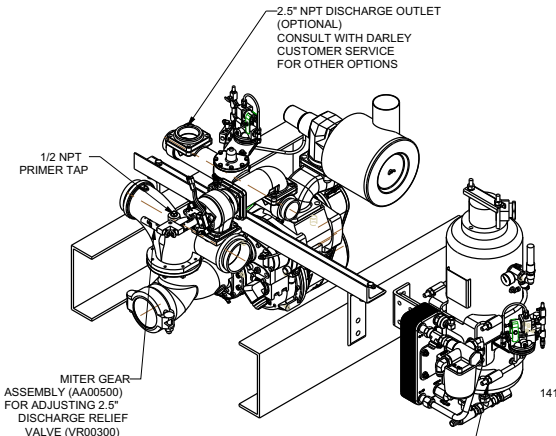
PTO DRIVE - ENGINE ROTATION ONLY

MODEL NAME	MDL CREATED	SHEET				
DHD2120	03/24/10	1/1	D			
REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI	
MATERIAL DESCRIPTION: -		MATERIAL NO.	PATTERN NO.		DWG - HMBC, 225 CFM INTEGRATED BELT COMP. DIM., TAMROTOR ENDURO 12TS, #3 ASSY	
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT		DRN RJG CHKD MCR TRCD	DATE 03/24/10 SCALE 1/8	DHD2120

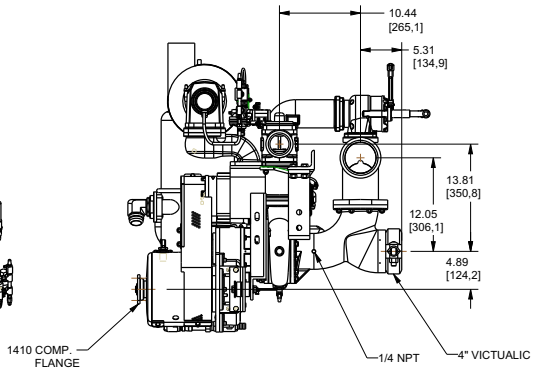
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD
A	AZ01708 WAS AZ01704. REPLACED INDIVIDUAL CAFS ASSY'S WITH INTEGRATED ASSY.	01/26/12	8051	RJG

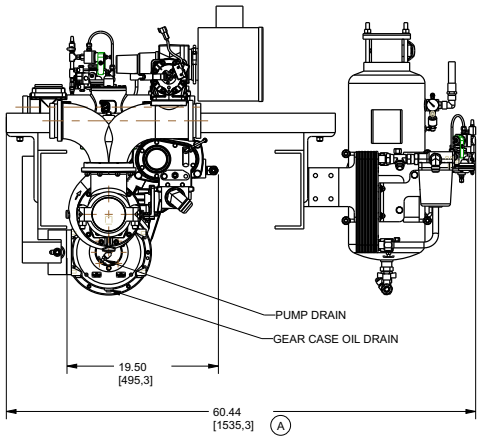






A OIL SEPARATOR TANK, HEAT EXCHANGER AND PRESSURE BALANCE VALVE INTEGRATED ASSY.
THIS ASSY CAN BE RELOCATED IN RELATION TO THE PUMP/COMPRESSOR UNIT. RECOMMENDED MOUNTING HEIGHT IS WHERE THE OIL SEPARATOR TANK OIL LEVEL IS AT OR BELOW THE COMPRESSOR ROTOR CENTERLINE. (AZ03201, REF. DWG. DCM1901)



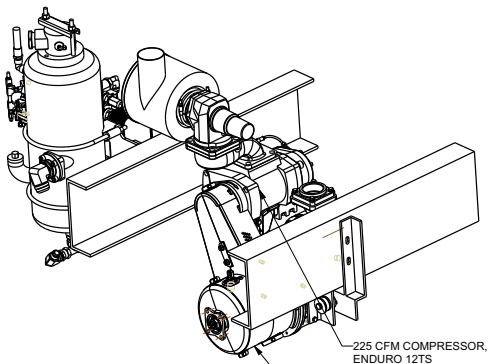


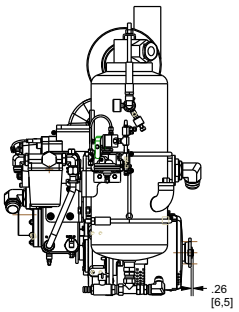
PTO DRIVE - ENGINE ROTATION ONLY

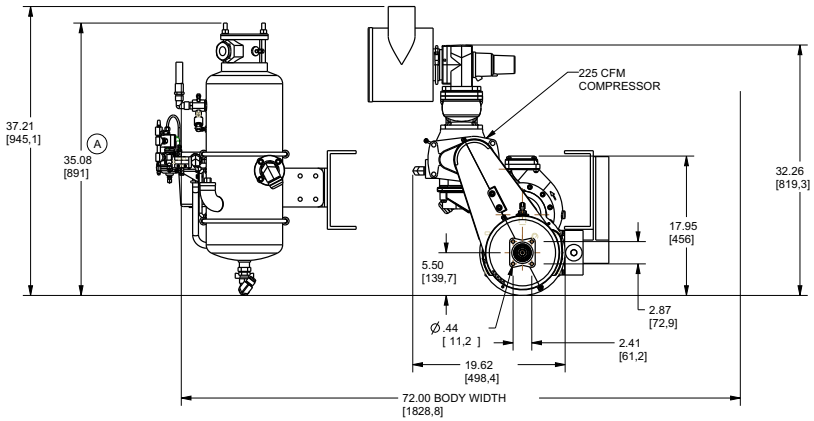
REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ± .03 .000 ± .010 ANGLES ± 1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI	
MATERIAL DESCRIPTION: -		MATERIAL NO.	PATTERN NO.		DWG - HMBC, 225 CFM INTEGRATED BELT COMP. DIM., TAMROTOR ENDURO 12TS, #2 ASSY	
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT		DRN RJG CHKD MCR TRCD	DATE 03/24/10 SCALE 1/8	DHD2130

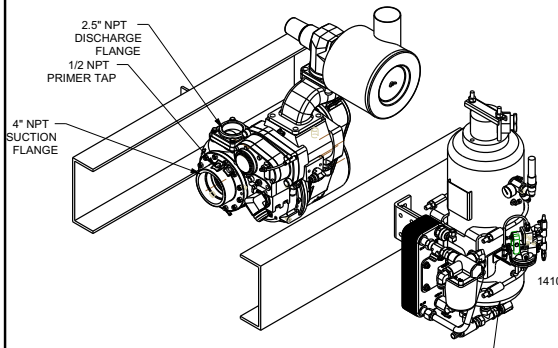
MODEL NAME	MDL CREATED	SHEET	
DHD2130	03/24/10	1/1	D

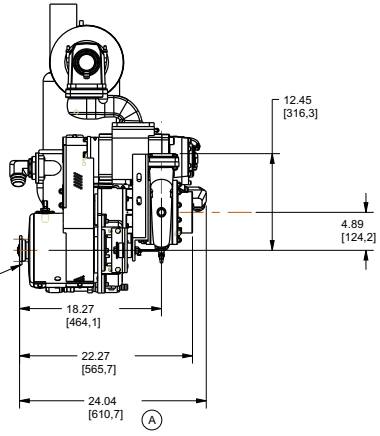
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD
A	AZ01708 WAS AZ01704. REPLACED INDIVIDUAL CAFS ASSY'S WITH INTEGRATED ASSY.	01/26/12	8051	RJG



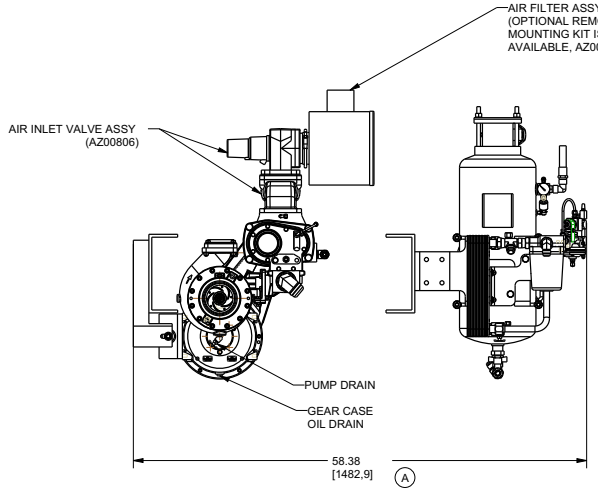








THIS ASSY CAN BE RELOCATED IN RELATION TO THE PUMP/COMPRESSOR UNIT. RECOMMENDED MOUNTING HEIGHT IS WHERE THE OIL SEPARATOR TANK OIL LEVEL IS AT OR BELOW THE COMPRESSOR ROTOR CENTERLINE. (AZ03201, REF. DWG. DCM1901)



PTO DRIVE - ENGINE ROTATION ONLY

MODEL NAME	MDL CREATED	SHEET					
DHD2140	03/24/10	1/1	D				
REMOVE SHARP EDGES	INCH [MILLIMETER]						
MATERIAL DESCRIPTION: -		MATERIAL NO.	PATTERN NO.				
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT					

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, 225 CFM INTEGRATED BELT COMP. DIM., TAMROTOR ENDURO 12TS, #1 ASSY

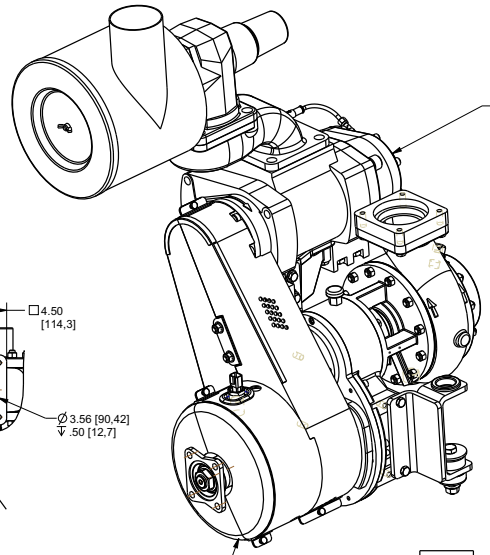
DRN RJG | CHKD MCR | TRCD

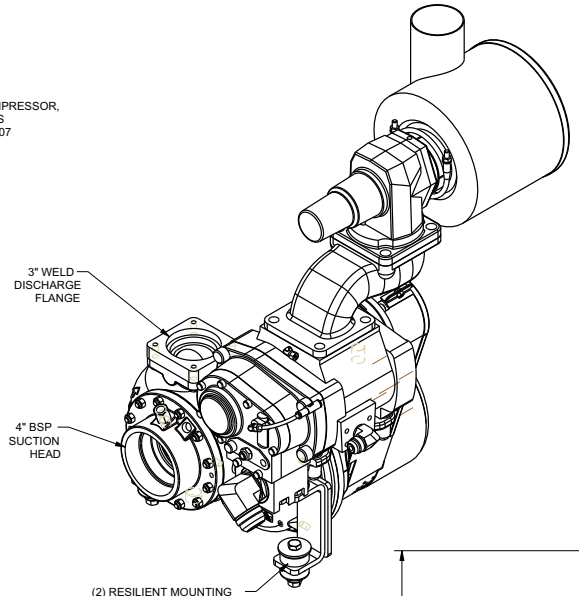
DATE: 03/24/10

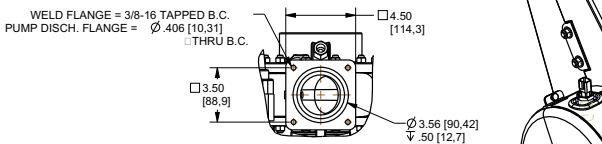
SCALE 1/8

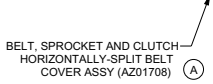
DHD2140

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRVD
A	AZ01708 WAS AZ01704	01/26/12	8051	RJG

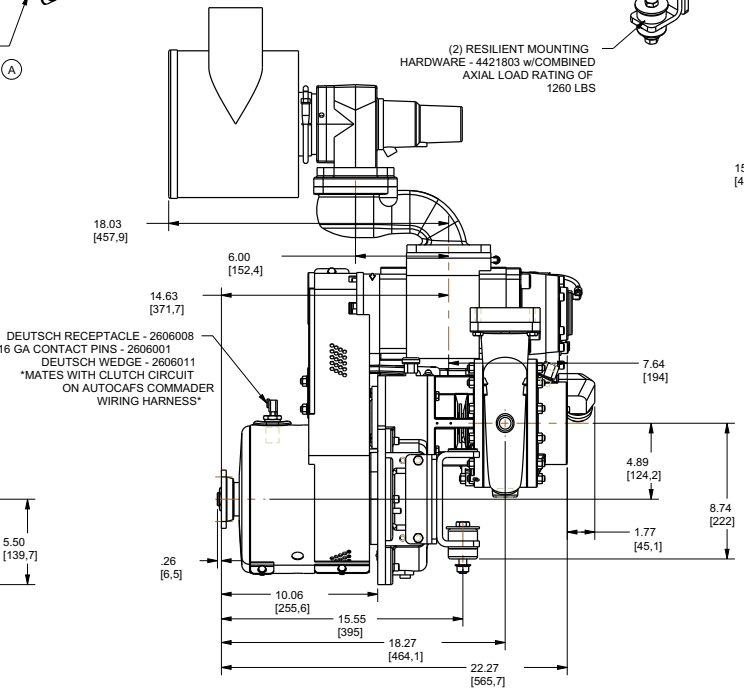


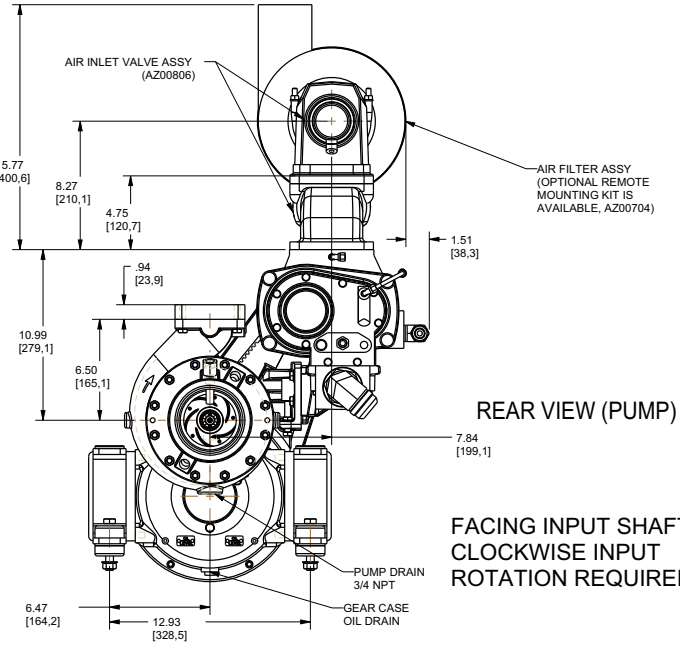






FRONT VIEW
(COMP. FLANGE)





REAR VIEW (PUMP)

FACING INPUT SHAFT
CLOCKWISE INPUT
ROTATION REQUIRED

APPROX. WEIGHT = 400 LB

REMOVE SHARP EDGES

INCH [MILLIMETER]

MATERIAL DESCRIPTION: -

MATERIAL NO.

PATTERN NO.

OLD PART NO.

TOLERANCE EXCEPT AS NOTED: .00 ± .03, .000 ± .010, ANGLES ± 1°

DRN RJG

CHKD MCR

TRCD

DATE 03/24/10

SCALE 1/4

MODEL NAME DHD2141 | MDL CREATED 12/15/11 | SHEET 1/1 | D

W.S. Darley & Co.
OIL FILTER
SPRCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, 225 CFM INTEG. BELT COMP., CHINA
DIM., TAM E1270, 3" WELD DISCH., 4" BSP THRD SUCT.

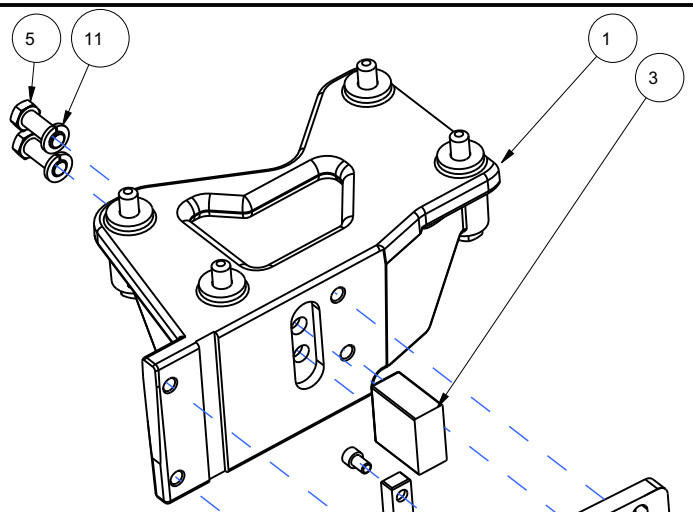
DHD2141

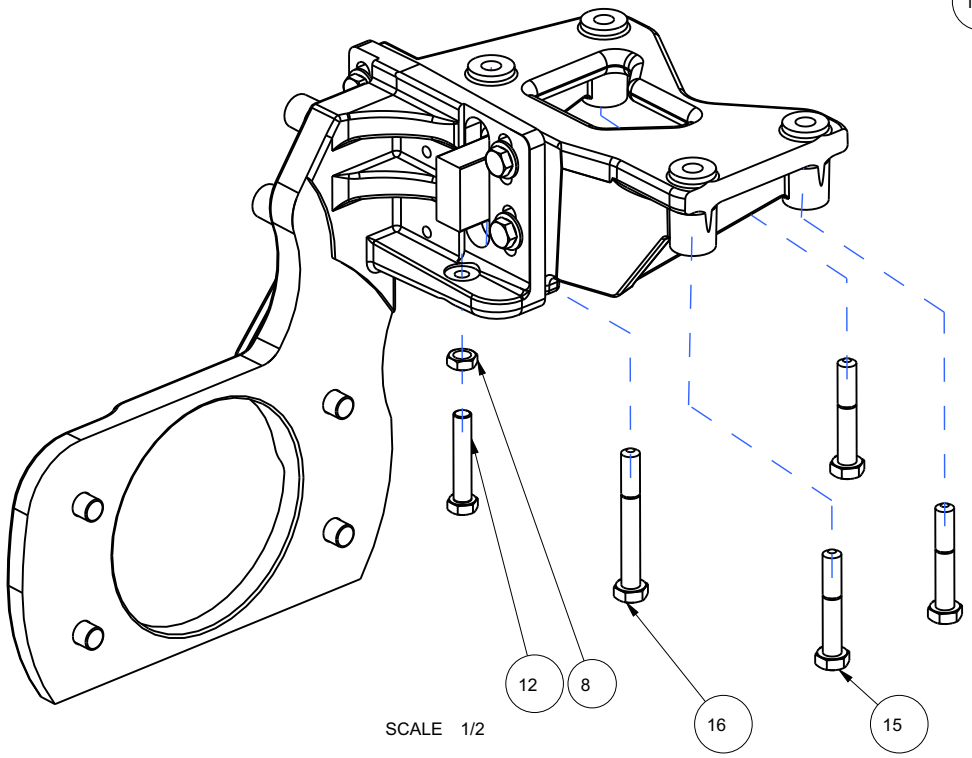
ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

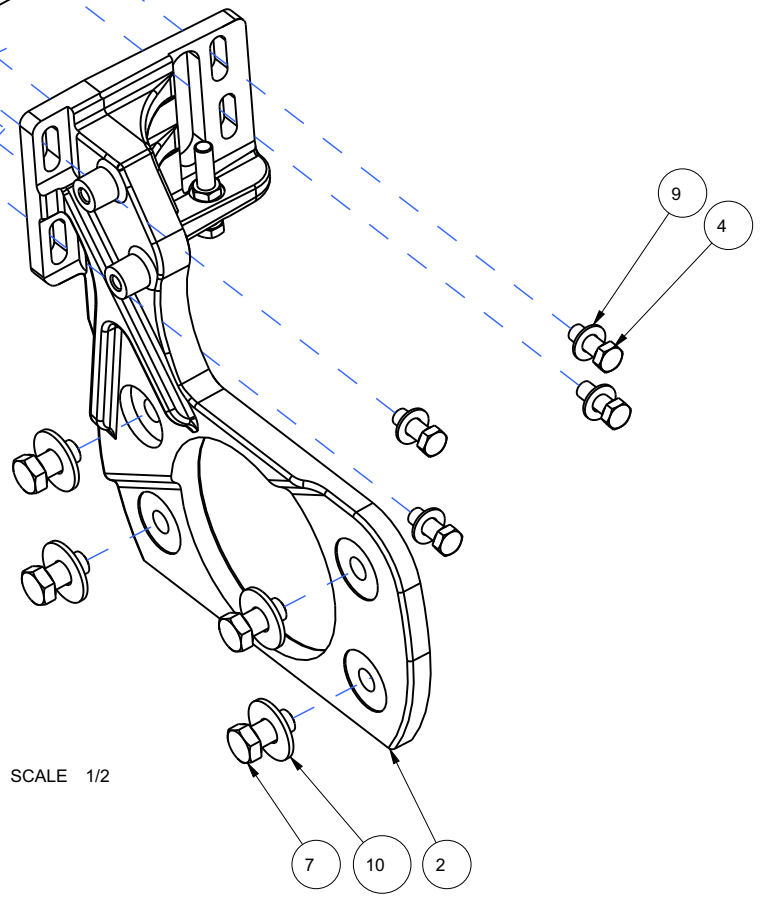
NO.	DESCRIPTION	PART NO.	QTY.
1	BRACKET - COMP. TO GC BRACKET	4037601	1
2	BRACKET - GC TO COMP. BRACKET	4037600	1
3	BRACKET GUIDE - ALIGNMENT BLOCK	4037602	1
4	HHCS - .375-16 x 1.00, GR5	5400036	4
5	HHCS - .375-24 x 1.00, GR5	5400057	2
7	HHCS - .500-13 x 1.00, GR5	5400065	4
8	NUT - JAM, .375-16, GR2	5403205	1
9	WASHER - FLAT	3603818	4
10	WASHER - FLAT, 1/2, STEEL	3603804	4
11	WASHER - LOCK, 0.375 ID	3603503	2
12	HHCS - .375-16 x 2.00, GR5 SPLC	5400091	1
13	KEY - 0.38 X 0.50 X 3.13	3602313	1
14	SHCS - .250-20 x 0.38, GR8	5401000	2
15	HHCS - M10-1.5 x 60MM, GR8.8	5400324	3
16	HHCS - M10-1.50 x 80MM, GR8.8	5400305	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D





SCALE 1/2



SCALE 1/2

MODEL NAME	MDL CREATED	SHEET	
KM01501	10/21/09	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - ASSEMBLY, MTG BRACKET HMBC/TAMROTOR

MATERIAL DESCRIPTION: SEE TABLE

MATERIAL NO. -

PATTERN NO. -

DR'N RJG

DATE 29-Mar-10

CHKD MCR

TRCD

SCALE 3/16

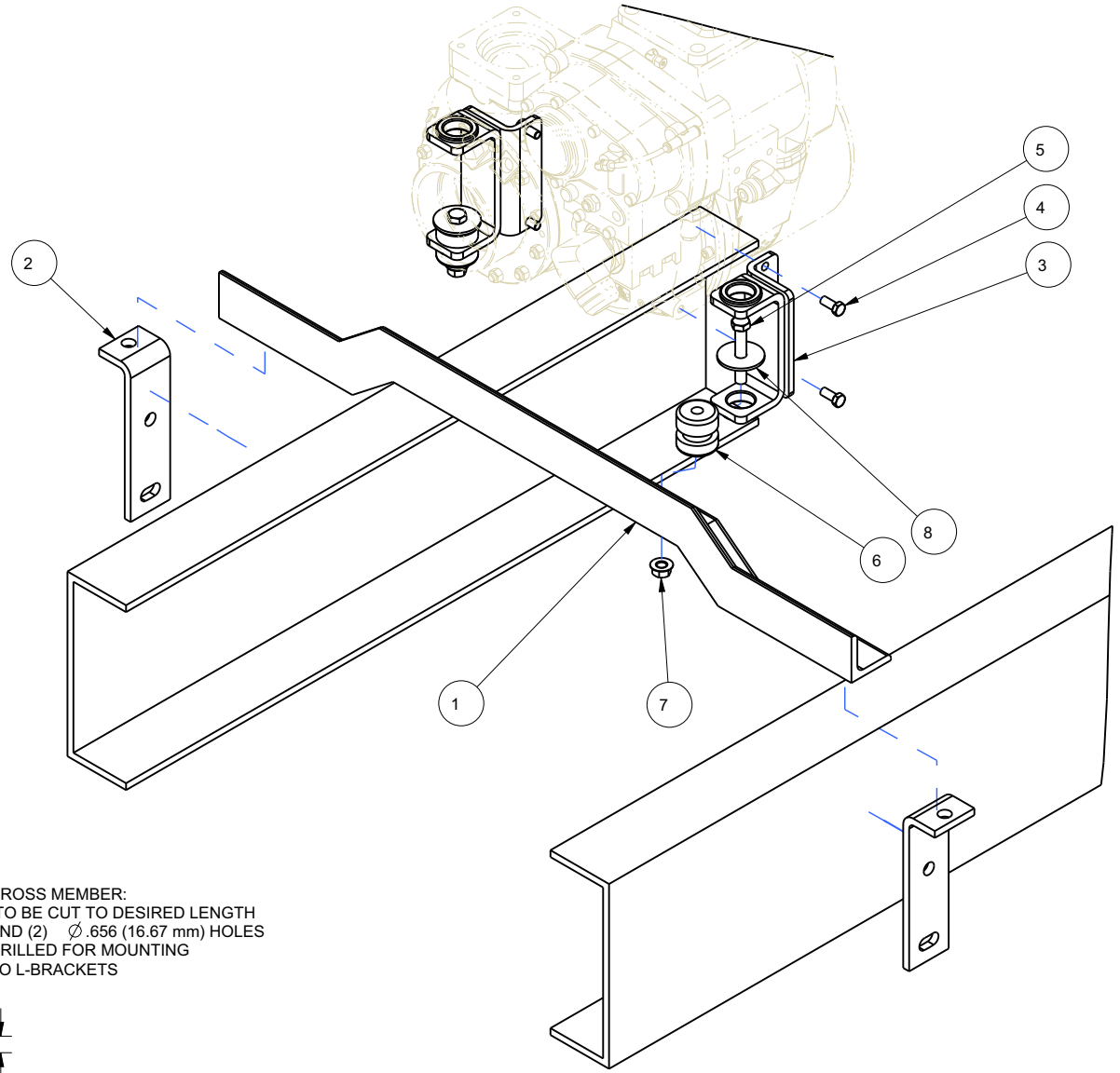
DCM0703

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

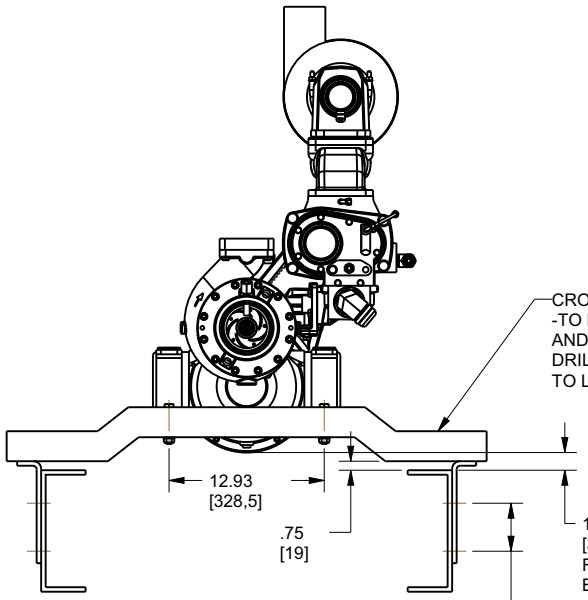
NO.	DESCRIPTION	PART NO.	QTY.
1	BRACKET - CROSS MEMBER, 40" LG	4037850	1
2	BRACKET - FRAME RAIL	4037851	2
3	BRACKET - HMBC MOUNTING ANGLE, RESILIENT	4037832	2
4	HHCS - .375-16 x 0.88, GR5	5400035	4
5	HHCS - .500-13 x 3.00, GR5	5400072	2
6	MOUNT - RESILIENT	4421803	2
7	NUT - FLANGED TOP LOCK	5403469	2
8	WASHER - SPECIAL, SNUBBING	3603919	2
9	PUMP CASING - H, 3/4" NPT DRAIN	2052710	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:

1) CUSTOMER / OEM IS RESPONSIBLE FOR PROPERLY SUPPORTING SUCTION MANIFOLDING FOR A SUFFICIENT, FULLY MOUNTED / SUPPORTED PUMP ASSY



CROSS MEMBER:
-TO BE CUT TO DESIRED LENGTH AND (2) ∅ .656 (16.67 mm) HOLES DRILLED FOR MOUNTING TO L-BRACKETS

1.5
[37]
FRAME RAIL TO BOTTOM OF GEARCASE

4.00
[101,6]
B.C. OF L-BRACKET
w/.Ø56" (16.76 mm)
THRU HOLES

SCALE 1/8

MODEL NAME	MDL CREATED	SHEET	
DHD2141	12/15/11	1/1	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. | PATTERN NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - HMBC, 225 CFM INTEG. BELT COMP., CHINA
DIM., TAM E12TS, 3" WELD DISCH., 4" BSP THR'D SUCT.

DR'N RJG | CHKD | TRCD

DATE 15-Dec-11

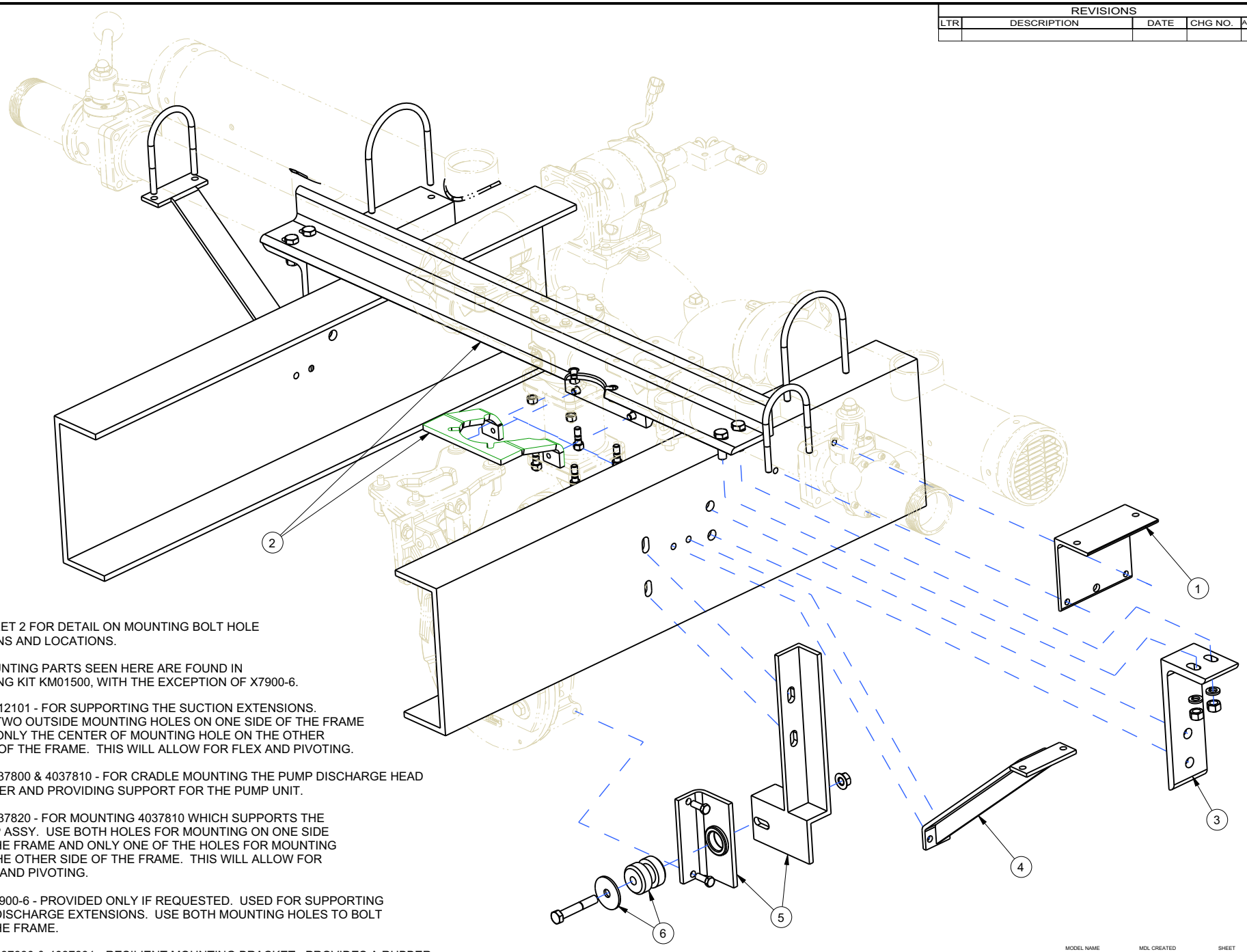
SCALE 1/4

DGM2320

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:
SEE SHEET 2 FOR DETAIL ON MOUNTING BOLT HOLE PATTERNS AND LOCATIONS.

ALL MOUNTING PARTS SEEN HERE ARE FOUND IN MOUNTING KIT KM01500, WITH THE EXCEPTION OF X7900-6.

1. (2) 4012101 - FOR SUPPORTING THE SUCTION EXTENSIONS. USE TWO OUTSIDE MOUNTING HOLES ON ONE SIDE OF THE FRAME AND ONLY THE CENTER OF MOUNTING HOLE ON THE OTHER SIDE OF THE FRAME. THIS WILL ALLOW FOR FLEX AND PIVOTING.

2. (1) 4037800 & 4037810 - FOR CRADLE MOUNTING THE PUMP DISCHARGE HEAD SPACER AND PROVIDING SUPPORT FOR THE PUMP UNIT.

3. (2) 4037820 - FOR MOUNTING 4037810 WHICH SUPPORTS THE PUMP ASSY. USE BOTH HOLES FOR MOUNTING ON ONE SIDE OF THE FRAME AND ONLY ONE OF THE HOLES FOR MOUNTING ON THE OTHER SIDE OF THE FRAME. THIS WILL ALLOW FOR FLEX AND PIVOTING.

4. (2) X7900-6 - PROVIDED ONLY IF REQUESTED. USED FOR SUPPORTING THE DISCHARGE EXTENSIONS. USE BOTH MOUNTING HOLES TO BOLT TO THE FRAME.

5. (1) 4037830 & 4037831 - RESILIENT MOUNTING BRACKET. PROVIDES A RUBBER ISOLATION MOUNTING OF THE GEARCASE OF THIS PUMP UNIT. REDUCES VIBRATION AND ALLOWS FOR FLEX AND PIVOTING.

6. (1) 3603919 & 4421801 - SNUBBING WASHER AND RESILIENT RUBBER MOUNT.

MODEL NAME	MDL CREATED	SHEET	
DHM0200	03/24/10	1/2	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - PUMP MOUNTING BRACKET CONFIGURATION HMBC

DR'N RJG | CHKD MCR | TRCD

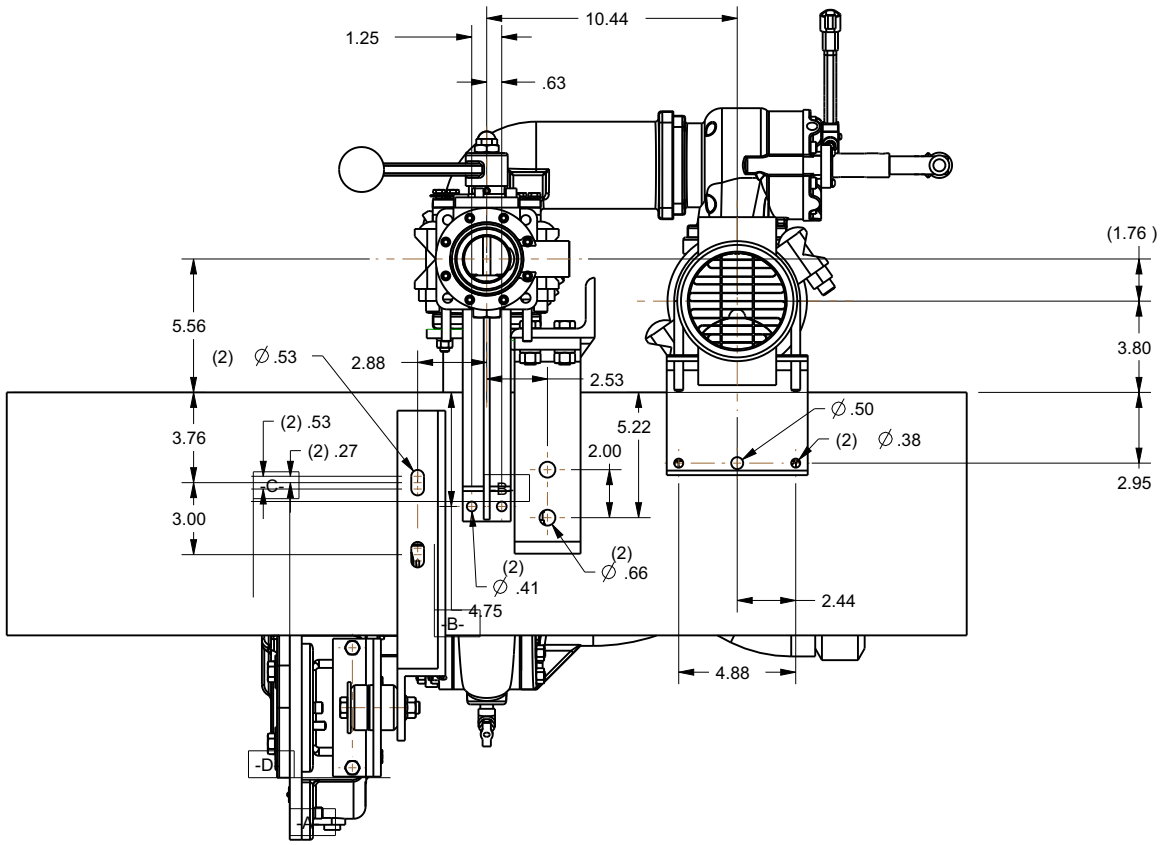
DATE 24-Mar-10 | SCALE 1/4

DHM0200

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:
ALL MOUNTING FASTENERS ARE TO BE SUPPLIED BY
THE CUSTOMER OR APPARATUS BUILDER

MODEL NAME	MDL CREATED	SHEET	
DHM0200	03/24/10	2 / 2	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - PUMP MOUNTING BRACKET CONFIGURATION HMBC

MATERIAL DESCRIPTION:	MATERIAL NO.	PATTERN NO.
-	-	-

DR'N RJG
CHKD MCR
TRCD

DATE 24-Mar-10
SCALE 1/4

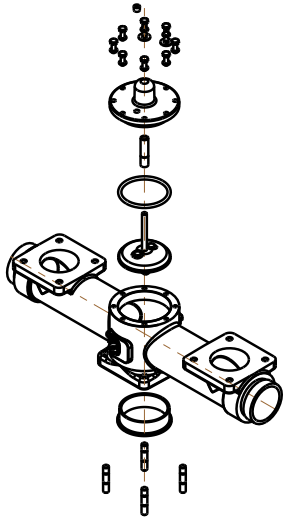
DHM0200

ALL DIMENSIONS IN INCHES UNLESS NOTED

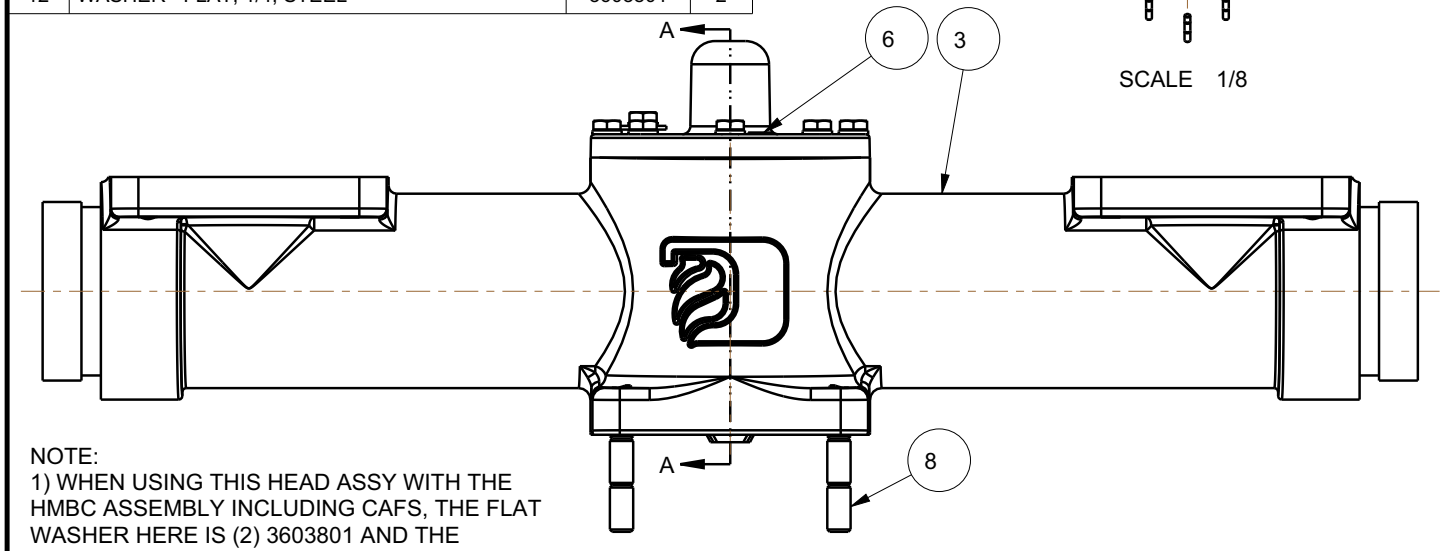
DO NOT SCALE PRINT

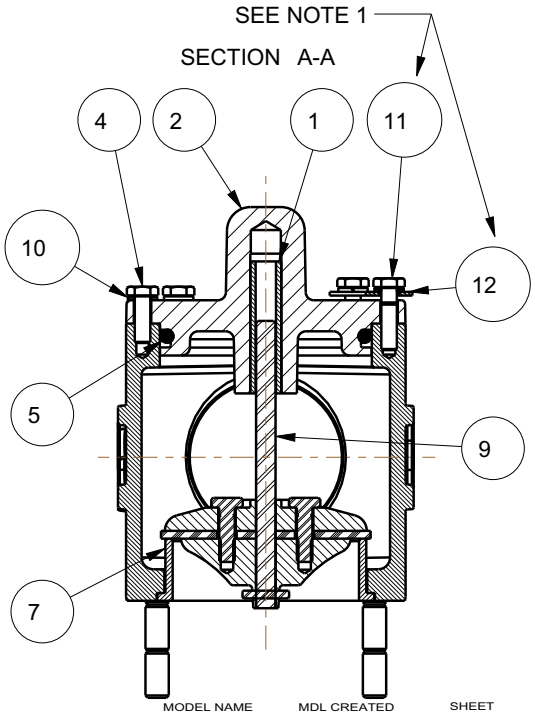
NO.	DESCRIPTION	PART NO.	QTY.
1	BUSHING - CHECK VALVE GUIDE	5320400	1
2	COVER - DISCHARGE HEAD - HM	2502601	1
3	HEAD - DISCHARGE, HM	2807900	1
4	HHCS - .250-20 x 0.75, GR5	5400002	6
5	O-RING - 3.00 x 3.38 x 0.19	3601306	1
6	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
7	SEAT - CHECK VALVE	5262000	1
8	STUD - 0.375-16 X 2.000, GR5	3606206	4
9	VALVE - DISCH CHECK, F	VK00103	1
10	WASHER - LOCK, 0.250 ID	3603501	8
11	HHCS - .250-20 x 1.00, GR5	5400004	2
12	WASHER - FLAT, 1/4, STEEL	3603801	2

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



SCALE 1/8





NOTE:
1) WHEN USING THIS HEAD ASSY WITH THE HMBC ASSEMBLY INCLUDING CAFS, THE FLAT WASHER HERE IS (2) 3603801 AND THE HHCS IS (2) 5400004. THESE ARE NEEDED TO MOUNT THE PRESSURE CONTROL ASSEMBLY (AZ01902) TO THIS HEAD.
2) IF THIS HEAD ASSY IS BEING USED WITH THE HMBC ASSEMBLY WITHOUT CAFS, THERE IS NO FLAT WASHER AND USE HHCS (2) 5400002.

MODEL NAME	MDL CREATED	SHEET	
HH00105	12/31/09	1/1	B

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

DR'N RJG

CHKD MCR

TRCD

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

HEAD ASSY - HM500 (2) 2.5VIC
-

DATE 31-Dec-09

SCALE 1/2

DHC0513

Mechanical Shaft Seal

This pump assembly incorporates high quality mechanical shaft seal(s) separating the pump housing components from atmosphere. Depending on the pump design, there may be one or two seals on each impeller shaft.

The seal size, design type, component materials, and housing configuration have been specifically designed for this pump application and rated operating parameters.

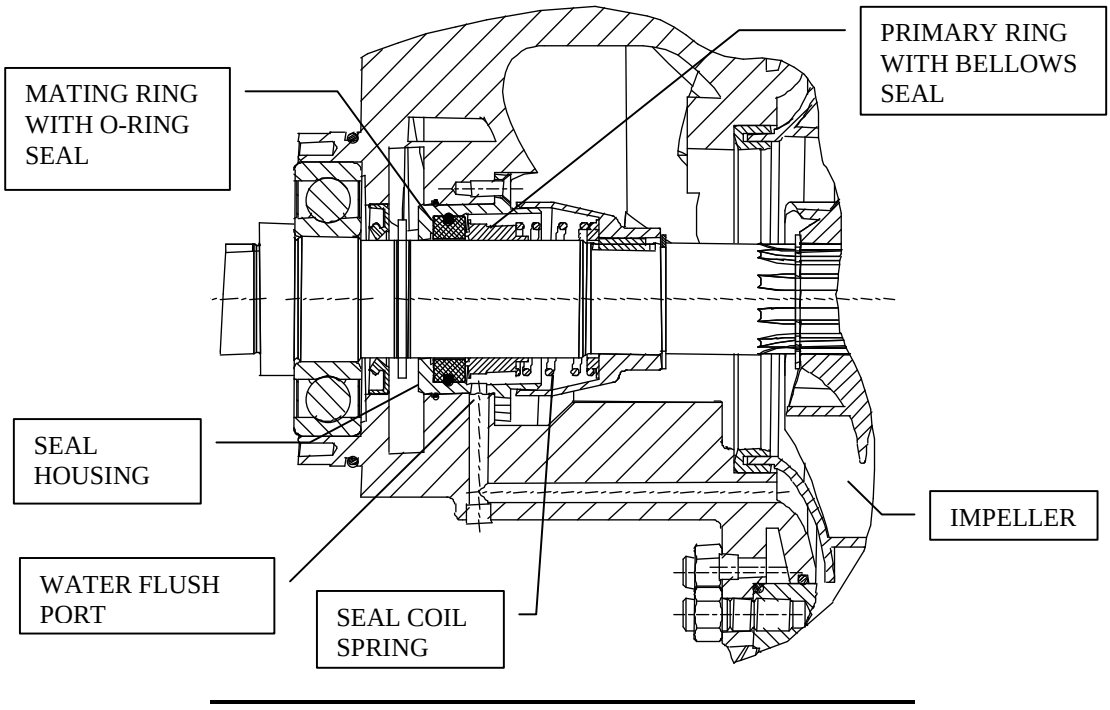
Mechanical Seal Basics

A mechanical seal is a device that houses two highly polished components (known as faces). One face rotates, the other is stationary. A secondary elastomer bellows seals the primary ring to the shaft. An o-ring or cup seal seals the mating ring in the housing. The polished seal faces of the primary and mating rings are pressed together by a spring mechanism to provide adequate force to affect a seal. The force acting between the seal faces increases in direct proportion to product pressure.

The elastomer bellows seal utilized in this pump has the following design features:

- Mechanical drive of the primary seal ring. The drive band's notch design eliminates overstressing the elastomer sealing bellows.
- Bellows design provides automatic compensation for shaft endplay, run out, and primary ring wear.
- Seal face contact pressure is controlled by a single, non-clogging coil spring. This coil spring has been custom welded per Darley specifications to eliminate high-speed spring distortion.

The seal housing is designed and ported to provide optimal water flow and pressure assuring proper cooling and flushing of the seal components.



Operation and Maintenance

When operated within rated operating conditions of this pump, these seals will provide trouble free service for extended periods.

Properly selected and applied mechanical shaft seals are leak free and require no adjustment. Should the seal area develop a leak, investigate the cause as soon as possible. Seal failure, leakage, may be the result of; worn seal faces, leaking bellows, or damaged o-rings. These failures may be attributed to bearing failure, impeller blockage, impeller imbalance, seal housing contamination, operating beyond pump design rating, or dry running,

Mechanical shaft seal design relies on the sealed media, in this case, water, to cool and lubricate the sealing surfaces. Therefore, extended dry operation may cause overheating and scoring or damage to the sealing surfaces, resulting in excessive leakage or a much shortened seal life.

To maximize seal life, minimize operation at pump pressures higher than pump rating. While operating at pressures beyond rating will not immediately damage the seal, it will increase sealing surface wear rate.

CAUTION: **DO NOT RUN THE PUMP DRY EXCEPT MOMENTARILY AND AT LOW SPEEDS**

CAUTION: **DO NOT USE THIS PUMP FOR HOSE TESTING**

CAUTION: **THE MECHANICAL SEAL SHOULD NOT BE RUN DRY, WHILE THE PUMP IS NOT ENTRAINED WITH WATER, FOR A PERIOD LONGER THAN 2 MINUTES. FAILURE TO FOLLOW THIS RECOMMENDATION WILL LEAD TO PREMATURE WEAR AND FAILURE OF YOUR MECHANICAL SHAFT SEAL.**

SUMMARY OF THINGS TO REMEMBER

1. Never shift CAFS clutch at engine speeds past idle.
2. Close all valves and ensure all caps and connections are air tight before attempting to prime the pump.
3. Always keep primer shut-off valve closed, except while priming.
4. Re-open and close primer valve to re-prime or eliminate trapped air from suction line.
5. Never run the pump without water in it except momentarily while priming.
6. Accelerate and retard speed of engine gradually, never rapidly accelerate engine when pump is engaged.
7. Watch the engine temperature, and start the cooling water at the first signs of overheating.
8. Keep good gaskets in suction hoses, and handle carefully to avoid damage to coupling threads.
9. Air leakage into suction lines is the most frequent source of trouble when pumping from a suction lift (draft).
10. Always us a suction strainer when pumping from draft, and a hydrant strainer when pumping from a hydrant.
11. Foreign matter in impellers is a result of failure to use adequate strainers and is a common source of trouble.
12. Drain pump immediately after each run. This is especially critical in freezing condition.
13. Do not run the pump long with discharge completely shut off
14. If water discharge “off” of the truck is not being performed, the tank recirculation/fill valve needs to be open at least ¼ turn.
15. Do not close a “Shutoff” nozzle when pumping with motor throttle wide open, unless relief valve, or pressure regulator is set for correct pressure.
16. Keep the pump gear case filled with oil to the level of the oil level plug/dipstick.
17. Check oil level in the pump transmission after every 25 hours of operation or 3 month, and changed it after every 50 hours of operation or 6 months.
18. Work all suction and discharge valves often to ensure free and easy operation. If necessary re-lubricate the valves.
19. Never attempt to operate CAFS without foam concentrate. Air and water do not mix without the foam concentrate.
20. Read this manual carefully to ensure full understanding of the operation of and the safety precautions required to successfully operate the fire pump and the CAFS system on your Fire Apparatus.

WARNING: DO NOT USE THIS PUMP FOR HOSE TESTING

OPERATING THE ENGINE

After the pump has been primed, the engine speed should be increased gradually -- never jerk throttle wide open. Likewise, the engine speed should be decreased gradually when shutting down.

Watch the pump pressure gage and open throttle only enough to give the desired pressure. The pressure may rise high enough to burst the discharge hose, when using small nozzles, if the engine is given full throttle (except pumps equipped with pressure regulators set for desired pressure).

Never run engine at high speeds except when pump is primed and ready to discharge water.

COOLING THE ENGINE

NFPA 1901 requires that a supplementary heat exchanger cooling system be provided. On most models, this heat exchanger is an integral part of the pump, and the installation of two hoses from the engine cooling system to the pump is all that is required.

On some models an external heat exchanger must be used. In that case two hoses from the engine cooling system and two lines from the pump will run to the heat exchanger.

The cooling line should not be opened until pressure develops in the pump, and pump should never be operated under heavy loads prolonged without an adequate supply of cooling water flowing.

Coolant temperatures should never be allowed to exceed 200^{o} F while pumping and 180^{o} F is usually taken as a safe operating temperature.

Always shut off cooling line when through pumping.

SUCTION STRAINERS

A large suction strainer, which will prevent the passage of a body larger than the pump impeller ports, must always be used on the free end of the suction line when pumping from draft.

The small hydrant strainer must always be inserted in the suction manifold of pump, when pumping from hydrants and at all other times except when maximum capacity is required from draft.

Failure to use a strainer at all times when pumping will cause serious trouble by clogging the pump because, even in water mains, foreign matter is invariably present, and will be drawn into pump by the high velocity of the water entering.

SUCTION LINE

The suction line of a fire pump can be the source of more operating difficulties than all the rest of the pump when working with a suction lift. Faults in the suction line which cause trouble in operation are as follows:

AIR LEAKS -- A small amount of air, expanding in the vacuum of the suction line, displaces a considerable volume of water which subtracts from the capacity that the pump is able to deliver, makes the priming difficult or causes pump to lose its prime. Therefore, it is absolutely essential to keep the suction line and the suction side of pump casing air tight at all time when drafting water.

Air leakage into pump while operating is usually indicated by a rattling sound in pump casing, miniature explosions in stream issuing from the nozzle, or by losing of prime when operating at very low capacities.

The usual cause of leaky suction lines is carelessness in handling of suction hose. Bruising of hose threads by bumping against hard surfaces or sand in the coupling often prevents tightening of the joints up against the gaskets. The hose gaskets are often defective and are sometimes lost without being noticed by the operator.

INSUFFICIENT SUBMERGENCE -- The free end of suction hose must be submerged to a sufficient depth to prevent the entrance of air that may be sucked down from the surface of the water to a considerable depth when operating at large capacities.

Entrance of air into suction lines in this manner is indicated by a small whirlpool, or vortex, on the surface of the water over the end of the hose.

A minimum submergence of 4 times the hose diameter to the upper holes in suction strainer is recommended where full capacity of pump is required. Where sufficient submergence is not possible, a board or sheet of metal laid over end of suction line will keep air from entering.

SUCTION LINE ENTRANCE TOO CLOSE TO BOTTOM -- If the end of suction line is laid on the bottom of the source of supply, a part of the suction opening will be shut off; and if the bottom is soft the hose will suck itself down into the earth, closing more of the opening and loosening sand and mud to be carried into the pump.

The suction entrance should be suspended a foot or more above the bottom, or if this is not possible, it should be laid on a board or piece of sheet metal. A rope tied to the suction strainer is a convenient means of holding it off the bottom.

OBSTRUCTION OF SUCTION STRAINER BY FOREIGN MATTER -- The high velocity of water entering the suction line will carry loose foreign bodies in against the strainer from a considerable distance. Therefore, all weeds and refuse should be removed from close proximity of the suction entrance.

SUCTION LINE TOO SMALL OR TOO LONG -- The flow of water into the pump is opposed by the frictional resistance in the suction line. This friction loss must be added to the height of the pump above the water (static lift) to determine the “total lift” of the pump. When all of the vacuum in the pump (atmospheric pressure) is consumed in raising water through this total life, then the limit of capacity has been reached. This capacity can be increased only by decreasing total lift. If the static lift cannot be reduced, then the friction loss must be reduced by using a shorter or larger suction hose.

The rated capacity of the pump is guaranteed for a static lift of 10 feet, with 20 feet of recommended suction hose at sea level. To increase the capacity without reducing the static lift, or to increase lift without sacrificing capacity, requires larger suction hose.

An excessively long suction line is a handicap to any pump, for besides reducing capacity through the added friction lose, it retards priming and it produces a detrimental effect known as “cavitation”. This means a separation of the water column in the pump suction, or void spaces, produced by the inertia of the heavy mass of water in the line resisting sudden change in the velocity when the pump starts to deliver or when discharge valves are opened or closed. This phenomenon reduces capacity further, and usually sets up a vibratory motion and “water hammer” as the water surges in and out of the void spaces.

When operating with a long suction line, the driving engine should be accelerated gradually, the discharge gates opened gradually, and the capacities of the pump should be held down to within the range of smooth performance.

AIR TRAP IN SUCTION LINE -- If the suction line is laid so that part of it is higher than any other part that is nearer to the pump, as when hose is laid over a high bridge rail, an air trap is formed at the highest part of the hose from which the air cannot be sucked out by the primer. This trapped air is expanded and carried into the pump with the first rush of water causing the pump to immediately lose its prime.

If suction line cannot be laid so that it slopes all the way from pump to water, it can still be primed easily by simply allowing the primer to continue to function until all the trapped air in the hose has been carried into the pump and picked up by the primer.

TESTING FOR AIR LEAKS

Tests for leakage should be made with the suction hose attached and capped, discharge gate open, and all other openings closed tightly.

Run electric priming pump with primer shut-off valve open, until maximum vacuum is shown on the gage. The vacuum should hold for several minutes before satisfactory performance of pump can be expected.

If excessive leakage of air occurs, the source of leaks can be located by shutting off primer motor, with vacuum at its highest point, and listening for the hiss of air.

In the absence of a vacuum gage, the vacuum in pump may be judged by closing suction opening with the flat of hand or a rubber pad.

Water or air pressure may be applied to pump casing to test for air leakage if more convenient. DO NOT pressurize with air beyond 10 PSI

SOURCE OF WATER SUPPLY

Water may be drafted from a pond, lake, stream, cistern, stock tank, or well; but whatever the source, the static lift must not exceed 20 feet from the center of the pump to the surface of the water and a lift not exceeding 10 feet is recommended. The source of supply should be reasonably clear and free from foreign matter. It is recommended that all water holes, which may be needed for fire protection, be deepened if necessary and kept free from weeds and refuse. In many fire protection areas, cisterns or reservoirs are built and allowed to fill up with rain water to be used in emergencies.

PUMPING IN COLD WEATHER

The first insurance against cold weather trouble is to keep fire apparatus stored in heated quarters. All water must be eliminated from pump casing and primer line between periods of operations.

When setting up for pumping, unnecessary delays should be avoided by having thoroughly trained pump operators. Be sure that primer and booster lines are kept closed until ready for use. Having discharge lines ready so that pump may be started as soon as it have become primed. Do not stop flow of water through the pump until ready to drain and return to the station.

Engine Coolant from the engine circulated through the heater jacket in pump casing prevents all ordinary freezing troubles.

WHEN FINISHED PUMPING

Drain water out of pump casing immediately. (Drain valve is located at lowest point in pump casing, and accessible from underneath chassis.)

Don’t forget to close all drain cocks after all water has been drained out. Trouble in priming will follow on the next run if this is forgotten.

Shut off cooling line to make pump ready for priming again.

If pump transmission is equipped with a transmission cooler it must be drained also. If the master drain is located below the cooler outlets it can be connected to the master drain, if not, two separate drains must be connected to the transmission cooler. **Failure to drain transmission cooler will result in water in the gearcase if water in the cooling coil freezes.**

If pump is equipped with an external heat exchanger, drain heat exchanger using gravity and vacuum drain on all trucks as follows: Close all open lines and drain cocks. Open cooler valve and open air vent at top or drain cock at bottom of heat exchanger depending on model. With the pump air-tight open primer with engine running for about a minute and then close primer. Drain pump of water which was deposited when heat exchanger and lines were being drained.

Pump not often used for fire service should be inspected and run periodically to ensure that they will be in readiness for an emergency.

PUMPING SALT WATER

The pump should be flushed out with fresh water immediately after pumping salt water to prevent excessive rusting. (Except pumps which are built of special material to resist the corrosive action of the brine.)

When measuring sea water with a Pitot Gage, capacities shown in Table No. 2 should be discounted approximately 1 1/2% to determine the correct capacity.

A centrifugal pump will show 2 1/2% higher pressure and require 2 1/2% more power when handling sea water than when handling fresh water if operated at the same speed and capacity.

TESTING OF EQUIPMENT FOR PRACTICE

It frequently happens that operators of fire apparatus, who are not thoroughly familiar with its operations, become confused under the stress of emergency and neglect some little detail that may cause trouble or delay in getting the equipment into operation. Therefore, we urge that practice tests be conducted repeatedly until operators are thoroughly trained. More than one person in the department should be a competent operator.

Practice should include pumping from low lifts, high lifts with short and long suction lines, with suction line elevated to form an air trap, and from hydrants, at large and small capacities.

It is well, also, to note the effects of air leaks in hose, insufficient submergence and restriction of suction line. (Suction line can be restricted by placing a can or other strong closure around the suction strainer).

NEVER BREAK OR RESTRICT SUCTION OR ALLOW AIR TO ENTER SUCTION LINE WHILE ENGINE IS OPERATING WITH THROTTLE OPEN. This will release the load and allow engine to run away.

Do not allow personnel to hold a large nozzle while working at high pressures for serious accidents may result if hose breaks loose.

MEASURING PUMP PERFORMANCE

Pump performance is measured by the quantity of water it can deliver per minute against a certain pressure called “Total Head” or “Net Pump Pressure”, as it is usually termed in fire pump testing.

The net pump pressure is the sum of the pump discharge pressure, as shown on the pressure gage with which the pump is regularly equipped, and the total suction lift converted to equivalent pounds per square inch. If pump is operating from a hydrant, the net pump pressure is the discharge pressure less the incoming pressure from hydrant measured at the suction entrance of pump.

Capacity of fire pump is measured in gallons per minute. The usual method of measurement is to determine the pressure of the jet of water leaving a given size of nozzle by means of a “Pitot Gage” from which the capacity is computed mathematically.

A Pitot Gage consists of a small tube adapted to a point directly into the hose nozzle from the center of the issuing stream, the other end of the tube being connected to an accurate pressure gage.

The nozzle jet drives straight into the Pitot tube and converts the velocity of the jet to pressure which is an accurate measure of velocity of the water as it leaves the nozzle. The tip of the Pitot tube should be one-half the diameter of the nozzle away from nozzle tip while taking reading. Table No. 2 gives nozzle capacities for various Pitot Gage readings.

If a Pitot gage is not available approximate pump capacities can be determined by reference to Table No.3

ACCEPTANCE TESTS

Acceptance tests require continuous tests of three hours duration: 2 hours at 100% rated capacity and 150 PSI net pump pressure; one-half hour at 70% capacity and 200 PSI; one-half hour at 50% capacity and 250 PSI; and a spurt test at 100% capacity and 165 PSI.

Table No. 1 shows recommended set-ups and gage readings for rating tests.

To adjust nozzle pressure for the correct capacity, while maintaining the correct pump pressure, it is necessary to make simultaneous adjustments of engine throttle and the discharge gate valve, partially closing the latter until just the right discharge resistance is built up.

ENGINES

An Underwriter fire pump imposes heavy loads on the engine that drives it, often absorbing all of the power the engine is capable of delivering at full throttle. Continuous pumping gives the engine no time to rest. Therefore, a new engine and pump unit must be thoroughly broken-in before it is required to deliver prolonged maximum pump performance.

We recommend a minimum break in period of 20 hours at light pumping loads, with occasional spurt tests and interruptions. Temperature and lubrication should be checked during this period.

Engine manufacturers' power ratings usually show maximum performance of a selected, factory adjusted engine, operating without fan, generator, muffler or other accessories, and corrected for "ideal" conditions, i.e. sea level barometer (29.92" of mercury) 60^{o}F and high humidity. Therefore, the actual power delivered by an average truck mounted engine is considerably lower than the manufacturers' rating, and allowances must be made in predicting pump performance.

EFFECTS OF ATMOSPHERIC CONDITIONS ON ENGINE AND PUMP PERFORMANCE

Each one inch of drop in Barometric pressure or each 1000 feet of elevation of the pumping site reduces engine power approximately 3 1/2% for engines not equipped with a turbo charger.

Each 12^{o} rise in temperature above 60^{o} F of carburetor intake air reduces engine power approximately 1%.

Lowering of humidity reduces power slightly.

Each one inch drop in Barometric pressure or each 1000 feet of elevation reduces the maximum possible static lift of a pump approximately one foot.

Temperature of the water supply affects the attainable suction lift of a pump. The effect is slight at low water temperatures but becomes increasingly detrimental as the temperature rises.

A 10^{o} rise from 70^{o}F will subtract about 1/2 foot from the maximum attainable suction lift, while an equal rise from 100^{o}F will reduce the lift at least 1 1/2 feet.

Temperature is an important consideration when pumping from a test pit where the water is heated by recirculation.

IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

DEFINITIONS

HEAD OF WATER -- vertical depth of water measured in feet or in pressure per unit or area. In hydraulics, head always represents pressure and it is expressed interchangeably in feet of water or pounds per square inch and sometimes in inches of depth of mercury.

STATIC HEAD -- the pressure that is exerted by a stationary column of water of a given height or depth.

TOTAL HEAD OR TOTAL DYNAMIC HEAD -- the maximum height above the source of supply to which the pump would elevate the water plus all the resistance to flow in the pipe or hose line.

DISCHARGE HEAD -- the pressure measured at the discharge outlet of a pump.

SUCTION HEAD -- the positive pressure measured at the suction entrance of a pump (when pumping from an elevated tank or hydrant).

VELOCITY HEAD -- the equivalent pressure represented by fluid in motion as measured by means of a Pitot Gage.

STATIC LIFT -- the vertical height of the center of the pump above the source of supply (when pump from draft).

TOTAL SUCTION LIFT -- the static lift plus the friction in suction line plus entrance losses.

NET PUMP PRESSURE -- the total dynamic head of the pump.

EFFECTIVE NOZZLE PRESSURE -- the pump discharge pressure minus hose friction plus or minus the difference in elevation above or below pump.

WATER HORSEPOWER - the theoretical power required to deliver a given quantity of water per minute against a given head.

BRAKE HORSEPOWER -- Actual power as delivered by a motor or engine to a driven machine.

PUMP EFFICIENCY -- The quotient of the water horsepower divided by brake horsepower required to produce it.

WATER HAMMER -- a series of shock waves produced in a pipeline or pump by a sudden change in water velocity. A sudden change in flow velocity can result from rapid closure of valves. A pressure wave is set up which travels back and forth in the water column at extremely high speed producing rapid vibrations that may be violent and destructive if the water column is long.

THE MAXIMUM THEORETICAL LIFT of a pump is 34 feet, which is the pressure of the atmosphere at sea level. The maximum practical total lift at sea level is 20 to 25 feet (depending on the type and condition of the pump) and this decreases with drops in barometric pressure.

OPERATING CHARACTERISTICS OF PUMPS

CENTRIFUGAL PUMPS: A centrifugal pump develops pressure by centrifugal force of the liquid rotating in the impeller wheel. The pressure developed depends upon the peripheral speed of the impeller (increasing as the square of the speed) and it remains fairly constant over a wide range of capacities up to the maximum output of the pump, if speed remains constant.

If the discharge outlet of a centrifugal pump is entirely shut off, with speed kept constant, there is a small rise in pressure, the water churns in the pump casing and the power drops to a low value. If the discharge is opened wide, with little resistance to flow the pressure drops while the capacity and power both increase to their maximum.

A centrifugal pump is an extremely simple mechanism mechanically, but rather complex hydraulically; in that many factors enter into the design of the impeller and water ways which will affect the pump's efficiency.

DISPLACEMENT PUMPS: Rotary and piston pumps are termed "Positive Displacement" pumps because each revolution displaces or discharge (theoretically) an exact amount of liquid, regardless of the resistance. The capacity is, therefore, proportional to the number of revolutions of the pump per minute and independent of the discharge pressure except as it is reduced by "slip" (leakage past the pistons or rotors). For a given speed the power is directly proportional to the head. If the discharge is completely shut off, the pressure, power, and torque climb indefinitely until the drive power is stalled or breakage occurs.

Slip is the greatest factor affecting efficiency of a displacement pump, and this factor is greatly influenced by the condition of and wears on the working parts.

IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

CONVERSION FACTORS

One pound per square inch	=	2.31 feet of water
	=	2.04 inches of mercury
	=	27.7 inches of water
One foot of water	=	0.43 pounds per square inch
One inch of mercury	=	1.13 feet of water
	=	0.49 pounds per square inch
One cubic foot of water	=	62.4 pounds
	=	7.5 gallons
One gallon of water	=	231 cubic inches
	=	0.13 cubic feet
	=	8.34 pounds
	=	3.8 liters
One Imperial Gallon	=	1.2 U.S. gallons
Atmospheric Pressure (Sea Level)	=	14.8 pounds per square inch
	=	29.9 inches of mercury
	=	34 feet of water

TABLE NO. 1
NFPA 1901 TEST

Class A							
TEST No.	GPM	Recom-mended Nozzles	Min. Nozzle Press. PSI	Min. Disch. Press. PSI	Min. Net Pump Press. PSI	Disch. Lines	Suction Hose
500 GPM Pump							
1	500	1-1/2"	57	143	150	1-50"	20' of 4"
2	350	1-1/4"	58	194	200		
3	250	1"	72	245	250		
4	500	1-1/2"	57	158	165		
750 GPM Pump							
1	750	1-3/4" or 2, 1-1/4"	68 66	142	150	2-50'	
2	525	1-1/2"	62	193	200	or	20' of 4-1/2"
3	375	1-1/4"	66	244	250	2-100'	
4	750	1-3/4" or 2, 1-1/4"	68 66	157	165	Siamesed	
1000 GPM Pump							
1	1000	1, 2" or 2, 1-1/2"	71 57	142	150	2-50'	
2	700	1-3/4" or 2, 1-1/4"	60 58	193	200	or	20' of 5"
3	500	1-1/2"	57	244	250	3-100'	
4	1000	1, 2" or 2, 1-1/2"	71 57	157	165	Siamesed	
1250 GPM Pump							
1	1250	2-1/4" or 2, 1-1/2"	69 88	143	150	3-50'	
2	875	1, 2" or 2, 1-3/8"	55 61	194	200	or	
3	625	1-1/2"	88	245	250	3-100'	20' of 6"
4	1250	2-1/4" or 2, 1-1/2"	69 88	158	165	and 1-50' Siamesed	

Min. discharge pressures listed above are for pumps operating with full 10’ static suction lift. These pressures must be increased by 1 PSI for each 2.3 ft. less than 10’ of lift.

TABLE NO. 1
NFPA 1901 TEST

Class A							
TEST No.	GPM	Recom-Mended Nozzles	Min. Nozzle Press. PSI	Min. Disch. Press. PSI	Min. Net Pump Press. PSI	Disch. Lines	Suction Hose
1500GPM Pump							
1	1500	2, 1-3/4" or 3, 1-1/2"	68 57	142	150	3-50'	20' of
2	1050	1, 2" or 2, 1-1/2"	78 62	194	200	or	6" Min
3	750	1, 1-3/4" or 2, 1-1/4"	68 66	245	250	3-100' and 1-50'	or (2) 20' of
4	1500	2, 1-3/4" or 3, 1-1/2"	68 57	157	165	Siamesed	6" Max
1750 GPM Pump							
1	1750	2, 2" or 3, 1-1/2"	55 76	143	150	4-50'	(2) 20' of 6"
2	1225	2, 1-5/8" or 2, 1-1/2"or 3, 1-1/4"	61 84 79	194	200	or	
3	875	1, 2"or 2, 1-3/8"	55 61	245	250	4-100'	
4	1750	2, 2" or 3, 1-1/2"	55 76	158	165		
2000 GPM Pump							
1	2000	2, 2" or 4, 1-1/2"	71 57	147	150	4-50'	(2) 20' of 6"
2	1400	2, 1-3/4"or 3, 1-1/2"	60 49	199	200	or	
3	1000	1, 2" or 2, 1-1/2"	71 57	249	250	4-100'	
4	2000	2, 2" or 4, 1-1/2"	71 57	163	165		

Min. discharge pressures listed above are for pumps operating with full 10' static suction lift. These pressures must be increased by 1 PSI for each 2.3 ft. less than 10' of lift.

IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

TABLE NO. 2
DISCHARGE FROM SMOOTH BORE NOZZLE
Pressures measured by Pitot gage.

Nozzle Pressure PSI	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4
	GALLONS PER MINUTE DELIVERED														
5	4	9	16	26	37	50	66	84	103	125	149	175	203	266	337
6	4	10	18	28	41	55	72	92	113	137	163	192	223	292	369
7	4	11	19	30	44	59	78	99	122	148	176	207	241	315	399
8	5	11	21	32	47	64	84	106	131	158	188	222	257	336	427
9	5	12	22	34	50	67	89	112	139	168	200	235	273	357	452
10	6	13	23	36	53	71	93	118	146	177	211	248	288	376	477
12	6	15	25	40	58	78	102	130	160	194	231	271	315	412	522
14	7	15	27	43	63	84	110	140	173	210	249	293	340	445	564
16	7	16	29	46	67	90	118	150	185	224	267	313	364	475	603
18	7	17	31	49	71	95	125	159	196	237	283	332	386	504	640
20	8	18	33	51	75	101	132	167	206	250	298	350	407	532	674
22	8	19	34	54	79	105	139	175	216	263	313	367	427	557	707
24	8	20	36	56	82	110	145	183	226	275	327	384	446	582	739
26	9	21	37	59	85	115	151	191	235	286	340	400	464	606	769
28	9	21	39	61	89	119	157	198	244	297	353	415	481	629	799
30	10	22	40	63	92	123	162	205	253	307	365	429	498	651	826
32	10	23	41	65	95	127	167	212	261	317	377	443	514	673	854
34	11	23	43	67	98	131	172	218	269	327	389	457	530	693	880
36	11	24	44	69	100	135	177	224	277	336	400	470	546	713	905
38	11	25	45	71	103	138	182	231	285	345	411	483	561	733	930
40	11	26	46	73	106	142	187	237	292	354	422	496	575	752	954
42	11	26	47	74	109	146	192	243	299	363	432	508	589	770	978
44	12	27	49	76	111	149	196	248	306	372	442	520	603	788	1000
46	12	28	50	78	114	152	200	254	313	380	452	531	617	806	1021
48	12	28	51	80	116	156	205	259	320	388	462	543	630	824	1043
50	13	29	52	81	118	159	209	265	326	396	472	554	643	841	1065
52	13	29	53	83	121	162	213	270	333	404	481	565	656	857	1087
54	13	30	54	84	123	165	217	275	339	412	490	576	668	873	1108
56	13	30	56	86	125	168	221	280	345	419	499	586	680	889	1129
58	13	31	56	87	128	171	225	285	351	426	508	596	692	905	1149
60	14	31	57	89	130	174	229	290	357	434	517	607	704	920	1168
62	14	32	58	90	132	177	233	295	363	441	525	617	716	936	1187
64	14	32	59	92	134	180	237	299	369	448	533	627	727	951	1206
66	14	33	60	93	136	182	240	304	375	455	542	636	738	965	1224
68	14	33	60	95	138	185	244	308	381	462	550	646	750	980	1242
70	15	34	61	96	140	188	247	313	386	469	558	655	761	994	1260
72	15	34	62	97	142	191	251	318	391	475	566	665	771	1008	1278
74	15	35	63	99	144	193	254	322	397	482	574	674	782	1023	1296
76	15	35	64	100	146	196	258	326	402	488	582	683	792	1036	1313
78	15	36	65	101	148	198	261	330	407	494	589	692	803	1050	1330

TABLE NO. 2
DISCHARGE FROM SMOOTH BORE NOZZLE
Pressures measured by Pitot gage.

Nozzle Pressure PSI	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4
	GALLONS PER MINUTE DELIVERED														
80	16	36	66	103	150	201	264	335	413	500	596	700	813	1063	1347
82	16	37	66	104	152	204	268	339	418	507	604	709	823	1076	1364
84	16	37	67	105	154	206	271	343	423	513	611	718	833	1089	1380
86	16	37	68	107	155	208	274	347	428	519	618	726	843	1102	1396
88	16	38	69	108	157	211	277	351	433	525	626	735	853	1115	1412
90	17	39	70	109	159	213	280	355	438	531	633	743	862	1128	1429
92	17	39	70	110	161	215	283	359	443	537	640	751	872	1140	1445
94	17	39	71	111	162	218	286	363	447	543	647	759	881	1152	1460
96	17	40	72	113	164	220	289	367	452	549	654	767	890	1164	1476
98	17	40	73	114	166	223	292	370	456	554	660	775	900	1176	1491
100	18	41	73	115	168	225	295	374	461	560	667	783	909	1189	1506
105	18	42	75	118	172	230	303	383	473	574	683	803	932	1218	1542
110	19	43	77	121	176	236	310	392	484	588	699	822	954	1247	1579
115	19	43	79	123	180	241	317	401	495	600	715	840	975	1275	1615
120	19	44	80	126	183	246	324	410	505	613	730	858	996	1303	1649
125	20	45	82	129	187	251	331	418	516	626	745	876	1016	1329	1683
130	20	46	84	131	191	256	337	427	526	638	760	893	1036	1356	1717
135	21	47	85	134	195	262	343	435	536	650	775	910	1056	1382	1750
140	21	48	87	136	198	266	350	443	546	662	789	927	1076	1407	1780
145	21	49	88	139	202	271	356	450	556	674	803	944	1095	1432	1812
150	22	50	90	141	205	275	362	458	565	686	817	960	1114	1456	1843

TABLE NO. 3
Approximate Discharge Flow From Different Nozzles
At the end of Fifty Feet of Average, 2 1/2"
Rubber Lined Fire Hose, for Various
Pump Pressures with Discharge
Valve Wide Open

PUMP	SIZE	OF	NOZZLE	&	GALLONS	PER	MINUTE
PRESSURE LBS	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
30	90	119	153	187	217	250	282
40	103	137	177	216	253	290	327
50	115	153	198	242	284	325	367
60	126	168	216	265	311	357	402
70	136	182	234	287	337	385	435
80	145	194	250	308	361	414	465
90	154	206	265	325	383	437	492
100	162	217	280	343	405	462	520
110	171	228	295	360	425	485	549
120	179	239	307	377	444	510	572
130	186	249	318	392	462	530	596
140	193	258	330	407	480	549	618
150	200	267	341	421	497	567	
175	215	288	374	455	538		
200	230	309	395	486			
225	243	328	420				
250	257	345					

This table is offered as an aide in testing pump performance where facilities for accurate measurement of capacity are not available. The capacities given above are conservative, and will not vary more than 5% from actual capacities with any of the standard hose that might be used.

TABLE NO. 4

Pump or Hydrant Pressure required to give Effective Nozzle Pressure through various Lengths of Rubber Lined Hose.

Size of Hose		1	1 1/2			2		2 1/2					3	
Size of Nozzle		1/4	3/8	1/2	5/8	5/8	3/4	3/4	7/8	1	1 1/4	1 1/2	1 1/4	1 1/2
Nozzle Press PSI	Length of Hose Feet	PUMP OR HYDRANT PRESSURE - PSI												
40	100	45	43	48	60	42	50	44	46	51	64	88	51	62
	200	49	46	56	79	43	60	47	52	60	86	130	59	78
	400	58	51	73	118	46	79	53	62	79	129	212	75	110
	600	67	57	89	158	50	99	59	74	97	172		92	143
	800	76	62	106	196	53	119	65	85	116	215		108	176
	1000	85	68	122	235	56	138	72	96	134	258		124	208
	1500	108	72	142		64	187	87	118	181			165	
	2000	130	96	204		72	226	103	151	227			205	
60	100	67	64	72	89	63	73	65	69	75	95	132	76	92
	200	74	68	84	117	65	86	70	78	89	126	196	88	115
	400	87	76	107	173	69	112	79	94	116	188		111	161
	600	101	85	131	231	74	138	88	111	143	250		135	208
	800	114	93	153		79	164	98	127	170			158	
	1000	127	101	178		83	190	107	143	197			182	
	1500	161	122	237		95	155	130	184	264				
	2000	195	142			106		153	225					
80	100	88	85	96	117	83	99	87	92	99	126	175	101	103
	200	97	91	112	154	86	117	93	103	115	167		116	154
	400	115	102	143	228	92	154	105	125	148	249		147	
	600	132	112	174		98	191	117	147	181			178	
	800	150	123	206		104	228	129	167	214			209	
	1000	167	134	238		110		141	191	247				
	1500	211	161			125		171	245					
	2000	254	188			140		201						
100	100	111	107	120	146	104	123	108	115	125	157		126	152
	200	122	113	139	192	108	145	116	128	150	209		146	190

	400	143	127	177	284	115	190	130	154	200			184	
	600	165	140	217		123	235	145	180	250			223	
	800	186	154	256		131		159	206					
	1000	208	167			138		174	232					
	1500	262	200			157		211						
	2000		234			175		253						

TABLE NO. 5
REACH OF FIRE STREAMS

Size of Nozzle	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"
NOZZLE PRESSURE	**EFFECTIVE VERTICAL REACH - Feet**								
40	30	35	40	50	59	62	64	65	69
60	35	40	45	60	74	77	79	84	87
80	38	42	48	65	81	85	89	94	96
100	40	44	50	68	84	89	94	100	102
NOZZLE PRESSURE	**MAXIMUM VERTICAL REACH - Feet**								
40	60	65	70	75	78	79	80	80	80
60	70	75	85	95	105	106	108	110	110
80	78	83	95	105	117	125	132	140	140
100	80	88	100	110	122	135	145	155	155
NOZZLE PRESSURE	**EFFECTIVE HORIZONTAL REACH - Feet**								
40	20	25	30	40	44	50	55	62	66
60	25	32	37	50	54	61	67	75	80
80	28	35	40	57	62	70	76	84	88
100	30	37	42	60	66	76	84	93	95
NOZZLE PRESSURE	**MAXIMUM HORIZONTAL REACH - Feet**								
40	65	80	90	100	108	120	125	138	140
60	80	95	95	120	127	142	156	176	183
80	90	105	105	135	143	160	175	201	210
100	95	110	110	140	153	180	205	215	223

TABLE NO. 6
Friction Loss in Fire Hose
Loss in PSI per 100 Feet of Hose

SIZE HOSE	LINEN HOSE			BEST RUBER LINED HOSE							
G.P.M.	1 1/2	2	2 1/2	3/4	1	1 1/2	2	2 1/2	3	3 1/2	(2)-2 1/2
10	1.0			13.5	3.5	0.5	.1				
15	2.2			29.0	7.2	1.0	0.3				
20	3.6			50.0	12.3	1.7	0.4				
25	5.5			75.0	18.5	2.6	0.6				
30	8.0	1.9		105.0	26.0	3.6	0.9				
40	13.0	3.2		180.0	44.0	6.1	1.5				
50	20.0	4.9	1.6		67.0	9.3	2.3				
60	28.0	7.0	2.2		96.0	13.5	3.3				
70	37.0	9.0	3.1		131.0	17.0	4..3				
80	47.0	11.5	3.8		171.0	23.0	5.6				
90	59.0	14.5	5.0		217.0	29.0	7.0				
100	72.0	17.5	5.9		268.0	33.0	8.4				
120		25.0	8.3		386.0	47.0	11.7				
140		34.0	11.0			62.0	16.0	5.2	2.0	0.9	1.4
160		43.0	14.0			78.0	20.0	6.6	2.6	1.2	1.9
180		53.0	17.7			97.0	25.0	8.3	3.2	1.5	2.3
200		63.0	21.5			121.0	30.6	10.1	3.9	1.8	2.8
220						146.0		12.0	4.6	2.1	3.3
240						173.0		14.1	5.4	2.5	3.9
260						204.0		16.4	6.3	2.9	4.5
280						237.0		18.7	7.2	3.3	5.2
300						272.0		21.2	8.2	3.7	5.9
320								23.8	9.3	4.2	6.6
340								26.9	10.5	4.7	7.4
360								30.0	11.5	5.2	8.3
380								33.0	12.8	5.8	9.2
400								36.2	14.1	6.3	10.1
425								40.8	15..7	7.0	11.3
450								45.2	17.5	7.9	12.5
475								50.0	19.3	8.7	13.8
500								55.0	21.2	9.5	15.2
525									23.2	10.5	16.6
550									25.2	11.4	18.1
575									27.5	12.4	19.6
600									29.9	13.4	21.2
650									34.5	15.5	24.8
700									39.5	17.7	28.3
750									45.0	20.1	32.2
800									50.5	22.7	36.2
850									56.5	25.4	40.7
900									63.0	28.2	45.2
1000									76.5	34.3	55.0

Losses in rough walled, rubber hose may be 50% higher than values given above.

TABLE NO. 7
Friction Loss in 15-year-old Steel Pipe
Loss in PSI per 100 Feet of Pipe

PIPE SIZE / G.P.M.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8
1	52.0	12.0	2.8	0.9										
2		45.0	10.0	3.2	4.0									
5			55.0	18.0	4.5	1.4	0.4							
10				64.0	16.0	5.0	1.3	0.6						
15				135.0	34.0	11.0	2.7	1.3	0.5					
20					59.0	18.0	4.7	2.2	0.8					
25					89.0	27.0	7.1	3.4	1.2					
30					125.0	39.0	10.0	4.7	1.7	0.6				
35						51.0	13.0	6.3	2.2	0.7				
40						66.0	17.0	8.0	2.9	0.9				
45						82.0	21.0	10.0	3.6	1.2				
50						99.0	26.0	12.0	4.3	1.4	0.6			
60						140.0	38.0	17.0	6.1	2.0	0.8			
70							49.0	23.0	8.0	2.7	1.1			
80							63.0	29.0	10.0	3.4	1.5			
90							78.0	36.0	13.0	4.3	1.8			
100							96.0	44.0	15.0	5.1	2.2	0.5		
125							144.0	66.0	24.0	7.8	3.3	0.8		
150								93.0	33.0	11.0	4.6	1.1		
175								125.0	44.0	15.0	6.1	1.5		
200									56.0	19.0	7.8	1.9		
250									84.0	28.0	12.0	2.9		
300									114.0	40.0	16.0	4.0	0.6	
350										53.0	22.0	5.4	0.8	
400										68.0	28.0	6.9	1.0	
450										84.0	35.0	8.6	1.2	
500										102.0	42.0	10.0	1.4	0.4
600											60.0	15.0	2.1	0.6
800												25.0	3.5	1
1000												37.0	5.2	1.3
1500													11.0	2.7
2000													19.0	4.7
2500													29.0	7.1
3000														10

TABLE NO. 8
Resistance of Fittings
Equivalent Lengths of Straight Pipe - Feet

PIPE SIZE	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8
Gate Valve	0.4	0.6	0.8	1.1	1.4	1.8	2.2	2.8	4.1	5.3	6.7	9.4
Global Valve	3.0	4.5	6.0	8.5	10.5	14.0	17.0	22.0	32.0	42.0	53.0	75.0
Angle Valve	1.4	2.0	2.7	3.8	4.8	6.3	7.9	10.5	14.5	18.5	23.0	33.0
Std. Elbow	1.1	1.5	2.0	2.8	3.5	4.7	5.8	7.5	11.0	14.0	18.0	24.0
45 Elbow	0.6	0.8	1.0	1.4	1.6	2.1	2.5	3.1	4.2	5.2	6.3	8.5
Long Sweep EI Str Run Tee	0.5	0.8	1.0	1.4	1.7	2.3	2.8	3.7	5.3	7.0	9.0	12.5
Std. Tee Thru Side Outlet	2.1	2.9	3.9	5.5	6.9	9.1	11.6	14.8	21.0	27.0	34.0	49.0
SuddenEnlarg or contraction	1.8	2.5	3.2	4.2	5.0	6.5	7.5	9.5	13.0	16.0	19.0	25.0
Entrance to Pipe	1.0	1.3	1.6	2.2	2.6	3.3	3.9	4.9	6.5	8.2	10.0	13.0

TABLE NO. 9
To Convert Pounds per Square Inch to
Feet Elevation of Water

Feet	5	10	15	20	25	30	35	40	45	50	60	70	80	90
Pounds	2.2	4.3	6.5	8.7	11	13	15	17	20	22	26	30	35	39
Feet	**100**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**	**220**	**240**	**260**	**280**
Pounds	**43**	**52**	**56**	**61**	**65**	**69**	**74**	**78**	**82**	**87**	**95**	**104**	**113**	**121**
Feet	300	320	340	360	380	400	425	450	475	500	525	550	600	700
Pounds	130	139	147	156	165	173	184	195	206	217	227	238	260	303

Table NO. 10
American National Fire Hose Connection Screw Thread - NH

Size of Hose	3/4	1	1 1/2	2 1/2	3	3 1/2	4	4 1/2	5	6
Thr'ds per inch	8	8	9	7.5	6	6	4	4	4	4
Thread Designation	0.75-8 NH	1-8 NH	1.5-9 NH	2.5-7.5 NH	3-6 NH	3.5-6 NH	4-4 NH	4.5-4 NH	5-4 NH	6-4 NH
Max. O.D. Male	1.3750	1.3750	1.9900	3.0686	3.6239	4.2439	5.0109	5.7609	6.2600	7.0250

Ref. NFPA 1963

Underwriters Nozzle Tip Thread: 2.1875 O.D. - 12 threads per inch.

IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

W.S. DARLEY & CO.

OPERATING INSTRUCTIONS - ELECTRIC PRIMING PUMP

The Darley electric primer will develop up to 25 in. Hg. in an air tight pumping system.

The Primer is activated by a combination spring return on-off valve and electric switch. Pulling the valve out opens the valve and closes the electrical circuit to start the motor.

Before the pump can be primed, booster line valves, drain valves, cooling line valve, and all other openings into the pump must be closed and absolutely air tight. The discharge side of the pump is sealed by a check valve, therefore the main discharge valves need not be closed.

When operating from draft, suction hose connections must be tight and free of air leaks.

Make certain the suction hose strainer is properly submerged and free of foreign material.

The main pump drive should remain disengaged until priming is complete to prevent possible damage to impeller seal rings by running "dry".

Pull the primer shutoff valve all the way out to start priming and hold open until water discharges from primer pump exhaust port. Push valve all the way in to shut off primer motor and seal tight.

CAUTION: FOR PRIMING UP TO 10' OF LIFT:

If water does not discharge from the primer exhaust within about 30 seconds (45 seconds with 2 – 20' lengths of hose) stop the primer pump, check for air leaks and make sure primer pump is receiving lubricant from its reservoir, if one is present. MAX PRIMER OPERATION TIME = 90 seconds every 5 minutes. DO NOT EXCEED 90 SECONDS OF PRIMER OPERATION.

CAUTION: FOR PRIMING 10' OF LIFT AND HIGHER:

If water does not discharge from the primer exhaust within 90 seconds stop the primer pump, check for air leaks and make sure primer pump is receiving lubricant from its reservoir, if one is present. DO NOT EXCEED 90 SECONDS OF PRIMER OPERATION.

CAUTION: The primer pump and motor will begin to generate heat as soon as operation begins. Extended run times (up to 90 seconds) and repeating priming cycles consecutively or within short time periods may lead to premature failure of the primer pump assembly: such failures include but are not limited to: overheating of the motor, seizure of the rotor, and cracking of primer vanes. To avoid this, after your first priming attempt, thoroughly inspect the pump system for air leaks, check that the primer is

receiving lubricant from its reservoir if such is present, and resolve the issue before attempting re-prime.

Engage "Pump" shift to start pumping water.

When pumping from hydrants, the primer is not needed and must be kept closed.

It may be necessary to use the primer momentarily when pumping from a booster tank when the suction head is insufficient to force all the air out of the pump.

LUBRICATING SYSTEM - ELECTRIC PRIMING PUMPS WITH FLUID RESERVOIR

The electric motor rotary van primer pump creates a high vacuum by continuous lubrication of rotor and vanes. Therefore the primer lubricant supply tanks (4 quarts) should be kept full at all times. Recommended primer system lubricant is Darley PRIME GREEN. PRIME GREEN is an environmentally safe, non-toxic, biodegradable lubricant. Its use assures proper primer vane lubricant while minimizing environmental effects.

After the main pump is drained, run the primer motor to drain primer lines and re-lubricate the primer pump.

The vent hole on the lubricant tank cap should be kept open at all times to prevent siphoning lubricant from the tank after the pump is stopped. Do not increase the size of the hole.

Locate the lubricant tank where it may be conveniently inspected and filled.

Should water appear in the lubricant supply tank, the primer valve is leaking. Check and replace valve plug seal o-ring if necessary.

ELECTRIC PRIMING PUMPS WITHOUT FLUID RESERVOIR

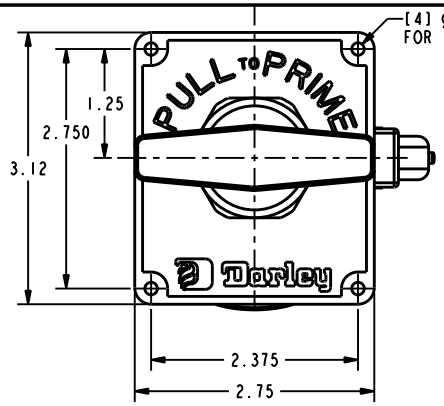
The fluidless electric-motor rotary-vane primer pump creates a high vacuum by using a special material for the vanes and an initial factory applied lubricant film. This film must be present in order for the primer to operate properly and to provide maximum life for the primer components.

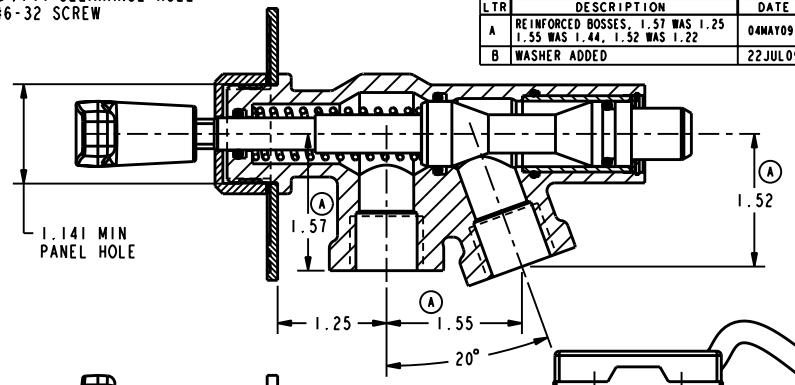
This film should not wash away completely if the pump is used to pump clean water. If the priming pump is disassembled for any reason, all internal surfaces of the housing and end caps must be cleaned and coated completely with Dow Corning #111 Silicone valve lubricant prior to operating the primer. If a degradation of performance is noticed, performance may be restored by re-applying the film in this manner. It is recommended to service the primer annually to clean and re-apply the silicone film to the inside of the primer housing and end caps. Do not apply grease to the rotor slots, or the sides of the vanes.

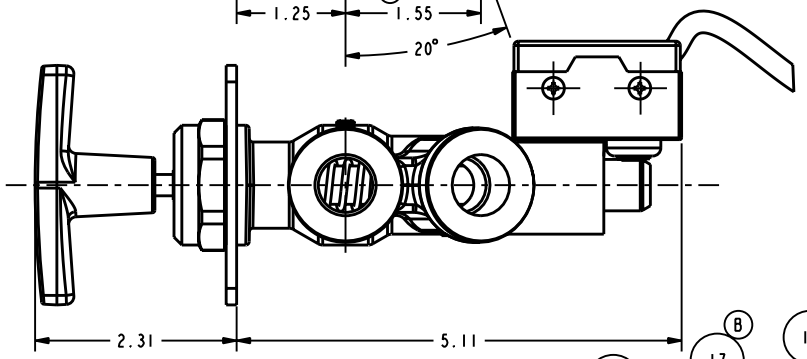
After the main pump is drained, run the primer motor to drain primer lines.

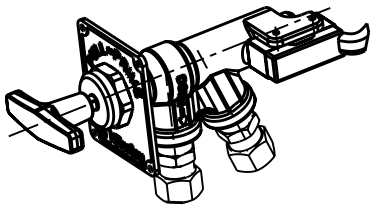
NO.	DESCRIPTION	PART NO.	QTY.
1	BODY - PRIMER VALVE	2056300	1
2	CONNECTOR - DUETCH DT 06-3S	2601618	1
3	HANDLE - PRIMER TEE	3012400	1
4	MICROSWITCH - PRIMER VALVE	2600146	1
5	NUT - PANEL VALVE, 1.250-12	5403511	1
6	O-RING - 0.38 x 0.56 x 0.09	3601104	1
7	O-RING - 0.562 X 0.750 X 0.09	3601128	1
8	O-RING - 0.75 x 0.94 x 0.09	3601112	1
9	PLATE - PRIMER, CAST ZINC	1977200	1
10	RHMS - NO.6-32 X1.00, BR	5402012	2
11	RING - RETAINER, 5000-87	3600453	1
12	SPRING - PRIMER VALVE	3600042	1
13	STEM - PUSH-PULL PRIMER VALVE	5243200	1
14	WASHER - LOCK, NO.6 ID, SST	3603508	2
15	BEARING - PRIMER VLV, IGLIDE	1762600	1
16	O-RING - 0.88 x 1.00 x 0.06	3601009	1
17	WASHER - 0.62 x 0.88 x .04, 303	3603339	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REINFORCED BOSSES, 1.57 WAS 1.25 1.55 WAS 1.44, 1.52 WAS 1.22	04MAY09	5408	DWS
B	WASHER ADDED	22JUL09	5642	DWS





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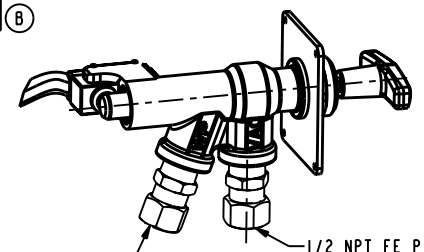
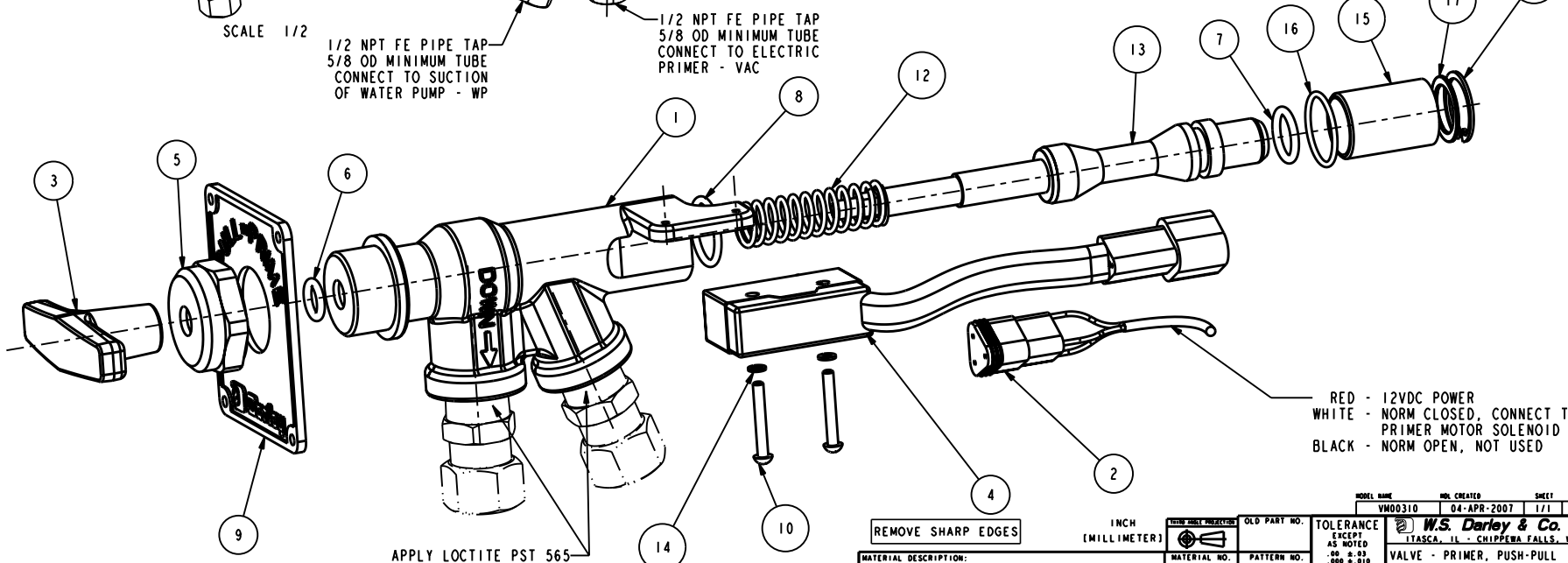




REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

DR'N DWS

CHK'D

TRC'D

MODEL NAME	MDL CREATED	SHEET	
VM00310	04-APR-2007	1/1	C

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

VALVE - PRIMER, PUSH-PULL HVY SPRING

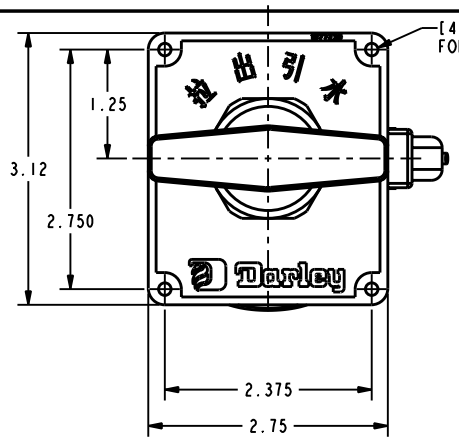
DATE 03-Apr-07

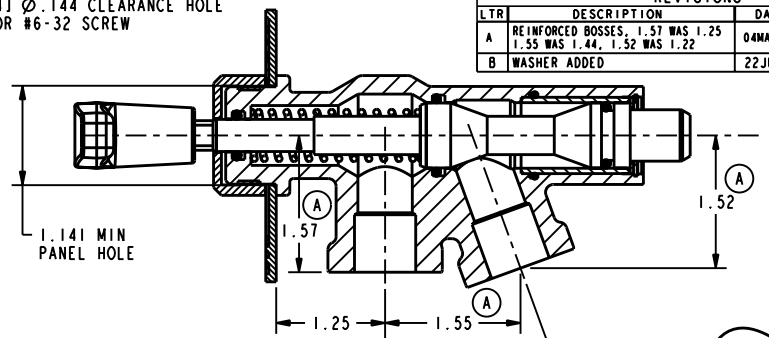
SCALE 1/1

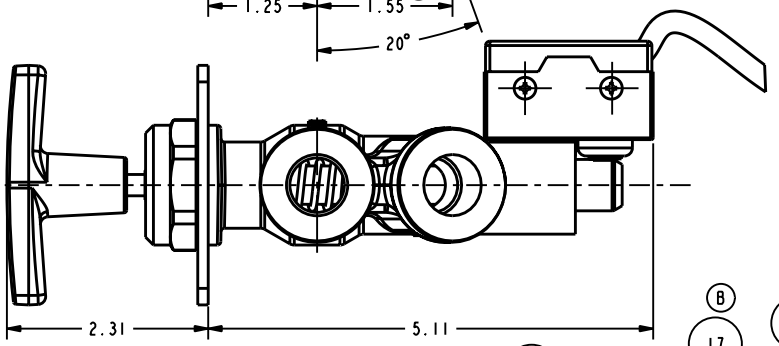
DVC0203

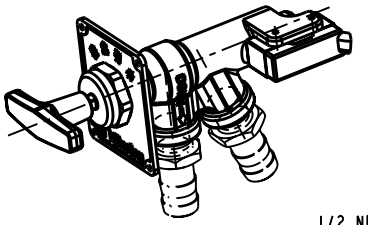
NO.	DESCRIPTION	PART NO.	QTY.
1	BODY - PRIMER VALVE	2056300	1
2	CONNECTOR - DUETCH DT 06-3S	2601618	1
3	HANDLE - PRIMER TEE	3012400	1
4	MICROSWITCH - PRIMER VALVE	2600146	1
5	NUT - PANEL VALVE, 1.250-12	5403511	1
6	O-RING - 0.38 x 0.56 x 0.09	3601104	1
7	O-RING - 0.562 X 0.750 X 0.09	3601128	1
8	O-RING - 0.75 x 0.94 x 0.09	3601112	1
9	PLATE - PRIMER, CAST ZINC	1977230	1
10	RHMS - NO.6-32 X1.00, BR	5402012	2
11	RING - RETAINER, 5000-87	3600453	1
12	SPRING - PRIMER VALVE	3600042	1
13	STEM - PUSH-PULL PRIMER VALVE	5243200	1
14	WASHER - LOCK, NO.6 ID, SST	3603508	2
15	O-RING - 0.88 x 1.00 x 0.06	3601009	1
16	BEARING - PRIMER VLV, IGLIDE	1762600	1
17	WASHER - 0.62 x 0.88 x .04, 303	3603339	1 (B)

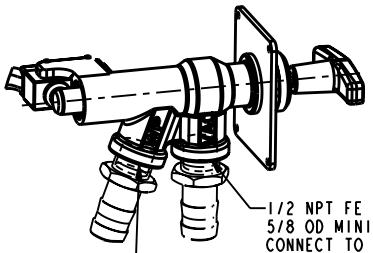
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REINFORCED BOSSES, 1.57 WAS 1.25 1.55 WAS 1.44, 1.52 WAS 1.22	04MAY09	5408	DWS
B	WASHER ADDED	22JUL09	5642	DWS



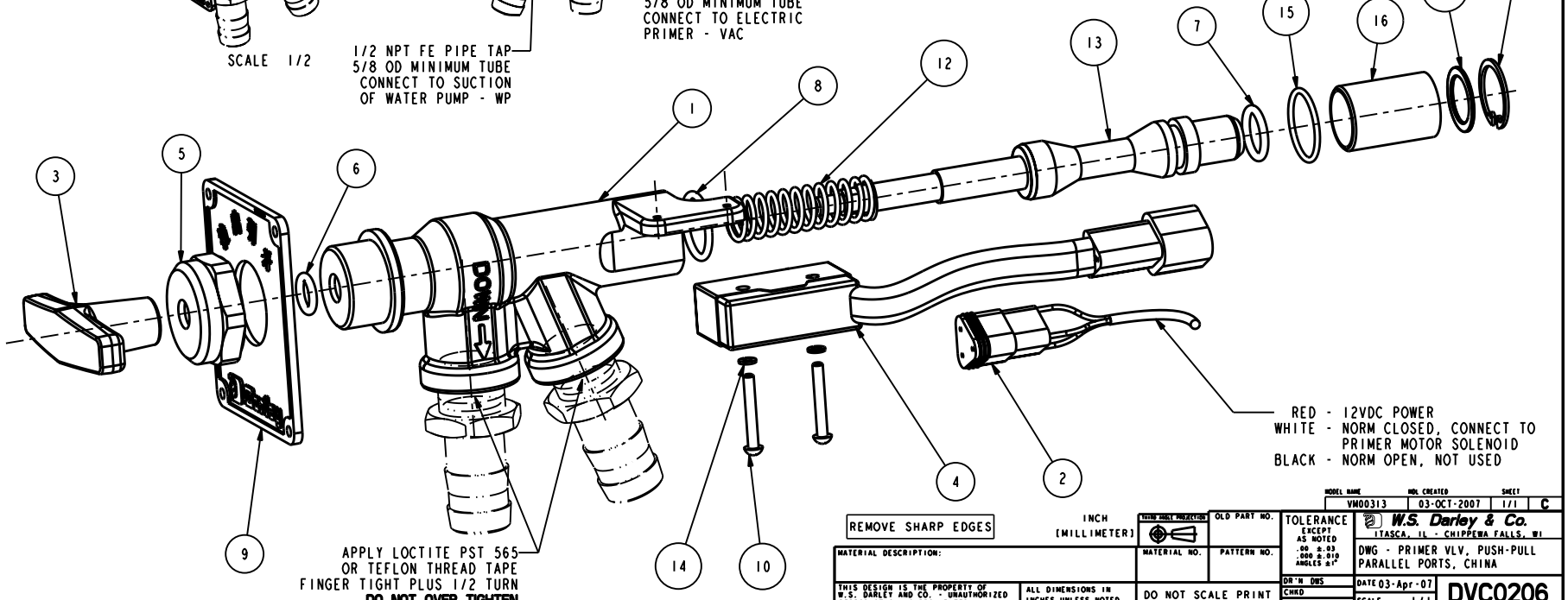





SCALE 1/2



1/2 NPT FE PIPE TAP
5/8 OD MINIMUM TUBE
CONNECT TO SUCTION
OF WATER PUMP - WP



REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

DR'N DWS

CHK'D

TRC'D

MODEL NAME: VM00313 | MDL CREATED: 03-OCT-2007 | SHEET: 1/1 | C

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - PRIMER VLV, PUSH-PULL PARALLEL PORTS, CHINA

DATE 03-Apr-07

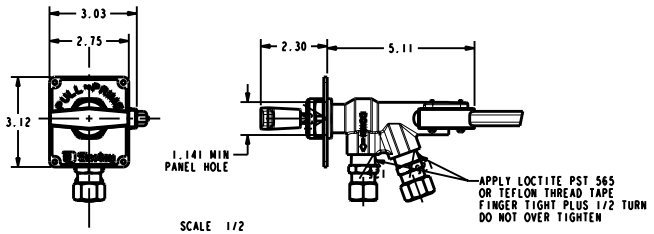
SCALE 1/1

DVC0206

NAME:DWS OBJECT:DVC0206 DATE:19-Aug-09 10:15:38

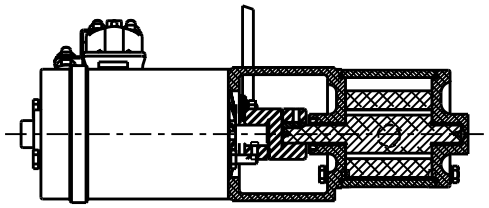
NAME:AAN OBJECT:DVC0207 DATE:17-Apr-09 09:42:43

NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 12V	4223400	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
16	STRAP - GROUND, 12V PRIMER	2600516	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

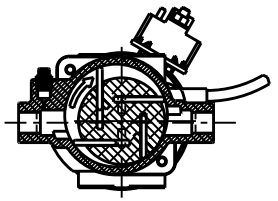


SCALE 1/2

NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DVC0203, DVC0204 & DVC0205
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.



SECTION A-A
SCALE 1/2



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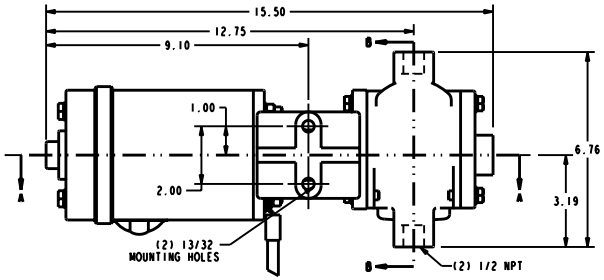
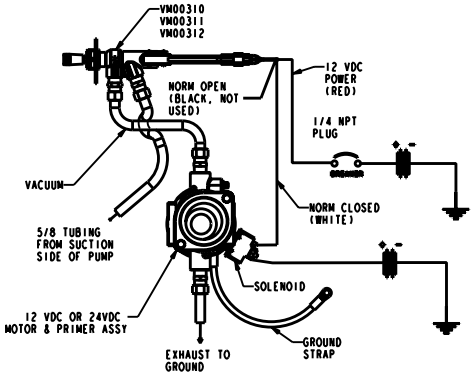




NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 12 V & 24 V PRIMERS:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0' TO 20' ..... #0 (12V), #3 (24V) COPPER
0' TO 25' ..... #00 (12V), #2 (24V) COPPER

THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
12 V = 240 AMP
24 V = 140 AMP

WEIGHT = 27 LB (12.1 KG)

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

REMOVE SHARP EDGES | INCH (MILLIMETER) | OLD PART NO. | TOLERANCE EXCEPT AS NOTED .XX ± 0.03 .XXX ± 0.010 ANGLES ± 1° | W.S. Darley & Co. ITASCA, IL. CHICAGO, FALLS, MT.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

DRN'N BJG | DATE 18-Apr-08
CHK'D BDS | SCALE 1/2
ENG'R

MODEL NAME DVC0207 | NO. CREATED 04/18/08 | SHEET 1/1 | D

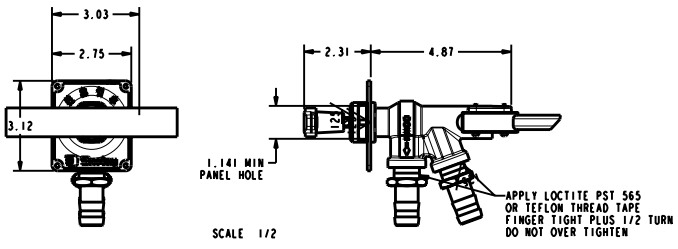
DWG - ELEC. PRIMER, VLV., 4 V W/ TANK, CR. SECTION, EXPLODED

DVC0207

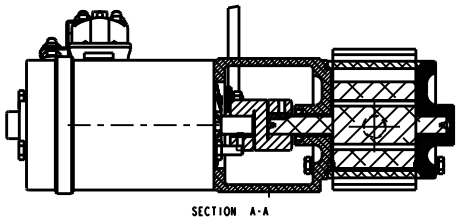
NAME:MJW OBJECT:DVC0208 DATE:23-Dec-09 08:56:54

NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - 844093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 24V	4223500	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	STRAP - GROUND, 12V PRIMER	2600516	1
16	TUBE FITTING - STR, .25 x .19	3500021	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

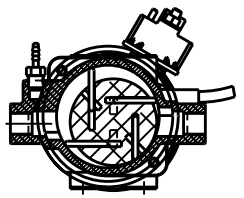
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAH



SCALE 1/2

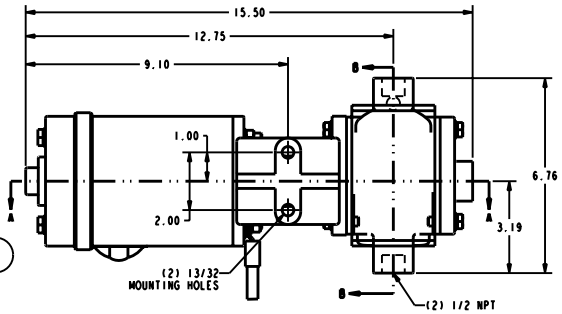


SECTION A-A



SECTION B-B

NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DRAWING DVC0206
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.



NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 24 V PRIMERS:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0° TO 20° ..... #3 COPPER
0° TO 25° ..... #2 COPPER

THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
24 V = 140 AMP

WEIGHT = 27 LB (12.1 KG)

REMOVE SHARP EDGES

INCH (MILLIMETER)

OLD PART NO.

TOLERANCE EXCEPT AS NOTED

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

MODEL NAME: AP0091J,CHINA | NO. CREATED: 24-SEP-2004 | SHEET: 1/1 | D

W.S. Darley & Co. ITASCA, IL. CHICAGO, FALLS, MN.

DWG - ELEC. PRIMER, VLV., 4 VANE W/TANK, CHINA, CR. SEC., EXPL.

DATE 18-Apr-08

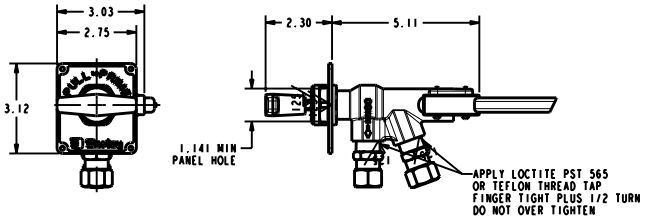
SCALE 1/2

DVC0208

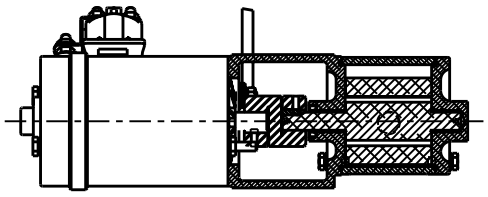
NAME:AAN OBJECT:DVC0209 DATE:29-Apr-09 10:21:45

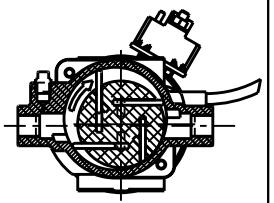
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - 844093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 24V	4223500	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	TUBE FITTING - STR, .25 x .19	3500021	1
16	STRAP - GROUND, 12V PRIMER	2600516	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

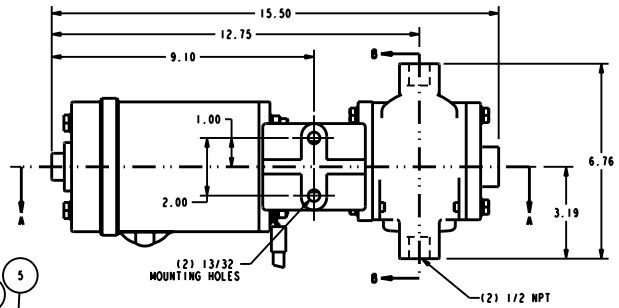
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

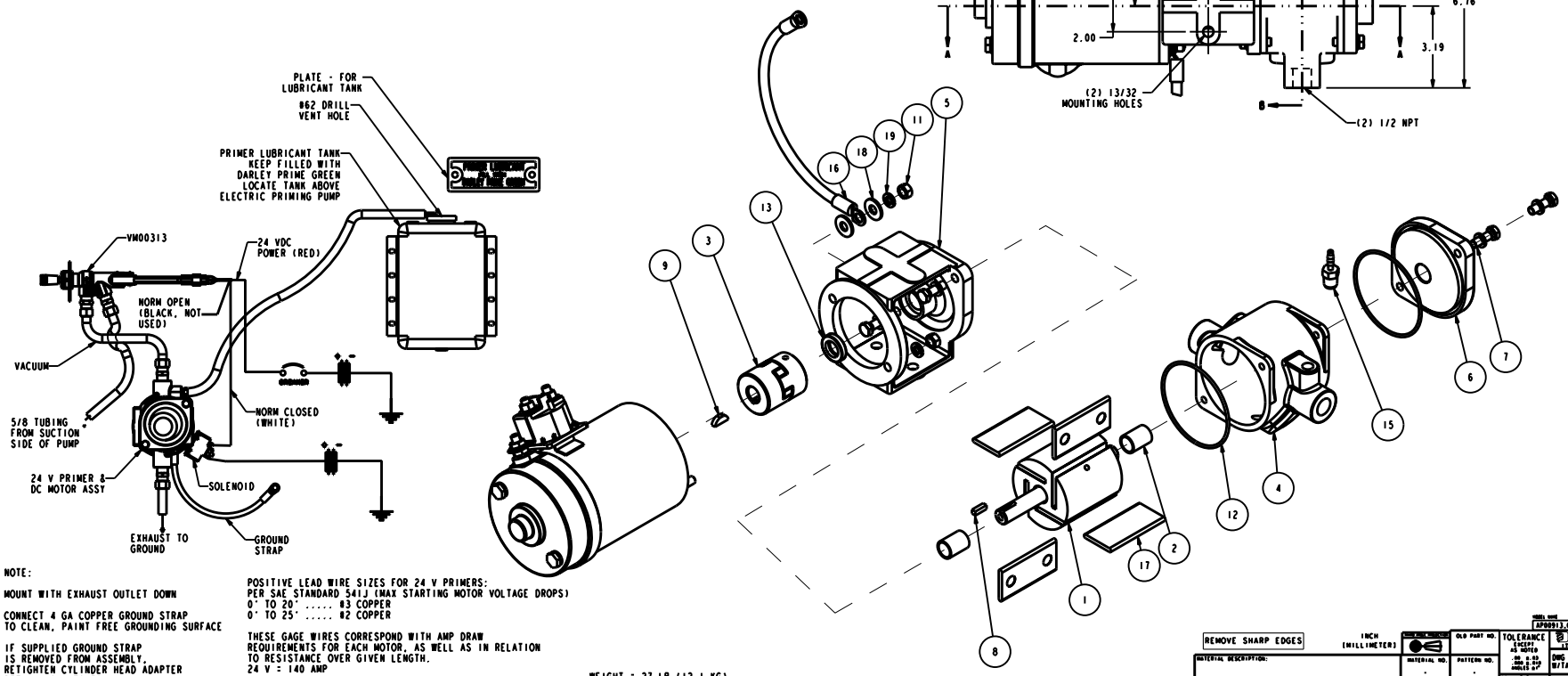


NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DRAWING DVC0203
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.









NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 24 V PRIMERS:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0° TO 20° ..... #3 COPPER
0° TO 25° ..... #2 COPPER

THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
24 V = 140 AMP

WEIGHT = 27 LB (12.1 KG)

REMOVE SHARP EDGES | INCH (MILLIMETER) | DO NOT SCALE PRINT | TOLERANCE EXCEPT AS NOTED .XX ± 0.03 .XXX ± 0.010 ANGLES ± 1° | W.S. Darley & Co. ITASCA, IL. CHICAGO (CALS., ILL.

MATERIAL DESCRIPTION: | MATERIAL NO. - | PATTERN NO. - | OLD PART NO. | THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED

DWG - ELEC. PRIMER, VLV. 4 VANE W/TANK, DARLEY, CR. SEC., EXPL.

MODEL NAME	MDL CREATED	SHEET
AP0091J.CHIBA	24-SEP-2004	1/1	D

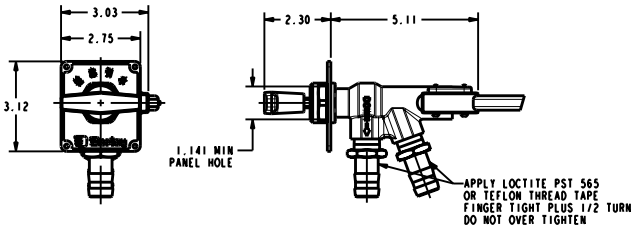
DRWN AAN | DATE 18-Apr-08 | CHKD BDS | SCALE 1/2 | DVC0209

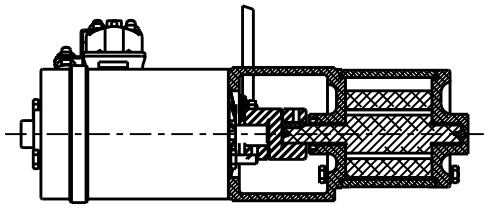
NAME:AAN OBJECT:DVC0212 DATE:23-Apr-09 08:29:37

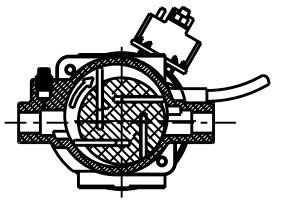
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 12V	4223400	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
16	STRAP - GROUND, 12V PRIMER	2600516	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

REVISIONS

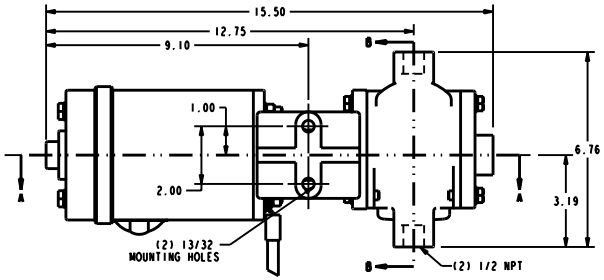
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

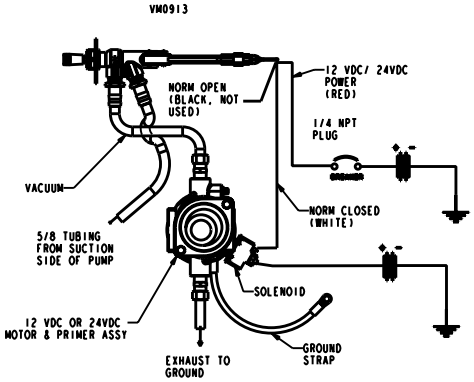






NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DVC0208
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.





NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 12 V & 24 V PRIMERS:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0' TO 20' ..... #0 (12V), #3 (24V) COPPER
0' TO 25' ..... #00 (12V), #2 (24V) COPPER

THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
12 V = 240 AMP
24 V = 140 AMP

WEIGHT = 27 LB (12.1 KG)

REMOVE SHARP EDGES | INCH (MILLIMETER) | OLD PART NO. | TOLERANCE EXCEPT AS NOTED .XX ± 0.03 .XXX ± 0.010 ANGLES ± 1° | W.S. Darley & Co. ITASCA, IL. CHICAGO, FALLS, NY.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

DWG - ELEC. PRIMER, VLV., 4 V NO TANK, CR. SECTION, EXPLODED

DRN AAN | DATE 23-Apr-09 | DVC0212

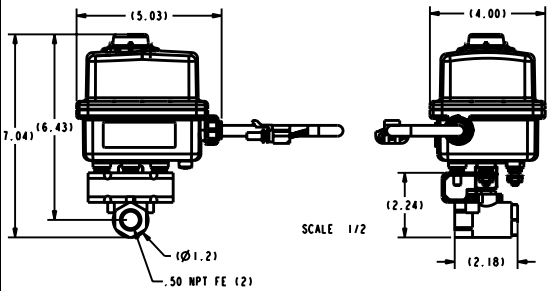
CHKD | SCALE 1/2

MODEL NAME DVC0212 | NO. CREATED 04/23/09 | SHEET 1/1 | D

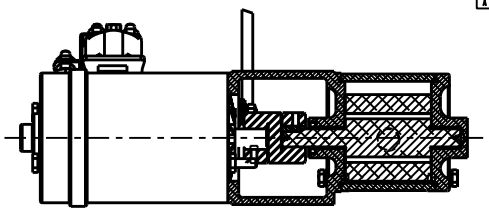
NAME:AAN OBJECT:DVC0210 DATE:17-Apr-09 09:46:12

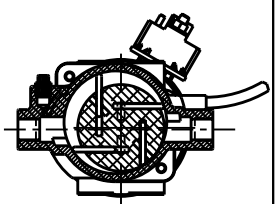
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 12V	4223400	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
16	STRAP - GROUND, 12V PRIMER	2600516	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

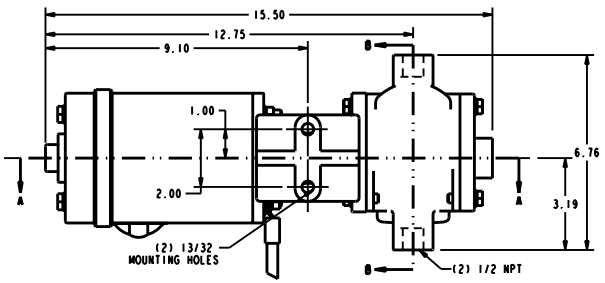
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

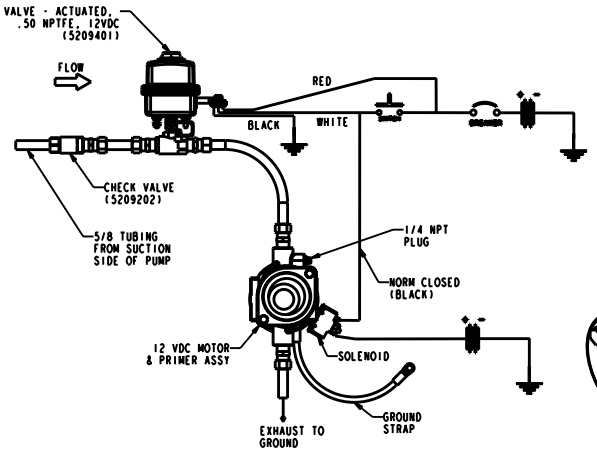


5209401 - KZCO VALVE - ACTUATED,
12 VDC, .50NPT FE
KZCO MDL #84D23-10D20-P01









NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 12 V PRIMER:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0' TO 20' ..... #0 (12V)
0' TO 25' ..... #00 (12V)

THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
12 V = 240 AMP

WEIGHT = 27 LB (12.1 KG)

REMOVE SHARP EDGES

INCH (MILLIMETER)

MATERIAL DESCRIPTION:

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

OLD PART NO.

MATERIAL NO.

PATTERN NO.

DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED
.XX ± 0.03
.XXX ± 0.010
ANG ± 0°30' DECIMALS ± 1°

MODEL NAME: DVC0210 | NO. CREATED: 04/18/08 | SHEET: 1/1 | D

W.S. Darley & Co.
ITASCA, IL., CALUMET CITY, IL.

DWG - ELEC. PRIMER, VLV., 4 V
W/ TANK, CR. SECTION, EXPLODED

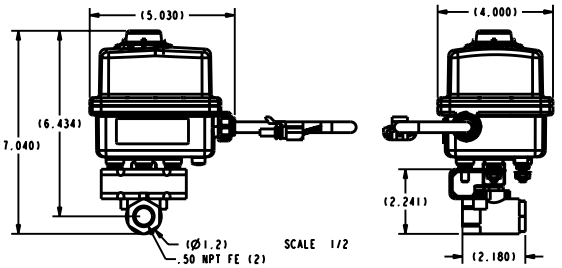
DATE 18-Apr-08

SCALE 1/2

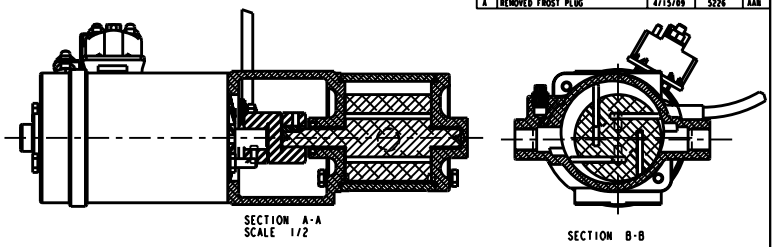
DVC0210

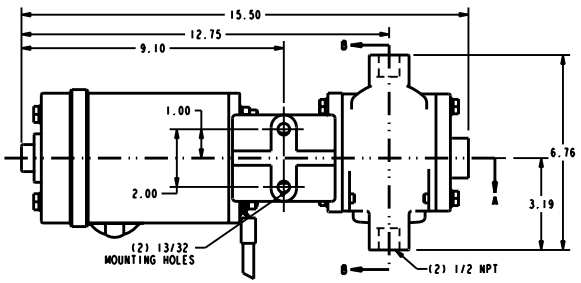
NAME:AAN OBJECT:DVC0211 DATE:17-Apr-09 09:47:18

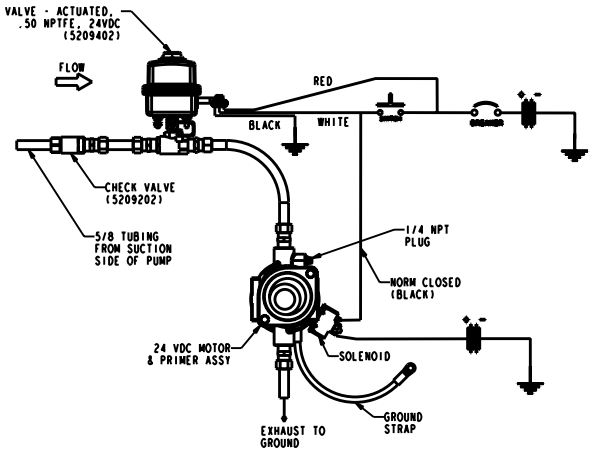
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 X 0.62 GR2	3602425	1
9	KEY - WOODRUFF, 606	3602200	1
10	MOTOR - PRIMER, 24V	4223500	1
11	NUT - HEX, .313-15, SST	5403024	2
12	O-RING - 3.50 x 3.69 x 0.09	3601101	2
13	OIL SEAL - 0.625 ID X 1.128 OD	3600505	1
15	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
16	STRAP - GROUND, 12V PRIMER	2600516	1
17	VANE - ROTOR, ELEC PRIMER	4407601	4
18	WASHER - FLAT, 5/16, STEEL	3603802	2
19	WASHER - LOCK, 0.313 ID	3603502	6

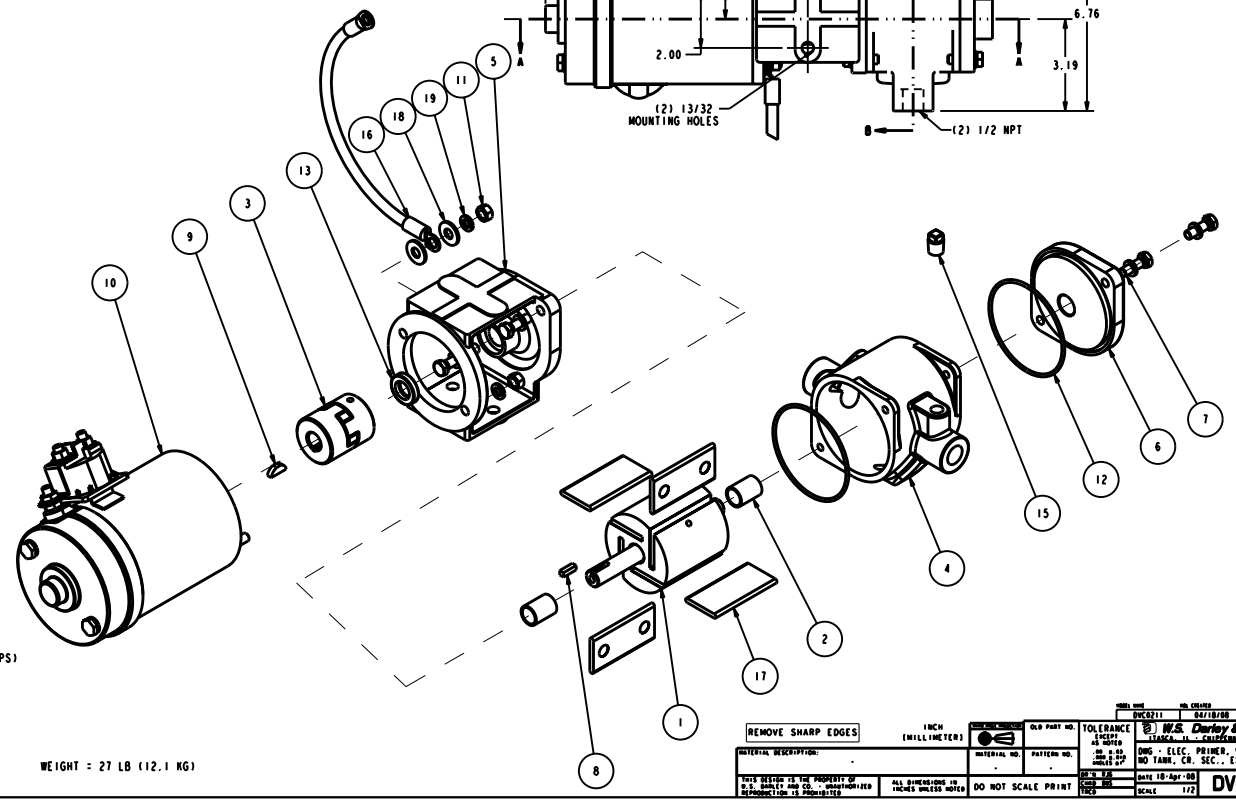


5209402 - KZCO VALVE - ACTUATED,
24 VDC, .50NPT FE
KZCO MDL #84D23-60AD-M









NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

CONNECT 4 GA COPPER GROUND STRAP
TO CLEAN, PAINT FREE GROUNDING SURFACE

IF SUPPLIED GROUND STRAP
IS REMOVED FROM ASSEMBLY,
RETIGHTEN CYLINDER HEAD ADAPTER
RETAINING NUTS EQUALLY
TO 90 IN.LB.

POSITIVE LEAD WIRE SIZES FOR 24 V PRIMER:
PER SAE STANDARD 541J (MAX STARTING MOTOR VOLTAGE DROPS)
0' TO 20' ..... #3 COPPER (24V)
0' TO 25' ..... #2 COPPER (24V)

THESE GAGE WIRES CORRESPOND WITH AMP DRAW
REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION
TO RESISTANCE OVER GIVEN LENGTH.
24 V = 140 AMP

WEIGHT = 27 LB (12.1 KG)

REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

REMOVE SHARP EDGES

INCH
[MILLIMETER]

MATERIAL DESCRIPTION:

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

OLD PART NO.

MATERIAL NO.

PATTERN NO.

DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED
.XX ± 0.03
.XXX ± 0.010
ANGLES ±1°

MODEL NAME DVC0211 | NO. CREATED 04/18/08 | SHEET 1/1 | D

W.S. Darley & Co.
ITASCA, IL. CHICAGO (FALS), ILL.

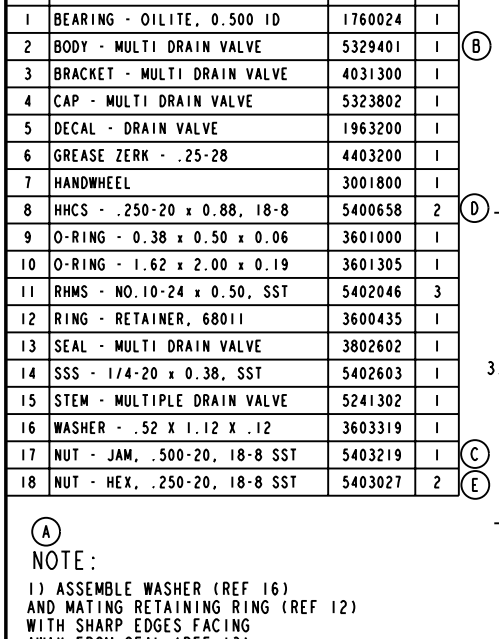
DWG - ELEC. PRIMER, VLV., 4 V
NO TANK, CR. SEC., EXPL., 24VDC

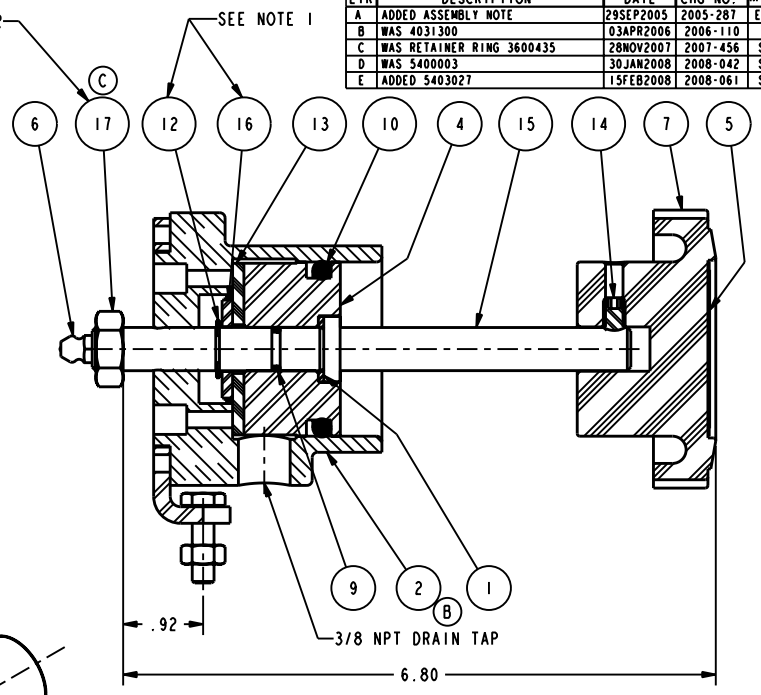
DATE 18-Apr-08
SCALE 1/2

DVC0211

NO.	DESCRIPTION	PART NO.	QTY.	
1	BEARING - OILITE, 0.500 ID	1760024	1	
2	BODY - MULTI DRAIN VALVE	5329401	1	B
3	BRACKET - MULTI DRAIN VALVE	4031300	1	
4	CAP - MULTI DRAIN VALVE	5323802	1	
5	DECAL - DRAIN VALVE	1963200	1	
6	GREASE ZERK - .25-28	4403200	1	
7	HANDWHEEL	3001800	1	
8	HHCS - .250-20 x 0.88, 18-8	5400658	2	D
9	O-RING - 0.38 x 0.50 x 0.06	3601000	1	
10	O-RING - 1.62 x 2.00 x 0.19	3601305	1	
11	RHMS - NO.10-24 x 0.50, SST	5402046	3	
12	RING - RETAINER, 68011	3600435	1	
13	SEAL - MULTI DRAIN VALVE	3802602	1	
14	SSS - 1/4-20 x 0.38, SST	5402603	1	
15	STEM - MULTIPLE DRAIN VALVE	5241302	1	
16	WASHER - .52 X 1.12 X .12	3603319	1	
17	NUT - JAM, .500-20, 18-8 SST	5403219	1	C
18	NUT - HEX, .250-20, 18-8 SST	5403027	2	E

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	ADDED ASSEMBLY NOTE	29SEP2005	2005-287	EWH
B	WAS 4031300	03APR2006	2006-110	
C	WAS RETAINER RING 3600435	28NOV2007	2007-456	SMS
D	WAS 5400003	30JAN2008	2008-042	SMS
E	ADDED 5403027	15FEB2008	2008-061	SMS



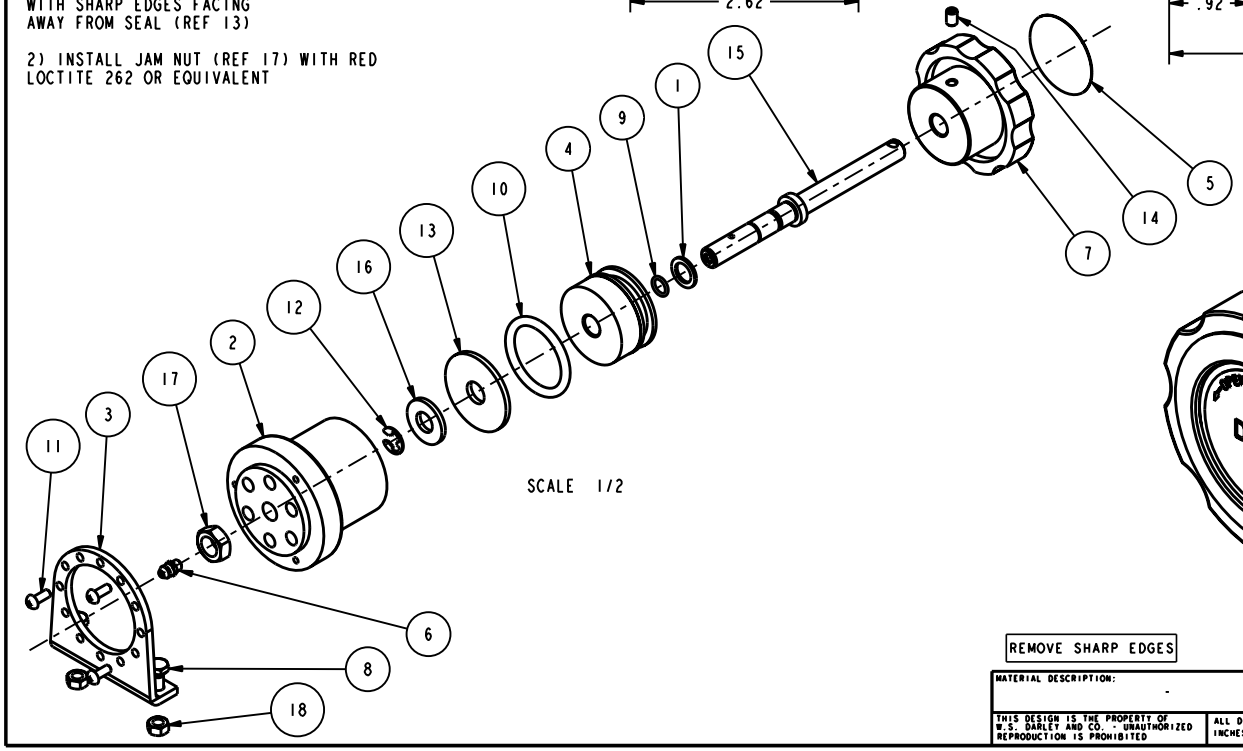


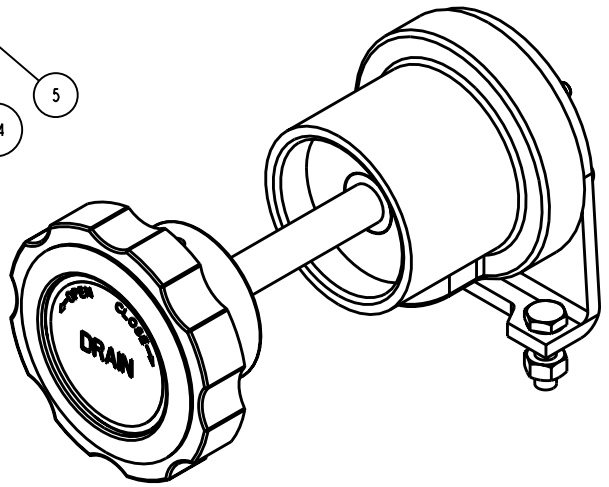
A

NOTE:

1) ASSEMBLE WASHER (REF 16) AND MATING RETAINING RING (REF 12) WITH SHARP EDGES FACING AWAY FROM SEAL (REF 13)

2) INSTALL JAM NUT (REF 17) WITH RED LOCTITE 262 OR EQUIVALENT





MODEL NAME	MDL CREATED	SHEET	
VD00500	12/29/04	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

USING FIRST PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

DWG - MULTIPLE DRAIN VALVE SCREW TYPE, VARIABLE POSITION

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

DR'N JSS

CHK'D DMD

TRC'D

DATE 29-Dec-04

SCALE 1/1

DGC0903

BALL VALVE QUARTER TURN - SELF LOCKING

The Darley Ball Valve is a quarter turn, all bronze valve designed for the fire service.

The ball is cast bronze, precision machined and hard chrome plated for long trouble free service. It is easily serviced in the field.

The lever is self locking and easily adjusted, even under extreme high pressure.

TO DISASSEMBLE AND REPAIR THE BALL VALVE
ILLUSTRATION DGC0100

TOOLS REQUIRED:

- 3/16" Allen Wrench
- 1-1/8" Wrench
- 3/4" & 1" Wrench
- Vise Grips or Pliers

1. Remove cap nut (20) and adjusting nut (16).

2. Lever Assembly (11) pulls straight up. Watch for 2 cam balls (12).

3. Unbolt and remove clutch ring (9), clutch sleeve (8), valve stem (7), spring (14), and valve stem washer (15). Check clutch ring (9) and sleeve (8) for scoring or excessive wear. Check o-ring (26). Replace if necessary.

4. Remove nipple (2). Check Quad Ring (25). Replace if necessary.

5. Unscrew ball guide screw (6). Check o-ring (23). Replace if necessary.

6. Remove valve ball (3). Check for scratches, corrosion, and wear. Replace if necessary.

7. Remove seat assembly (4). Check condition of rubber seat. Replace seat assembly if necessary.

REASSEMBLY OF BALL VALVE
ILLUSTRATION DGC0100

1. Position ball (3) in body so ball guide screw (6) engages bottom of ball as it is screwed into position.

2. Put valve stem (7) into position. Make certain stem engages slot on top of ball.

3. Slip washer (15), spring (14), and clutch sleeve (8) over the stem. Place clutch ring (9) over the sleeve and secure with the four (4) 1/4″ NC x 5/8″ socket head cap screws.

4. Set the two cam balls (12) into the V grooves in the clutch sleeve (8) and drop lever assembly over them. Tighten the adjusting nut (16) so that approximately 1/8″ play is left at the end of a 6″ lever. Over tightening this nut will make the clutch lock inoperative. Lock adjusting nut (16) with cap nut (20). Recheck this adjustment after valve is placed in service.

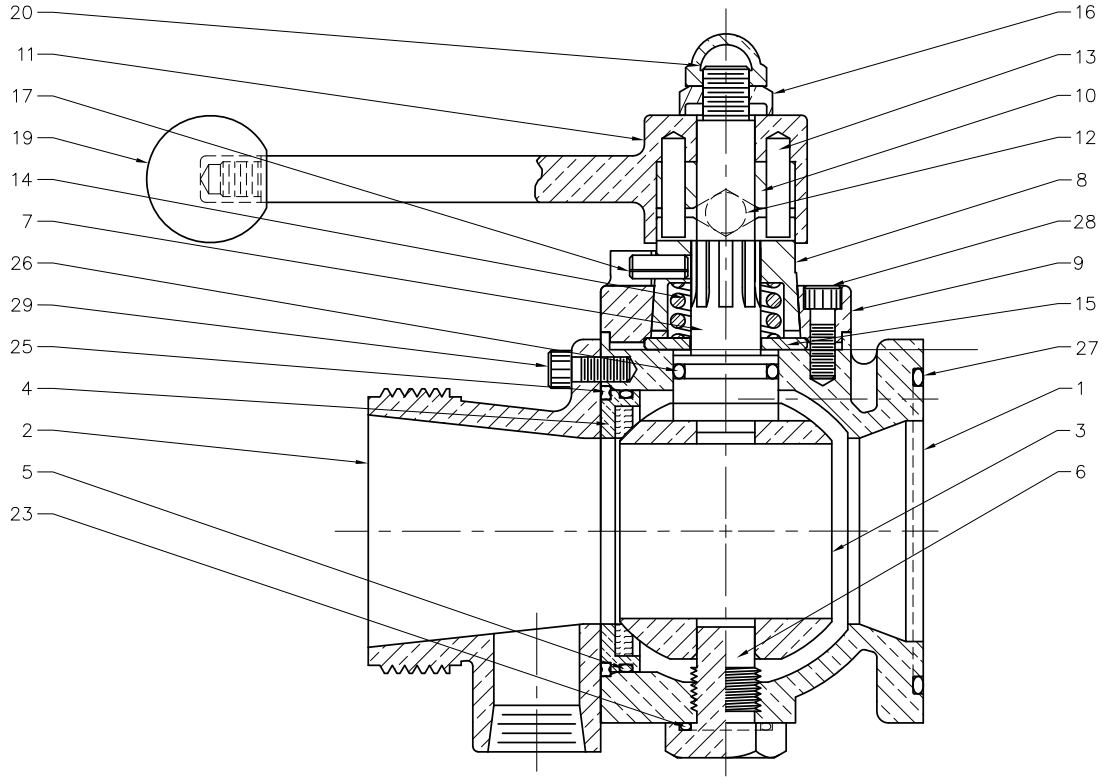
5. Place seat assembly (4), seat o-ring (5), and quad ring (25) into position.

6. Secure nipple (2) to valve body with eight (8) 1/4″ NC x 5/8″ socket head cap screws.

If more information is needed, call W.S. DARLEY & CO. at Chippewa Falls, WI at 800-634-7812 or 715-726-2650

LETTER	CHANGE NO.	DATE
(A)	96–53	5/15/96

REP NO.	NAME OF PART	QTY.
1	DISCHARGE VALVE BODY	1
2	VALVE NIPPLE	1
3	VALVE BALL	1
4	VALVE SEAT	1
5	O'RING	1
6	BALL GUIDE SCREW	1
7	VALVE STEM	1
8	CLUTCH SLEEVE	1
9	CLUTCH RING	1
10	LEVER CAM	1
11	FRONT MOUNT LEVER	1
12	CAM BALL	2
13	VALVE PIN	2
14	VALVE SPRING	1
15	VALVE STEM WASHER	1
16	ADJUSTING NUT	1
17	SPRING PIN–STL (A)	1
19	CONTROL LEVER BALL	1
20	CAP NUT	1
23	O'RING	1
25	QUAD RING	1
26	O'RING	1
27	O'RING	1
28	SOCKET HEAD CAP SCREW	4
29	SOCKET HEAD CAP SCREW	8



INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO. G1200

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. DARLEY & Co.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

DWG – BALL VALVE ASSEMBLY CROSS SECTION

DR'N JCM
CHKD
TRCDLMH 5/96

DATE NOV12,65
SCALE 1/1

DGC0100

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

W.S. DARLEY & CO.

REMOTE CONTROL PRESSURE RELIEF VALVE WITH MECHANICAL SHUTOFF

Refer to Drawing DGC0141

The relief valve bypasses water from the pump discharge manifold to the suction chamber at a set pump pressure, preventing excessive rise of discharge pressure when hose lines are shut off.

Turning pressure setting hand wheel (14) clockwise raises the relief pressure, and counter clockwise lowers it.

The self-cleaning fine mesh strainer will prevent the entry of solids that could cause the relief valve to malfunction. Open the strainer flush valve to remove small accumulations. This is accomplished by turning the strainer flush valve knob (6) counter clockwise 2 to 3 full turns. Strainer trapped debris will be flushed to the ground. Pump supply pressure should be 50-100 PSI when performing this procedure.

TO SET RELIEF VALVE

1. Turn four-way valve OFF.

2. Open at least one discharge valve and increase engine throttle setting until pressure gage indicates the pressure at which relief valve is to open.

3. Turn four-way valve ON.

4. If gage reading drops below pressure set in step 2, turn hand wheel (14) clockwise until pressure returns to set point.

5. If gage reading does not drop, turn hand wheel (14) counter clockwise until pressure drops 5 to 10 PSI below set point. Then slowly turn hand wheel clockwise until pressure returns to pressure set in step 2.

The relief valve will now prevent the discharge pressure from rising above that for which it is set, and requires no further attention.

Should a higher or lower relief pressure be desired, repeat above procedure.

CAUTION

With all discharge valves closed, water in the auxiliary pump casing will heat up rapidly. To avoid possible damage, allow a very small stream of water to discharge when the pump is running.

REMOTE CONTROL PRESSURE RELIEF VALVE WITH MECHANICAL SHUTOFF

MAINTENANCE
DRAWING DGC0141

Open the relief valve strainer flush valve (6) during every operation at 50-100 PSI supply pressure to insure foreign material is not blocking the screen.

The 3/32" diameter metering orifice and diaphragm chamber at (21) may be back-flushed if necessary while the pump is delivering water by opening the pilot head drain and placing valve handle (9) midway between ON and OFF position.

The relief valve, pilot unit, and strainer assemblies should be taken apart for inspection and cleaning at least annually, or as often as found necessary to insure trouble free performance.

To disassemble pilot head, first turn hand wheel (14) counter clockwise to remove spring compression. Remove the four 1/4" screws holding regulator spring housing (18). Lift out diaphragm (23) and pilot valve (51) assembly. Clean and make certain 3/32" diameter orifice hole is free of obstruction.

When reassembling pilot head, turn hand wheel (14) a few times clockwise to compress spring before tightening four screws holding spring housing. This will properly center valve seat and diaphragm.

The valve piston (40) and spring (44) chamber should be inspected and cleaned.

Replace diaphragm and o-rings if damaged or deteriorated.

Apply a thin coating of waterproof grease lubricant: to spring housing counterbore that guides the pilot valve (51) and ball (52), to end of tension screw (17), and between piston (40) and center post.

Self-cleaning strainer (63) can be removed for inspection or replacement by alternately turning valve knob (6) and stop nut (7) counter clockwise until stem is free for removal. To avoid discharging water through opening created by stem (62) removal, pump should be completely shut down before stem (62) is removed. Inspect and clean screen (63) if required. Check quad ring (64) for damage or deterioration. Reverse procedure to reassemble valve. Use case when initially inserting screen into body to avoid damaging quad ring (64) or valve seat.

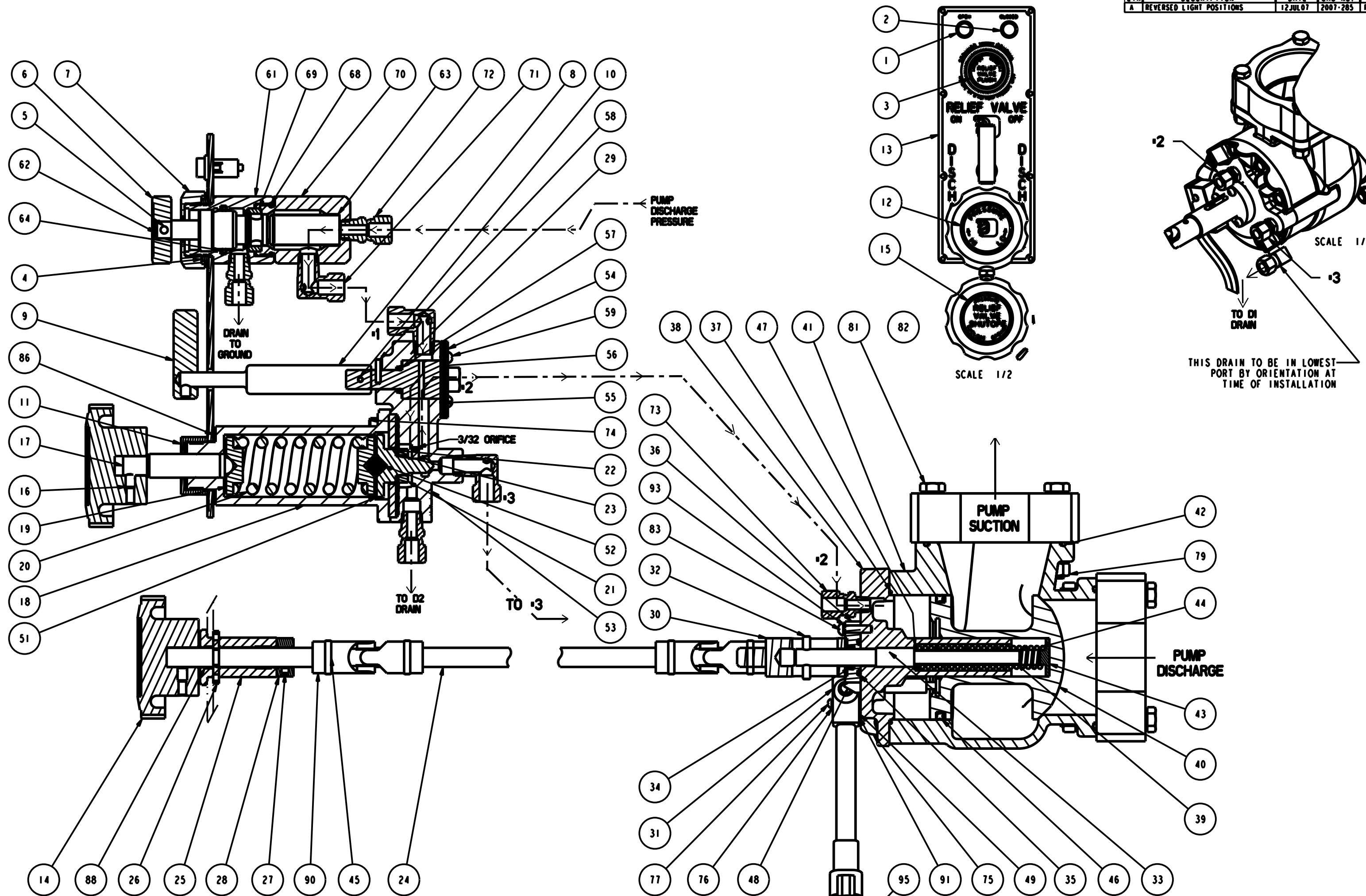
To replace flush valve seat (69), remove stem/screen assembly, disconnect tubing lines attached to (61) body half and unscrew (61) body half from (70) body half. Replace (69) valve seat. Reverse procedure to reassemble valve.

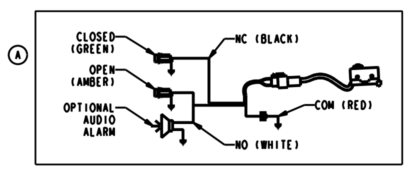
All Darley relief valves can be provided with a micro switch and either one or two pilot lights to indicate when the valve is open or closed.

IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REVERSED LIGHT POSITIONS	12JUL07	2007-285	RJG

NO.	DESCRIPTION	PART NO.	QTY.
1	LIGHT - AMBER, 24V	-	1
2	LIGHT - GREEN, 24V	-	1
3	DECAL - FLUSH SCREEN	-	1
4	NUT - PANEL, FLUSH VALVE	-	1
5	SSS - NO.10-32 x 0.38, GR5	-	1
6	KNOB - FLUSH VALVE	-	1
7	NUT - PANEL, 1.38-12	-	1
8	COUPLING - RELEIF VALVE STEM	-	1
9	LEVER - R.V. ON/OFF	-	1
10	PIN - DRIVE LOK, 0.125 X 0.750	-	1
11	NUT - PANEL VALVE, 1.250-12	-	1
12	DECAL - PRESSURE, HI/LO	-	1
13	PLATE - TRIM, REMOTE HEAD	-	1
14	HANDWHEEL	-	2
15	DECAL - PRESSURE RELIEF VALVE	-	1
16	SSS - 1/4-20 x 0.38, SST	-	3
17	SCREW - SPRING TENSION	-	1
18	HOUSING - PILOT VALVE	-	1
19	RETAINER - SPRING	-	2
20	SPRING - PRESSURE REGULATOR	-	1
21	NUT - PILOT VALVE	-	1
22	RING - HOUSING PILOT	-	1
23	DIAPHRAM - PIOLET HEAD	-	1
24	SHAFT - R.V. EXTENSION, 24"	-	1
25	BUSHING - RETAINER, PANEL	-	1
26	NUT - .750, CONDUIT	-	1
27	SSS - NO.10-24 x 0.19, GR5	-	1
28	COLLAR - SHAFT, 1/2" BORE	-	1
29	SSS - .313 x 0.31, GR5	-	1
30	COUPLING - RELIEF VALVE STEM	-	1
31	MICROSWITCH - OMRON	-	1
32	PIN - SPRING, 0.19 X 1.12	-	1
33	O-RING - 0.38 x 0.50 x 0.06	-	2
34	O-RING - 0.44 x 0.62 x 0.09	-	1
35	O-RING - 0.75 x 0.94 x 0.09	-	1
36	PLATE - SEAL, VALVE STEM	-	1
37	O-RING - 3.25 x 3.38 x 0.06	-	1
38	HEAD - RELIEF VALVE, REMOTE, 3"	-	1
39	STEM - RELIEF VALVE, 3"	-	1
40	PISTON - RELIEF VALVE, 3"	-	1
41	BODY - RELIEF VALVE, 3"	-	1
42	O-RING - 3.50 x 3.69 x 0.09	-	2
43	CENTER PLUG - PISTON SPRING	-	1
44	SPRING - PISTON	-	1
45	PIN - SPRING, 0.16 X 0.88	-	4
46	QUAD RING - 2.88 x 3.25 x 0.19	-	1
47	WASHER - 0.39 x 0.61 x .06 BR	-	1
48	STEM - RELIEF VALVE SWITCH	-	1
49	SHIM - SWITCH SPACER, 0.0125	-	1
50	PLUG - PIPE, 0.125, SST SOC HD	-	1
51	PIN - PILOT VALVE	-	1
52	BALL - CAM, 0.44"	-	1
53	HEAD - PILOT CONTROL	-	1
54	COVER - ON/OFF VALVE	-	1
55	O-RING - 1.12 x 1.25 x 0.06	-	1
56	PLUG - VALVE	-	1
57	O-RING - 0.50 x 0.69 x 0.09	-	1
58	PIN - SPRING, 0.12 X 0.62, SST	-	1
59	RHMS - NO.8-32 X 0.50, BR	-	4
61	BODY - FLUSH VALVE (HALF)	-	1
62	STEM - FLUSH VALVE	-	1
63	STRAINER - SCREEN	-	1
64	QUAD RING - 1.00 x 1.25 x 0.12	-	1
68	O-RING - 1.19 x 1.38 x 0.09	-	1
69	SEAT - FLUSH VALVE	-	1
70	BODY - FLUSH VALVE (HALF)	-	1
71	TUBE FITTING - EL, .38 x .25	-	5
72	TUBE FITTING - STR, .38 CF x .25 MPTH	-	4
73	TUBE FITTING - STR, .38 CF x .12 MPTH	-	1
74	SHCS - .250-20 X 0.88, SST	-	4
75	SHCS - .313-18 x 0.75, GR8	-	8
76	WASHER - LOCK, NO.6 ID, SST	-	2
77	RHMS - NO.6-32 X1.00, BR	-	2
79	NUT - HEX, .375-16, GR2	-	8
81	HHCS - .375-16 x 2.25, GR5	-	8
82	FLANGE - ADAPTER, 3 NPT	-	2
83	RHMS - NO.10-24 X 0.75, GR5	-	3
86	WASHER - INT, TOOTH, 1.250 ID	-	1
88	BEARING - NYLINER, 0.50 ID	-	2
90	JOINT - UNIVERSAL, .500"	-	2
91	SHIM - SWITCH SPACER, 0.025	-	1
93	WASHER - LOCK, NO.10 ID, SST	-	3
95	CONNECTOR - DUETCH DT 06-3S	-	1





EXTENSION SHAFT - PART #24 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION

SHOWN WITH OPTIONAL 3" NPT FLANGES P.N. 1920503

DO NOT CONNECT A D1 DRAIN TO A D2 DRAIN PORT ON MULTIPLE DRAIN VALVE
DRAIN MUST BE CLOSED DURING OPERATION

SEE DRAWING #DGC0112 FOR DETAILED LOCATION

REMOVE SHARP EDGES

INCH (MILLIMETER)

MODEL NAME	MDL CREATED	SHEET	
DGC0141	08JUN05	1/2	D

W.S. Darley & Co.
CHIPPEWA FALLS, WI - MELROSE PARK, IL

OLD PART NO. | MATERIAL NO. | PATTERN NO.

MATERIAL DESCRIPTION:

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

RELIEF VALVE

DR'N MAL
CHKD SJL
TACO

DATE 13-Jun-05
SCALE 3/4

DGC0141

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

1200503

7.34

NO.	DESCRIPTION	PART NO.	QTY.
1	LIGHT - AMBER, 24V	-	1
2	LIGHT - GREEN, 24V	-	1
3	DECAL - FLUSH SCREEN	-	1
4	NUT - PANEL, FLUSH VALVE	-	1
5	SSS - NO.10-32 x 0.38, GR5	-	1
6	KNOB - FLUSH VALVE	-	1
7	NUT - PANEL, 1.38-12	-	1
8	COUPLING - RELEIF VALVE STEM	-	1
9	LEVER - R.V. ON/OFF	-	1
10	PIN - DRIVE LOK, 0.125 x 0.750	-	1
11	NUT - PANEL VALVE, 1.250-12	-	1
12	DECAL - PRESSURE, HI/LO	-	1
13	PLATE - TRIM, REMOTE HEAD	-	1
14	HANDWHEEL	-	2
15	DECAL - PRESSURE RELIEF VALVE	-	1
16	SSS - 1/4-20 x 0.38, SST	-	3
17	SCREW - SPRING TENSION	-	1
18	HOUSING - PILOT VALVE	-	1
19	RETAINER - SPRING	-	2
20	SPRING - PRESSURE REGULATOR	-	1
21	NUT - PILOT VALVE	-	1
22	RING - HOUSING PILOT	-	1
23	DIAPHRAM - PIOLET HEAD	-	1
24	SHAFT - R.V. EXTENSION, 24"	-	1
25	BUSHING - RETAINER, PANEL	-	1
26	NUT - .750, CONDUIT	-	1
27	SSS - NO.10-24 x 0.19, GR5	-	1
28	COLLAR - SHAFT, 1/2" BORE	-	1
29	SSS - .313 x 0.31, GR5	-	1
30	COUPLING - RELIEF VALVE STEM	-	1
31	MICROSWITCH - OMRON	-	1
32	PIN - SPRING, 0.19 x 1.12	-	1
33	O-RING - 0.38 x 0.50 x 0.06	-	2
34	O-RING - 0.44 x 0.62 x 0.09	-	1
35	O-RING - 0.75 x 0.94 x 0.09	-	1
36	PLATE - SEAL, VALVE STEM	-	1
37	O-RING - 3.25 x 3.38 x 0.06	-	1
38	HEAD - RELIEF VALVE, REMOTE, 3"	-	1
39	STEM - RELIEF VALVE, 3"	-	1
40	PISTON - RELIEF VALVE, 3"	-	1
41	BODY - RELIEF VALVE, 3"	-	1
42	O-RING - 3.50 x 3.69 x 0.09	-	2
43	CENTER PLUG - PISTON SPRING	-	1
44	SPRING - PISTON	-	1
45	RHMS - NO.8-32 x 0.50, BR	-	4
46	QUAD RING - 2.88 x 3.25 x 0.19	-	1
47	WASHER - 0.39 x 0.61 x .06 BR	-	1
48	STEM - RELIEF VALVE SWITCH	-	1
49	SHIM - SWITCH SPACER, 0.0125	-	1
50	PLUG - PIPE, 0.125, SST SOC HD	-	1
51	PIN - PILOT VALVE	-	1
52	BALL - CAM, 0.44"	-	1
53	HEAD - PILOT CONTROL	-	1
54	COVER - ON/OFF VALVE	-	1
55	O-RING - 1.12 x 1.25 x 0.06	-	1
56	PLUG - VALVE	-	1
57	O-RING - 0.50 x 0.69 x 0.09	-	1
58	PIN - SPRING, 0.12 x 0.62, SST	-	1
61	BODY - FLUSH VALVE (HALF)	-	1
62	STEM - FLUSH VALVE	-	1
63	STRAINER - SCREEN	-	1
64	QUAD RING - 1.00 x 1.25 x 0.12	-	1
68	O-RING - 1.19 x 1.38 x 0.09	-	1
69	SEAT - FLUSH VALVE	-	1
70	BODY - FLUSH VALVE (HALF)	-	1
71	TUBE FITTING - EL, .38 x .25	-	5
72	TUBE FITTING - STR, .38 cf x .25 MPTM	-	4
73	TUBE FITTING - STR, .38 cf x .12 MPTM	-	1
74	SHCS - .250-20 x 0.88, SST	-	4
75	SHCS - .313-18 x 0.75, GR8	-	8
76	WASHER - LOCK, NO.6 ID, SST	-	2
77	RHMS - NO.6-32 x1.00, BR	-	2
79	NUT - HEX, .375-16, GR2	-	8
81	HHCS - .375-16 x 2.25, GR5	-	8
82	FLANGE - ADAPTER, 3 NPT	-	2
83	RHMS - NO.10-24 x 0.75, GR5	-	3
86	WASHER - INT. TOOTH, 1.250 ID	-	1
88	BEARING - NYLINER, 0.50 ID	-	2
90	JOINT - UNIVERSAL, .500"	-	2
91	SHIM - SWITCH SPACER, 0.025	-	1
93	WASHER - LOCK, NO.10 ID, SST	-	3
94	PIN - SPRING, 0.16 x 0.88	-	4
95	CONNECTOR - DUETCH DT 06-3S	-	1

SHOWN WITH OPTIONAL 3" NPT FLANGES - P.N. 1920503

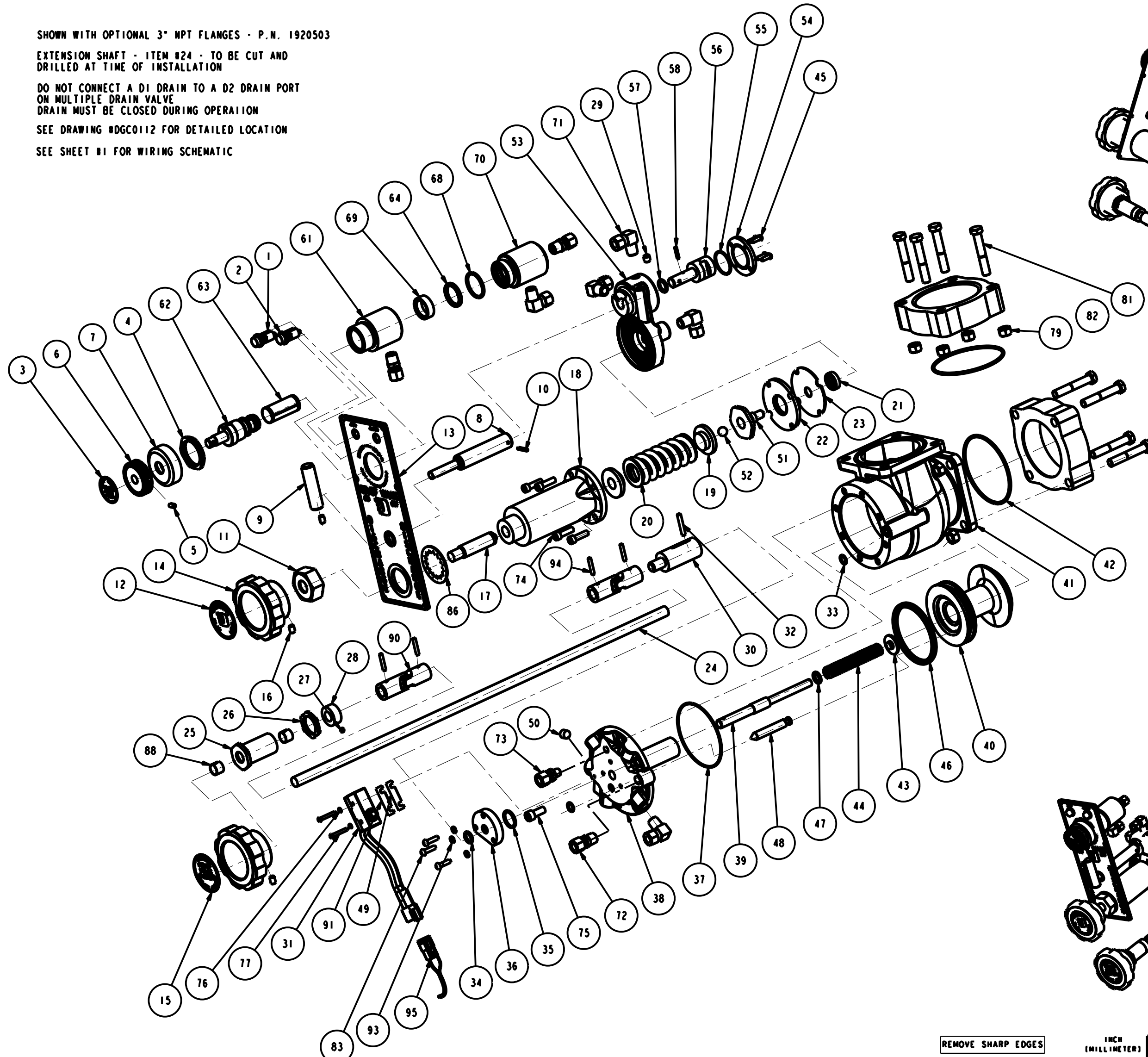
EXTENSION SHAFT - ITEM #24 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION

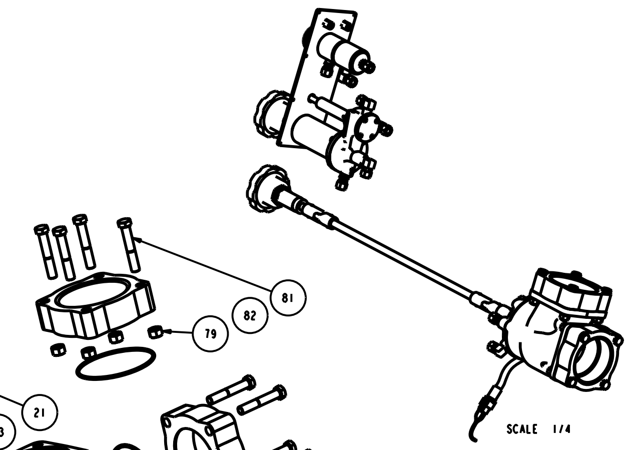
DO NOT CONNECT A D1 DRAIN TO A D2 DRAIN PORT ON MULTIPLE DRAIN VALVE
DRAIN MUST BE CLOSED DURING OPERAIION

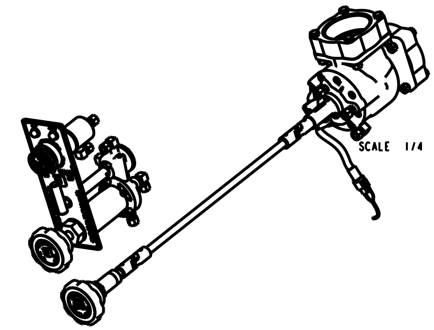
SEE DRAWING #DGC0112 FOR DETAILED LOCATION

SEE SHEET #1 FOR WIRING SCHEMATIC

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D







MODEL NAME: DGC0141 | DOC CREATED: 08JUN05 | SHEET: 2/2 | D

REMOVE SHARP EDGES

INCH (MILLIMETER)

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
CHIPPEWA FALLS, WI - MELROSE PARK, IL

MATERIAL DESCRIPTION:

MATERIAL NO. | PATTERN NO.

RELIEF VALVE

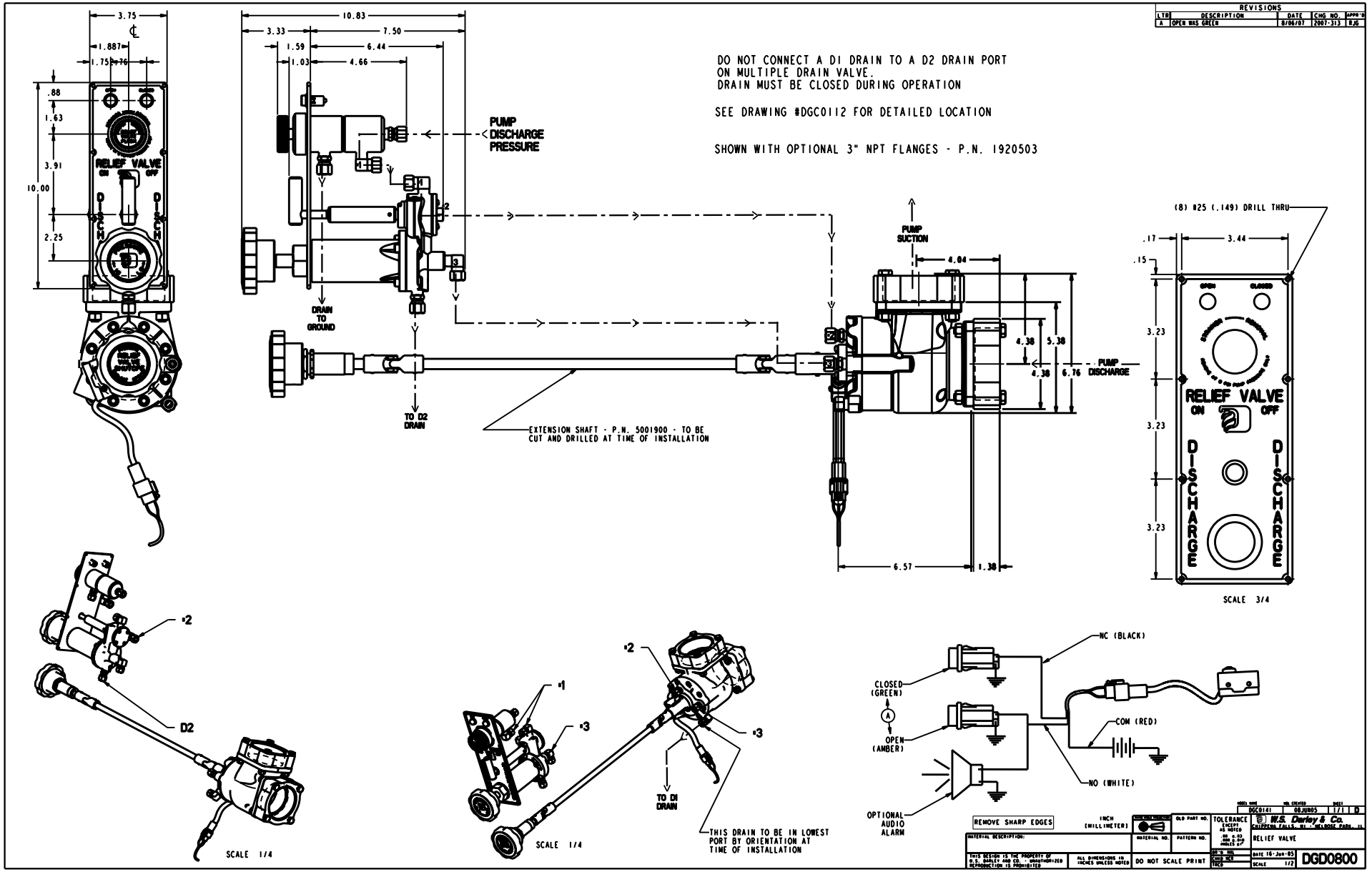
DR'N HAL | CHKD SJL | TRCD

DATE 15-Jun-05 | SCALE 3/4

DGC0141

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT


REVISIONS
LTR DESCRIPTION DATE CHG NO. APPR'D
A OPEN WAS GREEN 8/06/07 2007-313 RJG
DO NOT CONNECT A D1 DRAIN TO A D2 DRAIN PORT
ON MULTIPLE DRAIN VALVE.
DRAIN MUST BE CLOSED DURING OPERATION
SEE DRAWING #DGC0112 FOR DETAILED LOCATION
SHOWN WITH OPTIONAL 3" NPT FLANGES - P.N. 1920503
PUMP DISCHARGE PRESSURE
DRAIN TO GROUND
TO D2 DRAIN
EXTENSION SHAFT - P.N. 5001900 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION
PUMP SUCTION
PUMP DISCHARGE
(8) #25 (.149) DRILL THRU
RELIEF VALVE
ON
OFF
DISCHARGE
DISCHARGE
SCALE 3/4
D2
SCALE 1/4
SCALE 1/4
THIS DRAIN TO BE IN LOWEST PORT BY ORIENTATION AT TIME OF INSTALLATION
NC (BLACK)
CLOSED (GREEN)
COM (RED)
OPEN (AMBER)
NO (WHITE)
OPTIONAL AUDIO ALARM
REMOVE SHARP EDGES
DO NOT SCALE PRINT
W.S. Darley & Co.
RELIEF VALVE
DGD0800

W.S. DARLEY & CO.

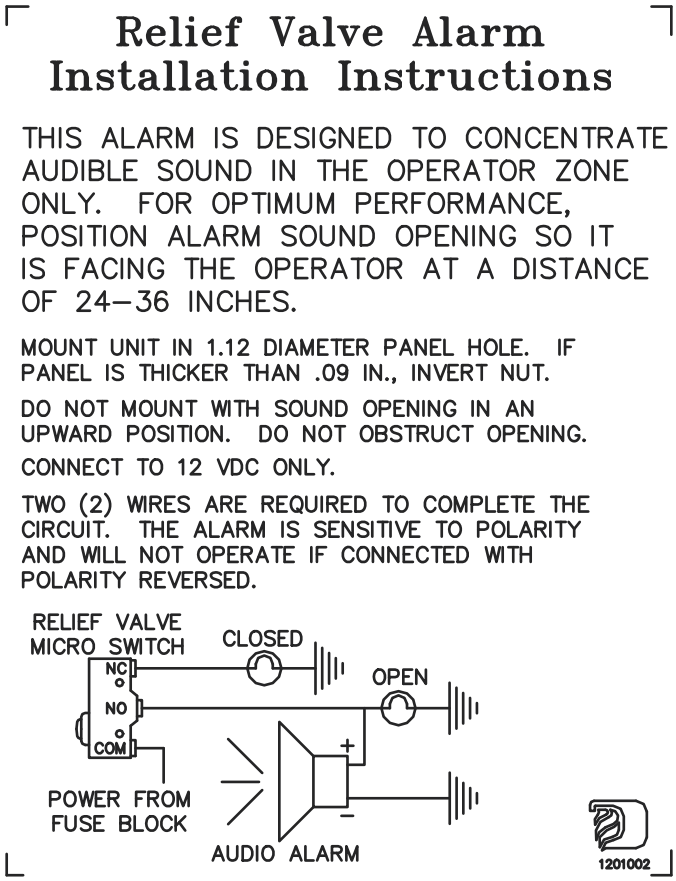
Relief Valve Alarm
Installation Instruction

This Alarm is designed to concentrate audible sound in the operator zone only. For optimum Performance, position alarm sound opening so it is facing the operator at a distance of 24 - 36 inches.

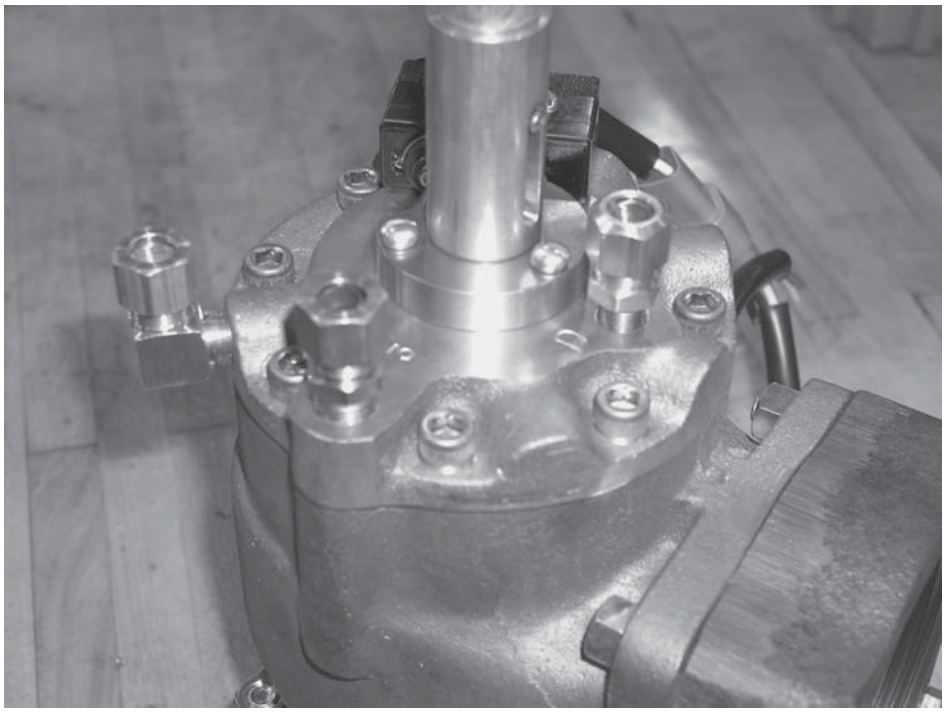
Mount unit in 1.12 diameter panel hole. If panel is thicker than .09 inches, invert nut.

Do not mount with sound opening in an upward position. Do not obstruct opening.

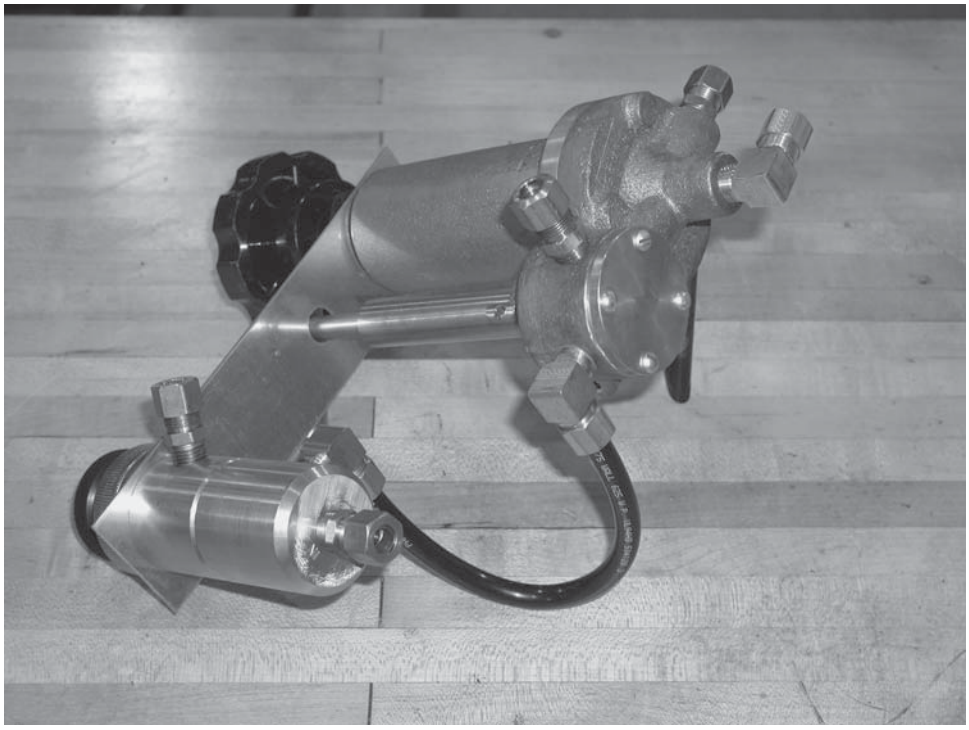
Connect to 12 VDC only.
Two (2) wires are required to complete the circuit. The alarm is sensitive to polarity and will not operate if connected with polarity reversed.



IF FURTHER INFORMATION IS NEEDED, CALL W.S. DARLEY & CO. AT CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650



Install compression fittings using Loctite PST565 in the location and orientation as shown in photographs.



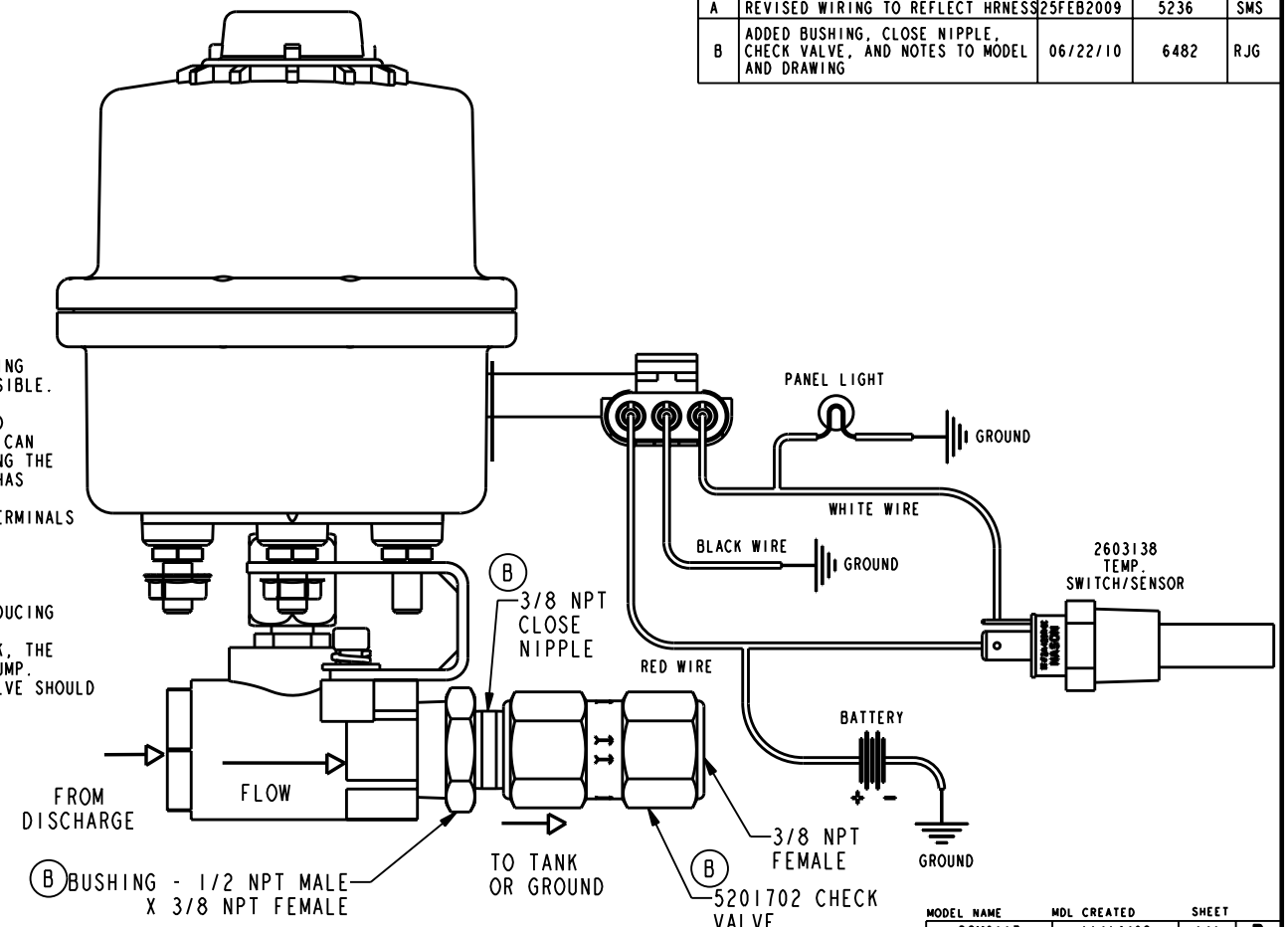
NAME:RJG OBJECT:DGM0117 DATE:22-Jun-10 14:41:12

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REVISED WIRING TO REFLECT HRNESS	25FEB2009	5236	SMS
B	ADDED BUSHING, CLOSE NIPPLE, CHECK VALVE, AND NOTES TO MODEL AND DRAWING	06/22/10	6482	RJG

INSTALLATION INSTRUCTIONS:

1) INSTALL TEMPERATURE SWITCH ON SUCTION SIDE OF PUMP, AS NEAR TO IMPELLER AS POSSIBLE, PREFERABLY BETWEEN THE IMPELLER AND THE RELIEF VALVE.
2) INSTALL THE ACTUATOR VALVE ON THE DISCHARGE SIDE OF THE PUMP. ITS LOCATION IS NOT CRITICAL.* IT CAN BE MOUNTED DIRECTLY TO THE PUMP OR POSITIONED REMOTELY AND CONNECTED WITH A 3/8 OD MINIMUM LINE.
3) VALVE DOES NOT NEED TO BE MOUNTED VERTICALLY AS SHOWN.
4) *PLUMB THE VALVE OUTLET TO TANK , IF DESIRED, USING 3/8 OD MINIMUM LINE. KEEP ALL LINES AS SHORT AS POSSIBLE.
5) ATTACH ONE LEAD OF VALVE TO THE TERMINAL ON THE TEMPERATURE SWITCH. ATTACH THE OTHER LEAD TO A FUSED VOLATAGE SOURCE. IF DESIRED, THE TEMPERATURE SWITCH CAN ALSO BE USED TO CONTROL A LIGHT ON THE PANEL NOTIFYING THE OPERATOR THAT OVERHEATING IS OCCURRING AND THE UNIT HAS BEEN ACTIVATED.
6) TO TEST THE VALVE: WITH PUMP RUNNING, JUMP THE TERMINALS ON THE TEMPERATURE SWITCH. IF THE VALVE DOES NOT DISCHARGE, IT MAY BE INSTALLED BACKWARDS OR WIRING CONNECTIONS MAY BE INCORRECT.

* CONNECTION TO TANK MAY CAUSE TANK TO OVERHEAT, REDUCING THE EFFECTIVENESS OF THIS DEVICE.
TO PREVENT FREEZING DAMAGE, WHEN CONNECTING TO TANK, THE VALVE SHOULD BE MOUNTED ON THE TANK, BUT ABOVE THE PUMP.
IF THE VALVE IS TO DISCHARGE TO ATMOSPHERE, THE VALVE SHOULD BE MOUNTED ON, OR AS CLOSE TO THE PUMP AS POSSIBLE.



MODEL NAME	MDL CREATED	SHEET	
DGM0117	11/14/08	1/1	B

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - THERMAL RELIEF SYSTEM
KZCO VALVE, 2603138 TEMP. SENSOR

DR'N RJG
CHKD DWS
TRCD

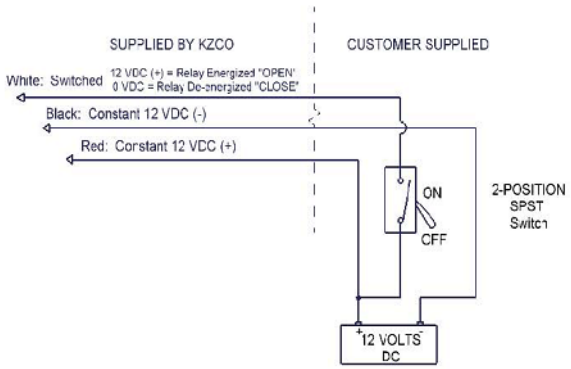
DATE 14-Nov-08
SCALE 1/1

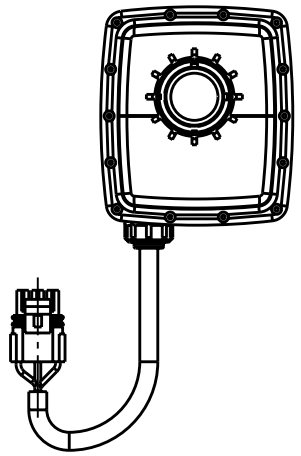
DGM0117

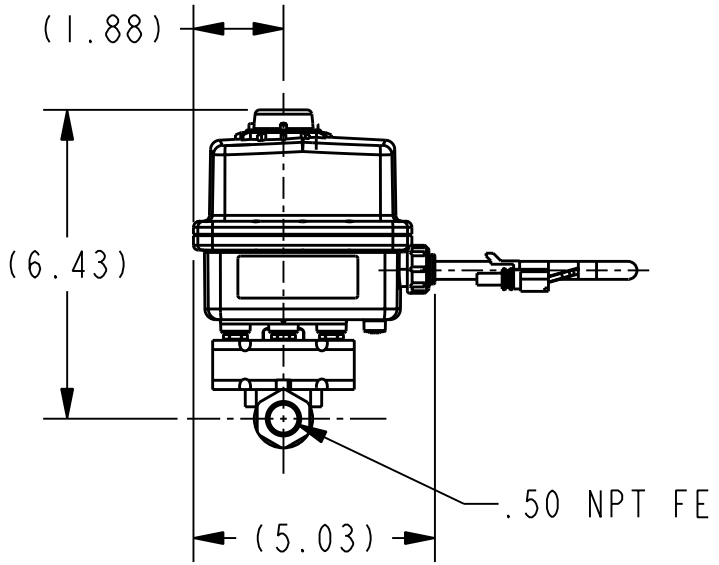
ALL DIMENSIONS IN INCHES UNLESS NOTED

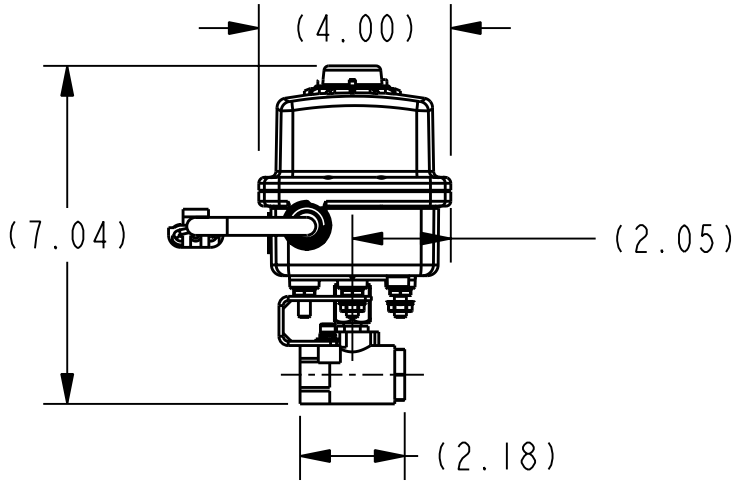
DO NOT SCALE PRINT

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D









MODEL NAME	MDL CREATED	SHEET	
5209401	11/13/08	1/2	A

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: KZCO 84D23-10D20-P01

MATERIAL NO. -

PATTERN NO. -

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

DR'N RJG
CHKD DWS
TRCD

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

VALVE - ACTUATED, 12VDC, .50NPT FE
KZCO 84D23-10D20-P01

DATE 13-Nov-08

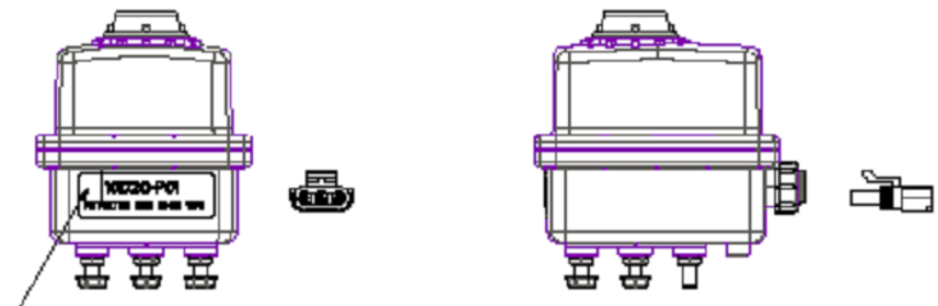
SCALE 1/4

5209401

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

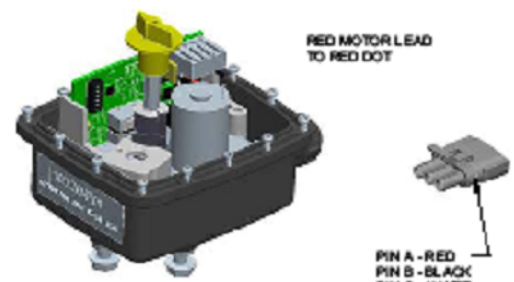
REV/VER	REVISION ECO	REVISION/VERSION DATE	REVISION/VERSION BY
-.2+		7/15/2008 9:41:57 AM	bgotschall



ACTUATOR LABEL
MAS90 / LABEL DESCRIPTION
"ACTUATOR, EH3 12 / 24 VDC"

INPUT/OUTPUT
POWER = 12/24 VDC
1 - BLACK - POWER (-) NEGATIVE
2 - RED - POWER (+) POSITIVE
3 - WHITE - SIGNAL 1 (+) POSITIVE TO OPEN
4 - ***

DIP SX 4 'ON'



RED MOTOR LEAD
TO RED DOT

PIN A - RED
PIN B - BLACK
PIN C - WHITE

SCALE .500

PROGRAM NOTE:

MAS90 SET DATA
CONTROL INPUT = 1
FEEDBACK = 0
OPERATION = 0
MOTOR = M2
SPEED CT = 0.8
ZEROSET = 135
RANGE TOLERANCE = 1
ROTATION = CC092
ACTUATOR RANGE = 0.00/0.00
DESIGN VOLTAGE = E
DIP SX = 3
LABEL = KZCO
OPTIONS = 0
PLUG TYPE = P
TEST PLUG =

21	1	EH-502	LABEL, EH ACTUATOR, 2.5" X 1", THERMAL TRANSFER, WHITE	NO_MATERIAL
20	1	800018	HARNESS, 60A,3ST, WP3T,22.5"	
19	1	EH3-115-Y	FLAG, YELLOW	POLYPROPYLENE_TALC_20
18	1	399-0029	PCB ASSY, EH3 L1 SOLID STATE 12 VDC	
17	1	100401	GEAR MOTOR, M2 18 RPM/MOLON	NO_MATERIAL
16	3	QX-222	NUT, HEX HEAD, SERRATED FLANGE, .250-20 UNC-2B	STAINLESS_STEEL,TYPE_303
15	4	EH3-135	STUD, 1/4-20 X 1/2 MTG	STAINLESS_STEEL,TYPE_303
14	1	EH-104	RETAINER, PUSH-ON 5/16" SHAFT	STAINLESS_STEEL_TYPE_18-8
13	1	499-0100	CAM ASSY, EXTD LOBE FOR EH2/5 E-OPT	
12	1	EH-502	LABEL, EH ACTUATOR, 2.5" X 1", THERMAL TRANSFER, WHITE	NO_MATERIAL
11	1	EH-130	O-RING, DOME	SILICONE,RED,55_DUROMETER
10	1	EH3-114	DOME, CLEAR	POLYCARBONATE,
9	14	EHPT-1103	SCREW, PAN, PHILLIPS, HIGH-LOW, 5-20 X .562	STAINLESS_STEEL_TYPE_410
8	1	EH3-1001-N	LID, CASE, EH3, DOME	NYLON_DPC_6N33-L_BLACK
7	4	EH3-139	SCREW, 8-32 X 1.25 PPHMS SS	STAINLESS_STEEL,TYPE_18-8
6	1	EH-157	SCREW, 8-18 x 3/8" TSB PPH SS	STAINLESS_STEEL,TYPE_18-8
5	1	EH3-1030	O-RING, EH3, CASE I.D., #120	SILICONE,RED,55_DUROMETER
4	1	EH-139	O-RING, #006, PRESSURE TEST PORT	FLUOROCARBON,BLACK,75_DUROMETER
3	1	EHPT-140	O-RING, #112, MOTOR SHAFT, VITON	FLUOROCARBON,BLACK,75_DUROMETER
2	1	EH3-1003-N	LOWER CASE - EH3 INTERNAL MTG	NYLON,DPC_6N33-L,BLACK
1	1	498-0002	CASE KIT, EH3 IM DOME NYLON M2 MTR	
DET	QTY	PART NUMBER	DESCRIPTION	MATERIAL

STANDARD TOLERANCES
ALL DIMENSIONS IN INCHES [mm]

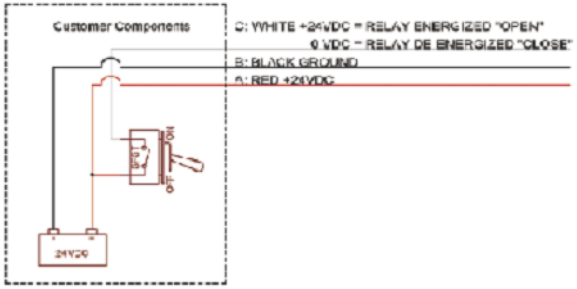
DATE: 2008-05-29
DESIGNED: L. ERDKAMP
DRAWN: W. FEDDE
APPROVED: A. KOTTAS
SCALE: .500 SIZE: B
MATERIAL:

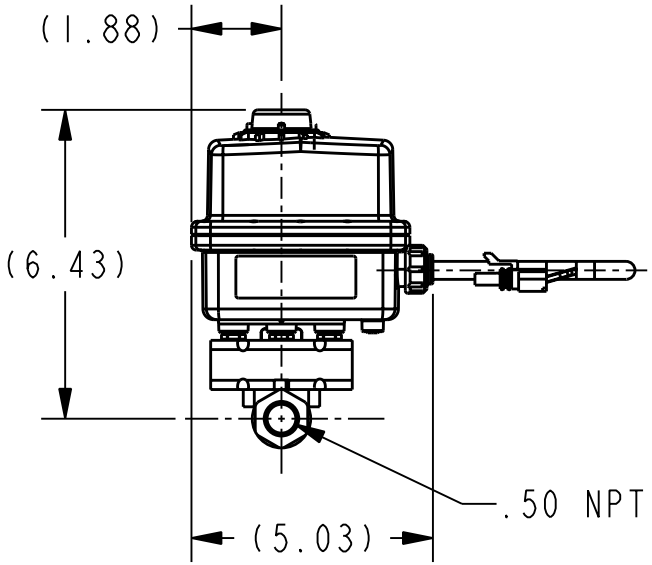
KZCO Inc.

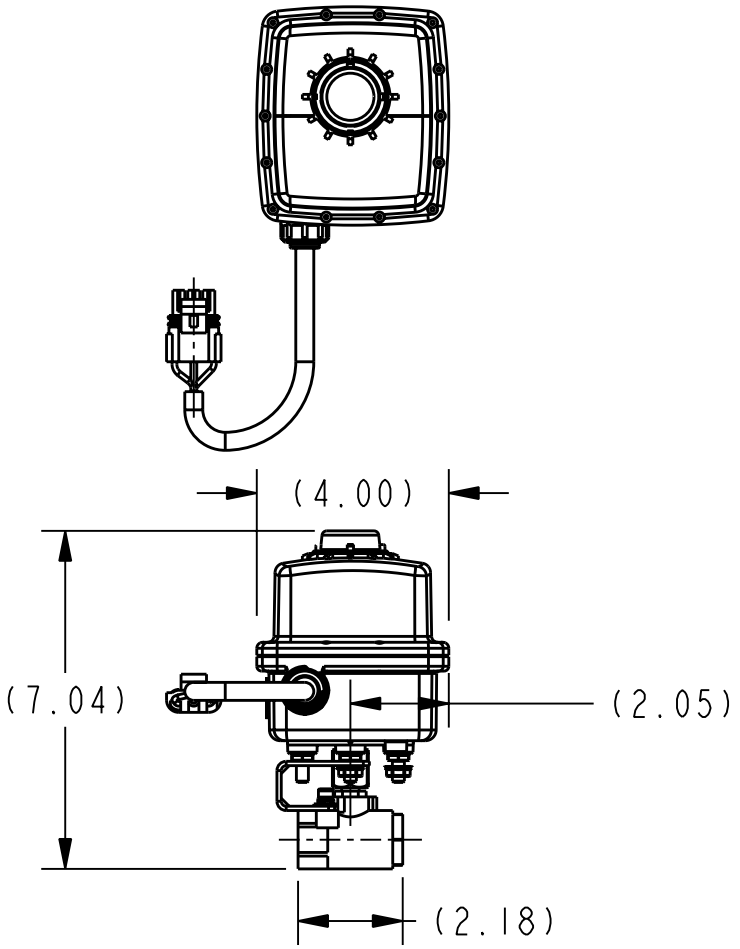
TITLE: ACTUATOR, EH3, SOLID STATE
REF:
PART NO: 10020-P01 REV/VER: -2+
DRAWING NO: 10020-P01 SHEET: 1 OF 1

60AD WIRING
Standard On/Off applications, SPST Switch
24 VDC

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D







MODEL NAME	MDL CREATED	SHEET	
5209402	11/13/08	1/3	A

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

VALVE - ACTUATED, 24VDC, .50NPT FE
KZCO 84D23-60AD-M

MATERIAL DESCRIPTION:	MATERIAL NO.	PATTERN NO.
KZCO 84D23-60AD-M	-	-

DR'N	RJG
CHKD	DWS
TRCD	

DATE 13-Nov-08

SCALE 1/4

5209402

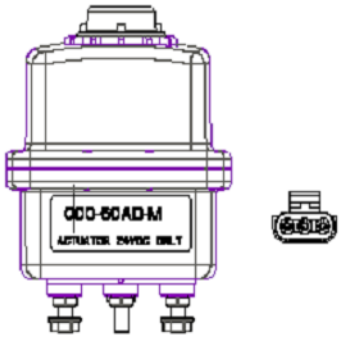
ALL DIMENSIONS IN INCHES UNLESS NOTED

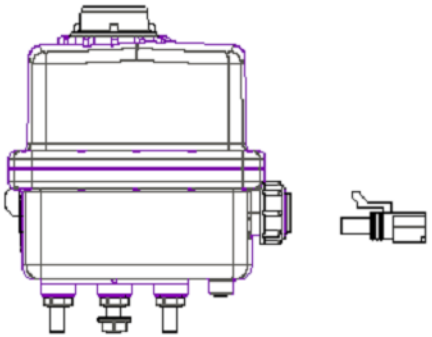
DO NOT SCALE PRINT

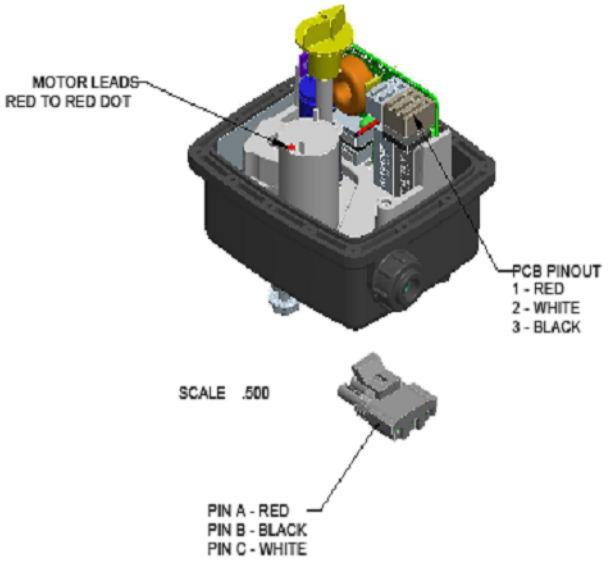
NAME:RJG OBJECT:5209402_1 DATE:19-Nov-08 13:40:10

NAME:RJG OBJECT:5209402_2 DATE:19-Nov-08 13:40:13

REVMER	REVISION ECO	REVISIONVERSION DATE	REVISIONVERSION BY
*** .1		3/28/2008 1:49:38 PM	wfedde







MAS80 SET DATA
CONTROL INPUT = 1
FEEDBACK = 0
OPERATION = 0
MOTOR = M
SPEED CT = 0.8
ZEROSET = 135
RANGE TOLERANCE = 1
ROTATION = CC091
ACTUATOR RANGE = 0.00/0.00
DESIGN VOLTAGE = D
DIP SX =
LABEL = KZCO
OPTIONS = 0
PLUG TYPE =
TEST PLUG =

DET	QTY	PART NUMBER	DESCRIPTION	MATERIAL
8	1	EH-502	LABEL, EH ACTUATOR, 2.5" X 1", THERMAL TRANSFER, WHITE	NO_MATERIAL
7	2	QX-222	NUT, HEX HEAD, SERRATED FLANGE, .250-20 UNC-2B	STAINLESS_STEEL,TYPE_303
6	4	EH3-135	STUD, 1/4-20 X 1/2 MTG	STAINLESS_STEEL,TYPE_303
5	1	800018	HARNESS, 60A,3ST, WP3T,22.5"	
4	1	EH3-115-Y	FLAG, YELLOW	POLYPROPYLENE_TALC_20
3	1	800488	PCB ASSY, EH3 24VDC 60AD/60DF	
2	1	EH3-110	GEAR MOTOR, EH3 SERIES M1 18 RPM @ 12VDC	
1	1	498-0005	CASE KIT, EH3 IM DOME NYLON M1 & N1 MTR	

-STANDARD TOLERANCES-
-ALL DIMENSIONS IN INCHES [mm]-
.Xa .1
.XXa .01
.XXXa .005
XX°a1°
TOTAL RUNOUT: .005 FIM
CORNER BREAK: .001/.010
SURFACE FINISH: 125µIN

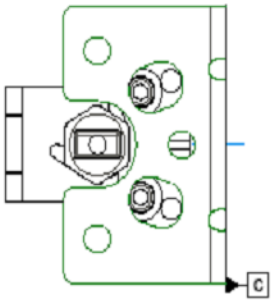
DENSITY: .047 LBM/CU IN
MASS: .592 LBM
SURF AREA: 163.793 SQ IN
VOLUME: 12.043 CU IN

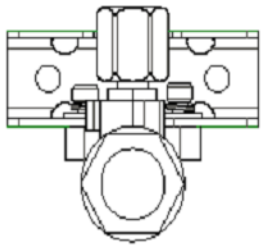
DATE: 2007-04-16
DESIGNED: L. ERDKAMP
DRAWN: W. FEDDE
APPROVED: A. KOTTAS
SCALE: .500
SIZE: B
MATERIAL:

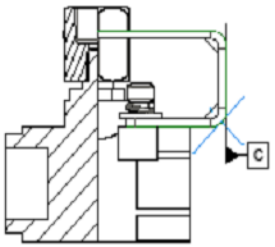
KZCO inc.
23660 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2767
FAX: +1.402.944.2402

TITLE: ACTUATOR, EH3, .8S @24VDC
REF:
PART NO: 000-60AD-M
REVMER: *** .1
DRAWING NO: 000-60AD-M
SHEET: 1 OF 1

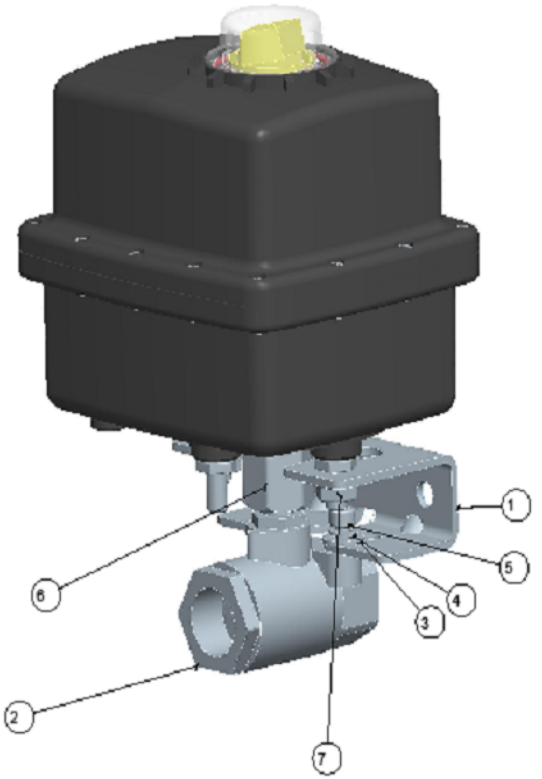
REVISER	REVISION ECO	REVISION/VERSION DATE	REVISION/VERSION BY
-.6+		8/12/2008 9:18:50 AM	bgotschall







SECTION A-A



ACTUATOR SHOWN IS REPRESENTITVE USED
ONLY TO SHOW PROPER ORIENTATION TO VALVE.

DET	QTY	PART NUMBER	DESCRIPTION	MATERIAL
7	3	QX-222	NUT, HEX HEAD, SERRATED FLANGE, .250-20 UNC-2B	STAINLESS_STEEL,TYPE_303
6	1	EH-145	COUPLER, 1/4" ~ 1/2" APOLLO	STAINLESS_STEEL_TYPE_316
5	2	EH-158	SCREW, #10-24 X 3/8" SS SOCKET HEAD	STAINLESS_STEEL,TYPE_303_OR_316
4	2	EHPT-109	WASHER, LOCK, .197 ID X .334 OD X .047 T	STAINLESS_STEEL_TYPE_316
3	2	EHPT-150	WASHER, FLAT, #10 18-8 SS	STAINLESS_STEEL_TYPE_316
2	1	EH3-84D	VALVE, 1/2" 2-WAY APOLLO 70-103-01 BRONZE BALL VALVE	BRONZE
1	1	EH3-174	BRACKET, MOUNTING EH3 SERIES	STAINLESS_STEEL_TYPE_304

-STANDARD TOLERANCES-
-ALL DIMENSIONS IN INCHES [mm]-

X±.1
.XX±.01
.XXX±.005
XX°±1°

TOTAL RUNOUT: .005 FIM
CORNER BREAK: .01/.010
SURFACE FINISH: 125µIN

DENSITY: .259 LBM/CU IN
MASS: 3.134 LBM
SURF AREA: 142.873 SQ IN
VOLUME: 12.142 CU IN

DATE: 2007-08-08
DESIGNED: L. ERDKAMP
DRAWN: C. HOWARD
APPROVED: L.ERDKAMP
SCALE: .750
SIZE: B
MATERIAL: AS NOTED

KZCO inc.
23593 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2767
FAX: +1.402.944.2402

TITLE: VALVE KIT, EH3 OFFSET MTG 1/2" 2-PC BRZ
REF:
PART NO: 84D23
REVISER: -.6+
DRAWING NO: 84D23
SHEET: 1 OF 1

Section 3

Air Compressor System Components, Operation and Maintenance

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Description - Air Compressor System

A Gardner-Denver Tamrotor rotary screw air compressor provides compressed air for the Darley HMBC AutoCAFS II Compressed Air Foam System.

Rotary screw air compressors are widely used in industrial, transportation, and construction applications where compactness, high efficiency, smooth operation, and reliability are paramount.

The compressor air end is driven via the fire pump gear case input shaft through a high performance, Gates Poly Chain drive belt. Compressor engagement is controlled by an electric multiple-disc clutch system (1) providing hot shift capability. The air end and drive system components are rated to provide up to 220 CFM airflow at 125 psi.

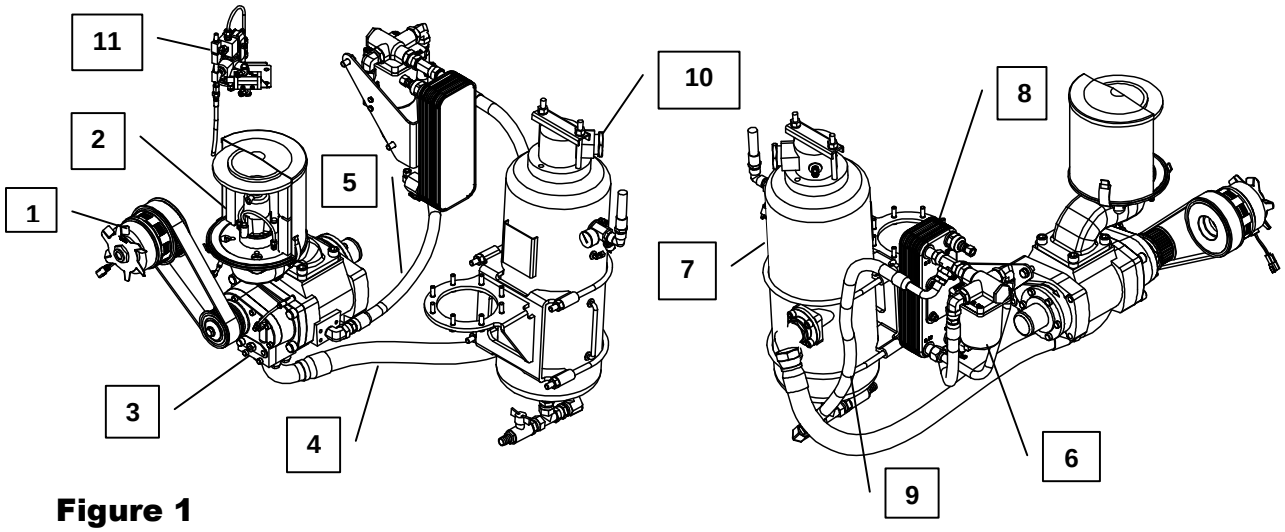


Figure 1

Referring to figures 1 and 2, the compressor system operates as follows: Air is drawn in through the filtered inlet-modulating valve (2) that also functions as a non-return valve during shut down. From the inlet valve, air enters the air end (3) where pressurization occurs. Cooling and lubricating oil is continuously injected into the rotor housing through hydraulic supply line (5). The pressurized air/oil mixture discharged from the air end flows through a hydraulic hose (4) into the oil receiver/separator tank (7) where oil is removed from the pressurized air.

Oil removal is a two-step process. Most of the oil is removed by the centrifugal effect of the cyclone in the lower part of the receiver (7). The remaining oil is removed by two coalescing elements located in the upper region of the separator tank (7). The oil removed by the separator elements is then returned to the air end via oil return line (13). An orifice in this return line restricts air circulation back to the air end. Clean air is then discharged through valve port (10).

From the oil separator tank (7), hot oil flow through hose connection (9) is led through oil cooler (8) to cool down the screw unit. The oil circuit includes a thermostat (15) in the filter head that bypasses the cooler when the oil is cold.

Oil circulation is forced, and is maintained by the pressure difference between the receiver and the screw unit. To keep oil in circulation under all operating conditions, discharge port (10) includes a minimum pressure check valve (12). This valve prevents the receiver pressure from dropping below 45 psi, thus assuring continuous oil flow through the system.

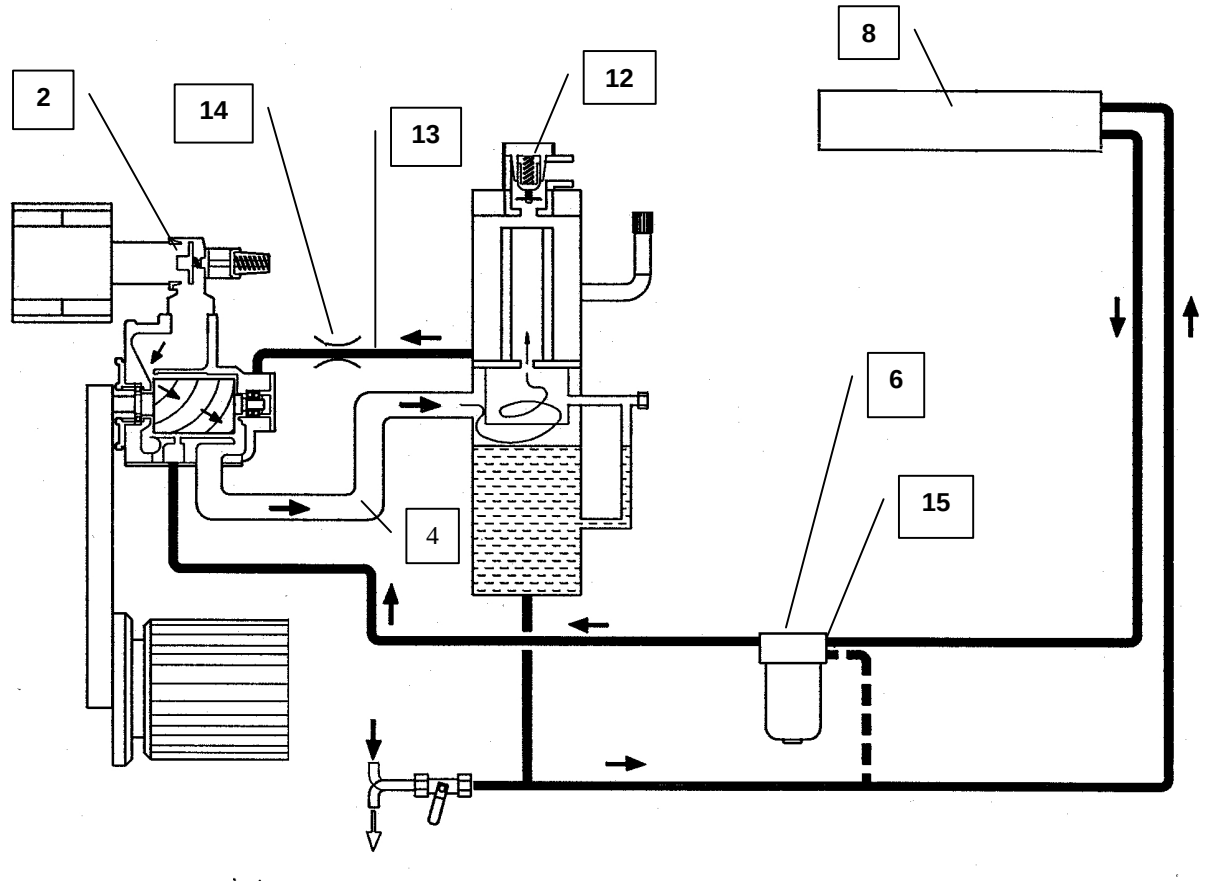
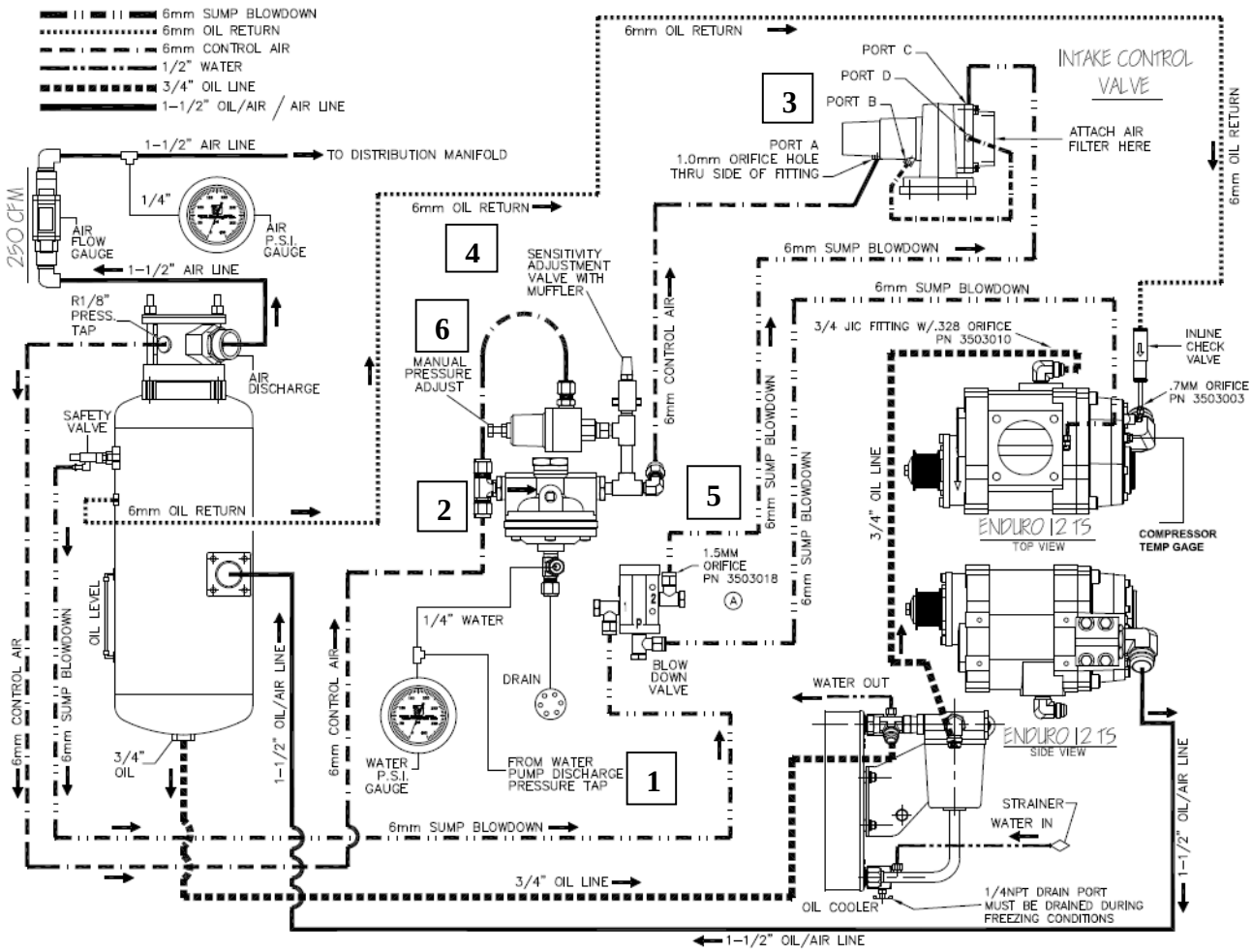


Figure 2

AutoCAFS II pressure balance valve assembly (11) includes a pressure balancing system and a system blow down valve.

Refer to drawing DCS0504 for a review of the compressor control system schematic.



DCS0504

Compressor System Pressure Control

Compressor discharge pressure is automatically balanced to match the fire pump discharge pressure. A line (1) is connected from a discharge pressure tap (located on the discharge head) to the bottom port of the balance pressure diaphragm valve. As pump discharge pressure is increased, the diaphragm valve (2) proportionally restricts control airflow from the receiver tank to the inlet valve. The inlet valve (3), being a positive pressure type valve, opens as the pressure in the control line decreases and closes as control line pressure increases. Opening the inlet valve increases air inlet volume that in turn increases discharge air pressure (constant flow rate). Therefore, as pump pressure increases, control line pressure decreases, inlet valve opens, and air pressure/volume increases.

Pressure Control Sensitivity

A needle type sensitivity valve (4) allows a small amount of control air to continually escape to atmosphere, buffering the fluctuations (hunting) of the control system as it

performs the balancing process. As a result, the inlet valve will respond slower to pressure change reducing modulator pulsation. If the sensitivity valve is set too far in or closed (clockwise rotation) no pressure modulation will take place. If it is too far open (counter-clockwise rotation) pressure fluctuations will go unnoticed and pressure spikes are then unavoidable.

Control Sensitivity Adjustment

Should the needle valve need adjustment, use the following as a guide. Start by closing the valve (4) completely. Then open it approximately 3 turns. Operate the unit at around 125 PSI, begin by flowing about one third the capacity of the air compressor. At this flow rate, the air inlet modulator valve will open to bring in air and then close as air pressure builds. The goal is to set the needle valve at a position where pressure fluctuations are minimized. If the red needle on the pressure gauge is fluctuating more than 20 PSI above or below the water pressure, then the needle valve should be adjusted out or counter-clockwise. As the pressures come closer to balancing, less flow meter fluctuation should also be noticed. **Note: Some pressure modulation is normal and required for the system to auto-balance while delivering CAFS. Expect pressure variation to range from 5-20 psi.**

Compressor System Pressure Limiting Valve

A pressure-limiting valve (6) is incorporated in the control airline to limit maximum air pressure to a preset value. This valve is factory preset to and should be maintained at 150 psi. As such, the compressor control system will maintain a balance between water and air up to 150 psi.

Pressure Limiting Valve Adjustment

Engage pump and compressor using prescribed methods. Initiate water flow through the pump to assure circulation through the heat exchanger, maintain a 50-100 gpm flow rate. Increase pump pressure to approximately 175 psi. Adjust air pressure manual adjustment valve (6) clockwise to increase pressure, setting the air pressure (red needle) to 150 psi.

To test setting, open an airflow valve on a CAFS discharge until air pressure drops, and then close it again. The pressure should quickly build back up to the maximum governed pressure as set by the manual pressure valve. **Important Note:** Choose a discharge that will safely discharge plain air to atmosphere such as deck gun. ***Do not discharge air into a preconnected bed of lay flat hose.***

CAUTION

- **Do not over speed compressor - Input RPM should not exceed that required to produce rated air flow of 220 cfm at 150 psi maximum pressure.**

- **Disengage air compressor when service testing or performing UL test on CAFS equipped vehicle.**

System Blow Down (Depressurization)

After compressor shutdown, system pressure is bled off to guard against overloading drive components at startup. If the receiver assembly is not depressurized on shut down, oil will flood the compressor filling the area above the screws. Oil trapped above the screws will then cause a hydraulic lockup when compressor rotation rapidly accelerates during startup. A hydraulic lockup of this type can induce extreme loads on the power train.

A blow down valve (5) is included in the system to automatically relieve system pressure at shutdown. System blow down valve (5) is a basic 2-way pilot operated pneumatic shuttle valve. When the compressor is operating, pilot pressure for shuttle valve port 'I', being connected to the inlet side of the compressor, is sensing a vacuum; ports 'R' and 'P' do not communicate.

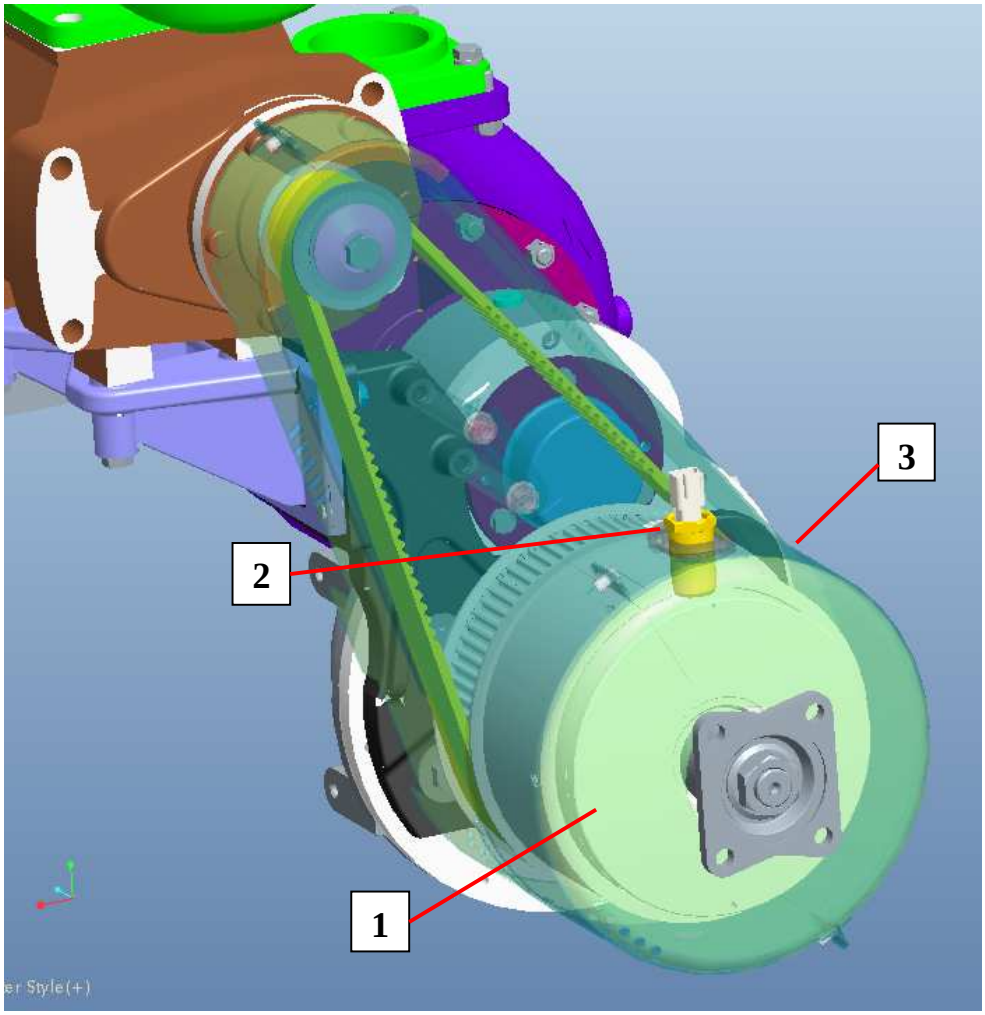
At shutdown, inlet valve (3) closes, acting as a check valve. At the same time, the inlet side of the compressor is pressurized from the receiver tank via the 1 ½" discharge line. Pilot port 'I' is in turn pressurized, shifting the valve spool and connecting port 'R' to port 'P'. Receiver pressure is thus vented to atmosphere inside the filter housing (3). Allow a 1-minute minimum time period between compressor shutdown and restart for system blow–down.

A separator tank pressure switch prohibits clutch engagement if tank pressure is above 10 psi thus assuring system blow-down before restart. *Always reduce engine rpm to 900 rpm or lower when switching the compressor engagement from DISENGAGE to ENGAGE.*

CAUTION ***Avoid immediate restart of compressor after shutdown. Allow a 1-minute minimum time period between compressor shutdown and restart for system blow–down.***

Compressor Clutch Assembly

The compressor air end is driven via the fire pump gear case input shaft through a high performance, Gates Poly Chain drive belt. Compressor engagement is controlled by an electric wet type, sealed, multi-plate clutch system providing hot shift capability. Chassis electrical power is utilized to provide engagement of the clutch.



1. Clutch
2. Anti-Rotation Post
3. Belt / Clutch Cover

12 VDC or 24 VDC (depending on VDC rating/model of clutch) +10% / -0% must be supplied to the clutch (1) for proper performance. If supplied voltage is too low, then the clamping force on the clutch discs may not be adequate to carry compressor torque loads at full capacity. This will result in clutch slippage and consequent overheating. Power is supplied to the clutch through the AutoCAFS Commander Control module. Refer to Section 4 of this manual for further details.

Compressor Engagement RPM

The compressor may be engaged before or after the pump is engaged, however, do not engage compressor when engine is turning faster than 900 rpm. Engine rpm must be reduced to 900 rpm or lower before engagement. The AutoCAFS Commander module will only allow compressor engagement at engine speeds below 900 rpm. The Commander will

display ‘RPM >900’ when engagement is requested with speeds higher than 900 rpm. Refer to Section 4 of this manual for further details on the AutoCAFS Commander Control module.

Compressor Disengage RPM

The compressor can be switched off (DISENGAGED) at any time or input speed.

CAUTION ***Avoid immediate restart of compressor after shutdown. Allow a 1-minute minimum time period between compressor shutdown and restart for system blow–down.***

Maximum Compressor RPM

Air pressure will match the water pressure up to 150 PSI if the pump input speed is adequate to maintain flow rate setting. Note: Do not exceed 175-PSI pump pressure while the air compressor is engaged. Maximum air pressure has been factory preset to 150 PSI.

To avoid compressor over-speed, the commander will display a warning message ‘OVERSPD” when engine rpm approaches maximum allowable compressor speed. The Commander is by default programmed to provide a visual speed warning at a specific engine RPM and completely disengage the compressor system at a different specific engine RPM above the warning RPM. The warning and shutdown engine RPM’s are in place as a safety feature to protect not only the compressor system but the operator, these settings are preset by W.S. Darley based on the Compressor sprocket ratio and Truck PTO ratio. The Pump ratio is determined by the available PTO ratios to provide the best possible pump performance taking into account governed engine speed, PTO ratios and rated performance. This in turn gives operating input speeds to the pump transmission which are used to determine optimal matched compressor performance, and hence a necessary Compressor sprocket ratio.

In the case that programming of the AutoCAFS Commander CODES is necessary (Reference “*SECTION 4*” of this manual in the “*CODES*” portion):

READ BELOW WARNINGS THEN PROCEED TO FOLLOW THE STEP BY STEP INSTRUCTIONS TO ACHIEVE THE CORRECT PROGRAMMING OF THE AUTOCAFS COMMANDER FOR YOUR PARTICULAR TRUCK AND PUMP.

CAUTION ***The following logic is needed in the event that reprogramming of the AutoCAFS Commander settings is necessary; reference SECTION 4 of this manual to check all parameters of the AutoCAFS Commander in the event reprogramming is needed. This pump is driven off of a PTO and PTO’s come in multiple brands and multiple ratios, the following calculations will take your PTO***

Ratio and Sprocket Ratio into account ensuring the correct OVERSPEED warning and SHUTDOWN action of the AutoCAFS Commander occurs for your Enduro Compressor. If these steps are not performed correctly you will not gain optimal CAFS performance for fire fighting and you may OVERSPEED and DAMAGE your Enduro Compressor beyond repair and possibly causing personal injury.

USE THESE STEPS IN THIS ORDER TO REDEFINE YOUR PRESET OVERSPEED AND SHUTDOWN SIGNALS IN YOUR AUTOCAFS COMMANDER (for overspeed and shutdown of the compressor system):

1. **Begin by flipping to CODES portion in SECTION 4 of this manual.**
2. **The information provided in this section will allow you to properly reprogram your AutoCAFS Commander.**

FUNCTIONS AND BUTTONS IN THE AUTOCAFS COMMANDER:

The AutoCAFS Commander has two buttons for operation, toggling through features and programming the Commander Head: When looking at the Commander Face the Mode button is always on the left and the On/Off button is always on the right of the main screen.

You must first enter a CODE, and then you will see the INPUT Screen which shows the default factory settings for the CODE you have entered. You are required to change the default factory INPUT / setting for the following CODES:

Important CODES: Note that you should check all codes referenced in SECTION 4 of this manual to properly verify your Commander is set correctly.

- 3140 = Compressor Overspeed Warning Engine Speed (RPM)
- 3150 = Compressor Overspeed Shutdown Engine Speed (RPM)

To enter the Data Entry Mode / Programming Code Mode for the AutoCAFS Commander:

- Press and Hold the "MODE" button for ~3 seconds
    - Once the Data Entry Mode is displayed the main screen will show "-- -- -- --"

Entering the CODE:

- Pressing "On/Off" (x3) will yield: "3 0 0 0"
- Then Pressing "MODE" (x1) will yield: "3 1 0 0"
- Then Pressing "On/Off" (x4) will yield: "3 1 4 0"

Example:

- Pressing the "On/Off" and "MODE" buttons in the following sequence will yield "3 1 5 0":

    "On/Off"(x3) + "MODE"(x1) + "On/Off"(x5) = "3 1 5 0"

ONCE THE DESIRED CODE IS ENTERED → wait ~3 seconds

The INPUT SCREEN will be displayed with the factory default setting under the CODE you entered above:

Pressing "MODE" selects the digit you desire to change "0 0 0 0" and pressing "On/Off" will change the digit you currently have selected.

To set the INPUTS you have entered for your desired CODE: PRESS and HOLD the "MODE" button (first) and PRESS and HOLD the "On/Off" button for ~3 seconds until the INPUT disappears and you return to the main screen for operation.

REPEAT THE CODE ENTRY and INPUT ENTRY PROCESS until all codes and their corresponding inputs are set as required and shown in SECTION 4 of this manual.

Compressor RATIO = _____ (ex. 3.20)	
PTO RATIO = _____ (ex. 1.22)	
Compressor Sprocket Ratio x PTO Ratio =	"Comp. to Eng. Speed RATIO"
Warning Preset RPM / "Comp. to Eng. Speed Ratio" _____	Value to enter in CODE 3140
Shutdown Preset RPM / "Comp. to Eng. Speed Ratio" _____	Value to enter in CODE 3150

1. **Perform the above calculate with this: Overspeed "Warning preset RPM" = 6600.**
2. **Enter the correct code for redefining your compressor OVERSPEED PRESET (Code 3140)**
3. **Enter the RPM calculated in STEP 4 for CODE 3140.**
4. **Enter the correct code for redefining your compressor SHUTDOWN PRESET (Code 3150)**
5. **Perform the above calculate with this: Overspeed "Shutdown preset RPM" = 7000.**
6. **Enter the RPM calculated in STEP 7 for CODE 3150.**
7. **Exit the Code entry mode of the AutoCAFS Commander.**

Performing this will provide the correct engine speed that the compressor OVERPSEED warning or COMPRESSOR SHUTDOWN is provided at. This will also ensure that you are able to get full CAFS performance without the OVERSPEED warning activating or completely disengaging the compressor system.

If the compressor is disengaged due to over-speed, engine rpm must be reduced to 900 rpm and the compressor system must blow-down before re-engagement can occur. Refer to Section 4 of this manual for further details on the AutoCAFS Commander Control module.

CAUTION

- **Do not over speed compressor - Input RPM should not exceed that required to produce rated air flow of 220 cfm at 150 psi maximum pressure.**
- **Disengage air compressor when service testing or performing UL test on CAFS equipped vehicle.**

System Temperature Sensors

The AutoCAFS Commander incorporates one thermal sensor.

A thermal sensor is attached to the compressor air end with a digital display on the AutoCAFS Commander. This sensor is incorporated into the compressor engagement system to avoid compressor over heating that may result in premature bearing failure, scored housing or rotor seizure. If compressor temperature rises above normal operating temperature to 212°F, the Commander will flash a warning 'COMP HOT' and the compressor temperature will be displayed. *If temperature warning is indicated, shut down the compressor as soon as practical.* The compressor can be switched off (DISENGAGED) at any time or input speed.

If compressor temperature is allowed to increase to 240°F, the AutoCAFS Commander will automatically disengage the compressor. At this time the Commander will alternately display 'SHUTDOWN' – 'COMP HOT' along with the actual compressor temperature.

Check for adequate water flow through heat exchanger. Check for adequate oil level in separator tank. See trouble-shooting guide for further options. *Do not restart compressor until source of problem is determined and rectified.*

CAUTION ***If compressor temperature continues to rise to 240°F, the compressor will be automatically disengaged***.

Compressor Maintenance

	Daily or After Use	25 Hr	6 Mo	100 Hr	12 Mo	2000 Hr	24 Mo
Check Oil Level	X[1]	X	X				
Check Air Filter		X[2]					
Change Oil/Filter				X	X		
Replace Air Filter				X[3]	X		
Check Safety Valve					X		
Inspect Hoses and Fittings						X	X
Inspect Drive Belt						X	X
Replace Oil Separator Elements						X	X

1) Check oil in stopped compressor (wait until air and oil are separated)
2) Check air filter more frequently under adverse/dusty operating conditions.
3) As conditions dictate

The air filter is the most important filter in the system; if it is kept clean the other filters will also stay cleaner. Always use a new filter element; **DO NOT** blow out element with compressed air and reuse.

Compressor Oil:

It is recommended that a circulation oil (hydraulic oil) or synthetic lubricating oil per the following specifications be used.

Mineral Oil:

Use compressor oil specially made for screw compressors, including antioxidants and rust, foaming, and wearing preventative components.

Synthetic Lubricant:

Use compressor oil specially made for screw compressors, including antioxidants and rust, foaming, and wearing preventative components.
Viscosity:

- Maximum 500mm^2/s (centistokes) at startup temperature
- Minimum 7mm^2/s at running temperature (185^oF)

Flash point:

- Minimum 360^0F

Under normal conditions, the above requirements are fulfilled using an ISO VG 32 oil.

Examples:

Phillips 66 MAGNUS OIL ISO VG 32 (mineral oil) or

Phillips 66 SYNDUSTRIAL E Compressor Oil 32 (synthetic)

Approximate Capacity - 12 to 16 Qt.

Compressor Oil Filter:	Part No. 1122802, (1) req'd
Compressor Separator Cartridge:	Part No. 1122702, (2) req'd
Air Filter Element:	Part No. 1122601, (2) req'd

Clutch Oil:

It is recommended that 1 oz. of CAT 8T-9569 10W CAT TO-4 Transmission and Drive Train Lube Oil be used. Due to the shearing action on the lubrication oil of the clutch disks it is highly recommended the above name oil only be used. Any other oil may break down due to this shearing action and lead to clutch failure, thereby voiding any warranty on the system or component.

NOTE:

Refer to pump and apparatus manual (Section 1) for maintenance requirements of the main pump and components.

Refer to proportioner manual (Section 4) for maintenance requirements on the foam proportioner system.

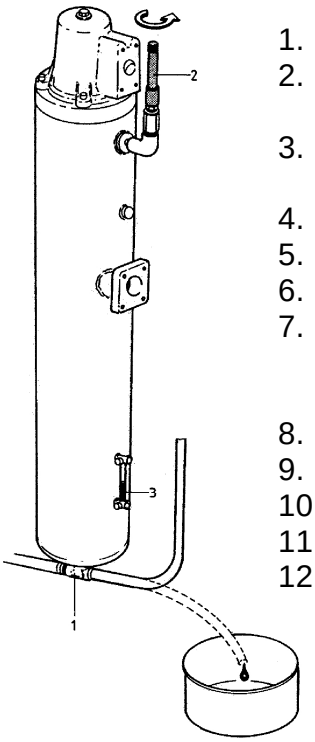
Oil Change

⚠WARNING

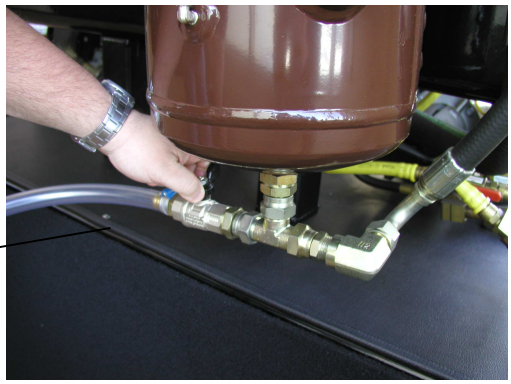
- **Oil is hot when compressor is first shut down (185°F); allow the compressor system to cool before starting maintenance work.**
- **Dispose of the used oil according to regulations on waste oil.**
- **Do not open the oil drain valve if receiver is pressurized. Open safety valve 4-5 turns before opening oil/fill valve.**

CAUTION

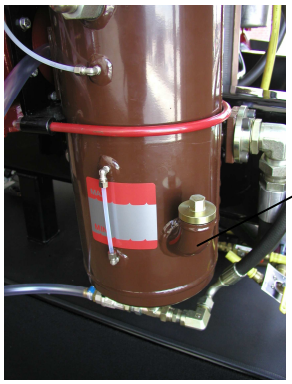
- **Use recommended oil types only; do not mix different oil types.**



1. Run the compressor to warm up the oil to approximately 100°F.
2. Stop the compressor and check that the receiver is not under pressure. After stopping, blow down empties the compressor; wait approx. 2 minutes.
3. Secure apparatus so it cannot be started while maintenance is being performed.
4. Open safety valve (2) 4-5 turns.
5. Open drain/fill valve (1) and let oil run into suitable container.
6. Close drain/fill valve (1). Drain and clean fill hose.
7. Confirm correct oil type. Using a filtered funnel, fill receiver tank to mark on oil level indicator (3). Use care to assure oil system is kept clean and free of contamination.
8. Close safety valve (2).
9. Replace oil filter.
10. Run compressor for 1 minute.
11. Stop compressor.
12. Allow air and oil to separate; recheck oil level.



DRAIN VALVE



FILL PORT

Prepared by: RJG
Approved by: MCR
Revised by: RJG

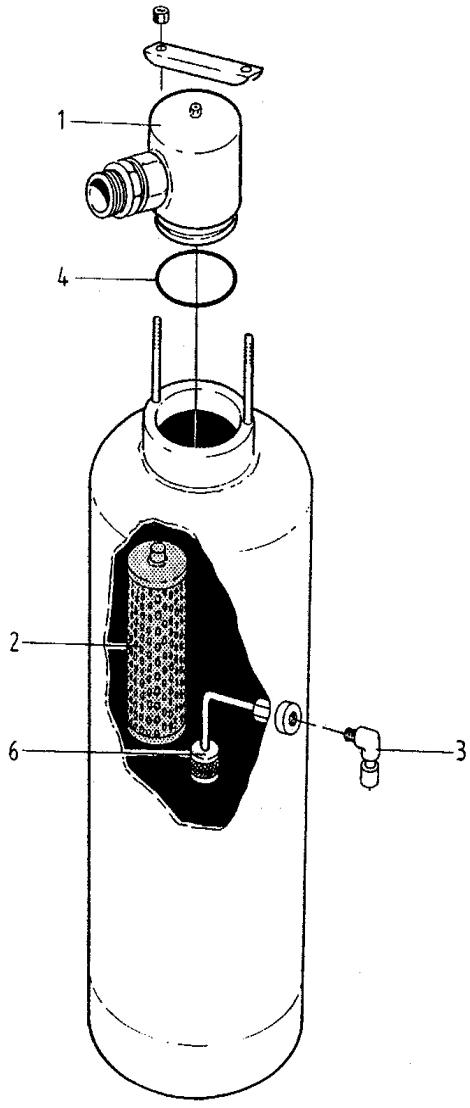
Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Replacing Oil Separator Element

⚠WARNING

- **Allow the compressor to cool down before starting maintenance work.**
- **Dispose of the used separator element according to regulations on toxic waste.**

REMOVAL



1. Stop the compressor and check that the receiver is not pressurized. After shutdown, allow 2 minutes for system blow down.
2. Make sure system cannot be started while maintenance is being performed.
3. Remove output valve (1).
4. Remove the separator elements (2) by removing the two SHCS that retain the elements.

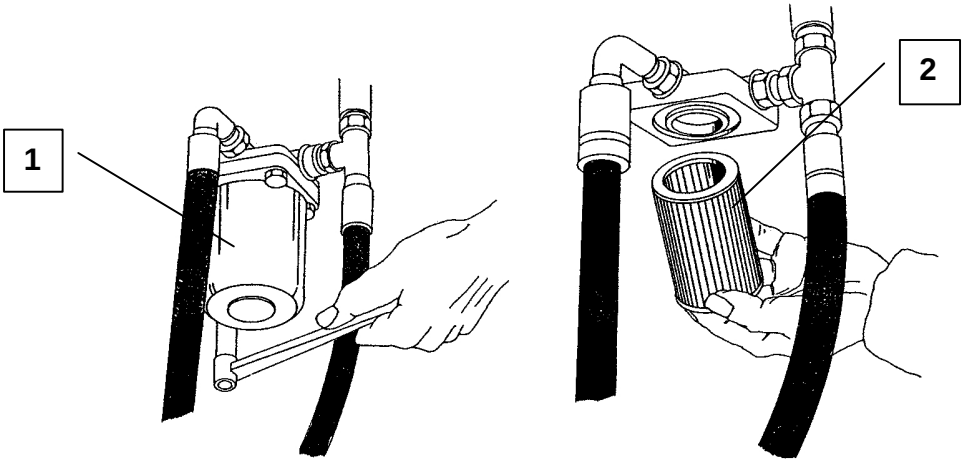
INSTALLING

1. Carefully clean the sealing surfaces on the receiver and output valve (1).
2. Clean the .7mm orifice in the oil return line which is located in the fitting sleeve at the compressor (see DWG DCS0504)
3. Clean the return oil screen filter (6) (inside the receiver) by blowing in pressurized air through fitting (3).
4. Install the new separator elements (2) in place. Secure with two SHCS.
5. Check the condition of the sealing of the output plate.
6. Inspect seal (4), replace if damaged.
7. Install the valve assembly (1).
8. Tighten retaining nuts alternately and evenly.

Replacing Oil Filter

⚠WARNING

- **Allow the compressor to cool down before starting maintenance work.**
- **Dispose of the used filter element according to regulations on toxic waste**



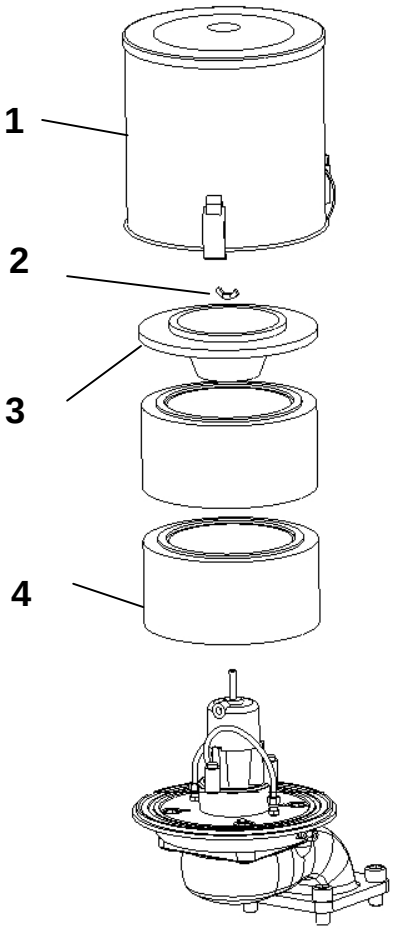
1. Stop the compressor and check that the receiver is not pressurized. After shutdown, allow 2 minutes for system blow down.
2. Make sure system cannot be started while maintenance is being performed.
3. Remove the filter housing cover (1) and take out the old filter (2).
4. Install a new filter element (2).
5. Inspect cover o-ring and replace if required.
6. Replace cover.
7. Tighten the cover mounting screws alternately and evenly.

Replacing Air Filter Elements (Vertical)

⚠WARNING

- **Allow the compressor to cool down before starting maintenance work.**

Vertical Air Cleaner (Integrated Air Inlet Valve)



REMOVAL

1. Toggle three retaining clips and remove filter housing (1)
2. Remove wing nut (2) and retaining plate (3).
3. Remove and discard the filter elements (4).

INSTALLING

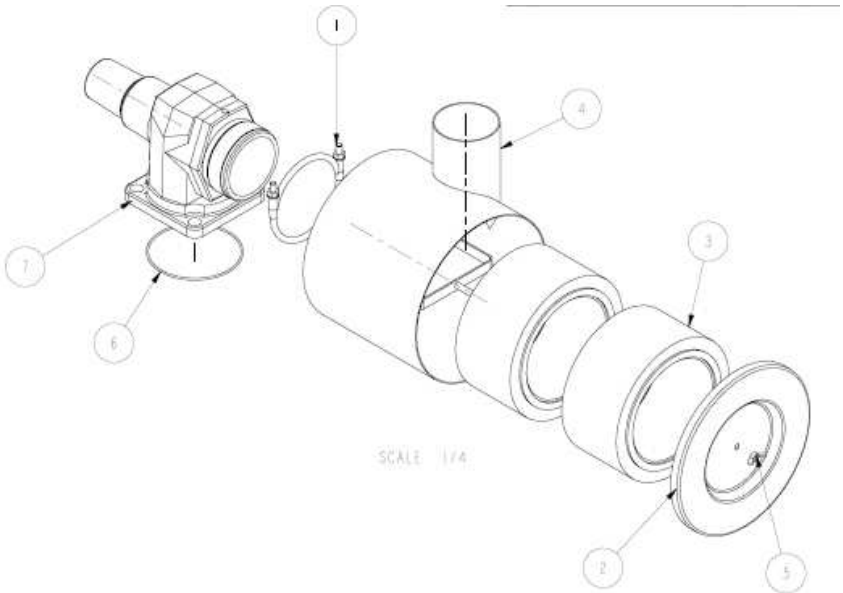
1. Carefully clean and inspect the sealing surfaces and housing components.
2. Install two new filter elements (4).
3. Assemble retainer plate (3) and wing nut (2).
4. Replace filter housing (1) and fasten three retainer clips.

Replacing Air Filter Elements (Horizontal)

⚠WARNING

- **Allow the compressor to cool down before starting maintenance work.**

Horizontal Air Cleaner



REMOVAL

1. Toggle 2 U-bolt nuts and remove filter housing (1)
2. Remove wing nut (5) and retaining plate (2).
3. Remove and discard the two filter elements (3).

INSTALLING

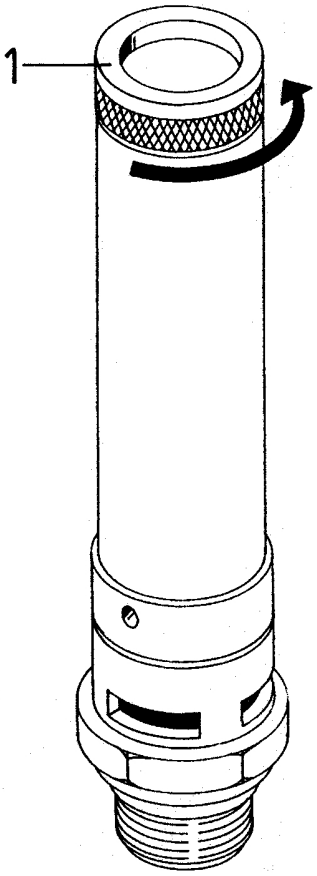
1. Carefully clean and inspect the sealing surfaces and housing components.
2. Install two new filter elements (3).
3. Assemble retainer plate (2) and wing nut (5).
4. Replace filter housing (4) and tighten U-bolt around Air Cleaner bore and Air Inlet Valve as shown.

Testing Safety Valve

⚠WARNING

- **Oil is hot when compressor is first shut down (185°F); allow the compressor system to cool before starting maintenance work.**
- **All adjusting and repair work on the safety valve must be left to a qualified mechanic (observe local regulations)**
- ***Never operate the compressor system with a malfunctioning, modified, plugged, or missing air safety valve*.**

The receiver tank safety valve provides for pressure relief should the control system malfunction. The valve is factory preset at 200 psi and is non-adjustable.



The operation of the valve can be confirmed by turning the safety valve cap (1) counterclockwise 1-2 turns while the receiver is pressurized. Air should be released as the valve is opened. Close valve.

Opening (safety blow-off) pressure of the valve must be tested with the valve removed from the receiver tank and connected to test air supply.

Belt Adjustment and Replacement

⚠WARNING

- **Stop the compressor and check that the receiver is not pressurized. After shutdown, allow 2 minutes for system blow down.**
- **Allow the compressor to cool down before starting maintenance work.**
- **Make sure system cannot be started while maintenance is being performed**

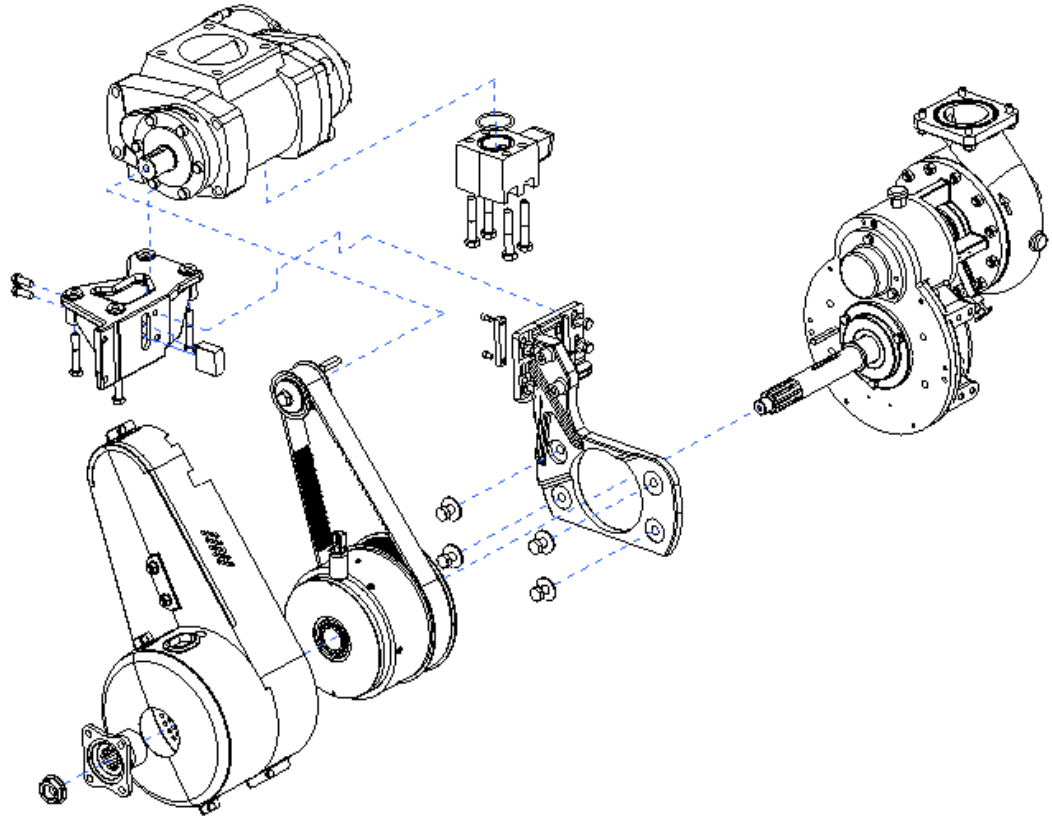


Figure 3

A high performance, poly chain, toothed belt drives the compressor. The belt is constructed using a combination of a chemical resistant elastomeric compound and Kevlar tensile cords that provide for virtually no elongation.

The belt has been properly tensioned on assembly. Under normal circumstances, the belt is maintenance free and will last for years of service. Should adjustment or replacement become necessary, use the following steps as a guide.

In addition to figure 3 and 4, please refer to drawings DHC2330, DCM0504 and DCM0703.

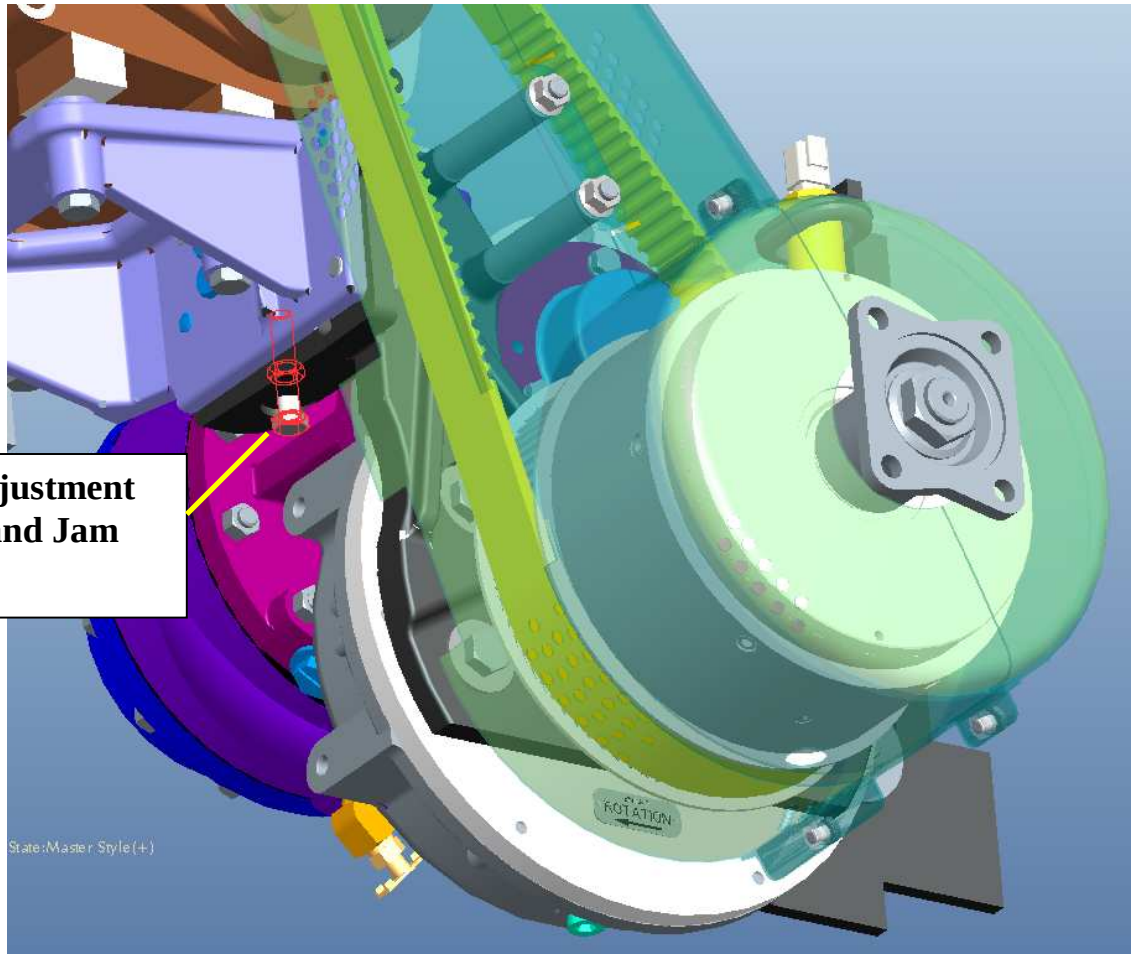

Belt Adjustment Screw and Jam Nut
ROTATION
State:Master Style(+)

Figure 4

Belt Inspection and Adjustment

1. Remove two belt cover retaining nuts (5). (Ref Drawing DCM0507 for steps 1 & 3).
2. Remove Anti-Rotation tube (48). (Ref Drawing DHC2330).
3. Remove four ¼-20 HHCS (4) from belt cover halves (1 & 2).
4. Inspect belt (7) for wear. Note that it is normal for a small amount of dust to accumulate around the belt housing as the belt breaks in. (Ref Drawing DHC2330 pg's 3-4)
5. Check for proper belt tension. A 22-pound force applied in the middle of the belt span should deflect the belt approximately 3/16 (.19) inches.
6. Should belt tension adjustment be required (Ref Drawing DCM0703 for steps 5a-5e)):
    a. Loosen four compressor bracket bolts (4).
    b. Install 3/8-16NC jackscrew (12) in compressor bracket (2) as shown in the lower left view of drawing DCM0703. OR tighten jackscrew as it is, in place.
    c. Apply pressure to jackscrew until proper belt tension is achieved.
    d. Once proper belt tension is achieved, tighten jam nut (8) to lock adjustment in place.
    e. Tighten four compressor bracket bolts (4), torque to 50 ft lb.
7. Replace belt cover halves (1 & 2) feeding electric power connection wires through cover opening and screw the clutch anti-rotation tube onto the anti-rotation post of the clutch in its corresponding groove on the belt cover (1 & 2). (Ref Drawing DCM0507 for steps 7-10)
8. Secure two halves of the belt cover together with four ¼-20 HHCS (4).
9. Secure belt cover with two retaining nuts (5).

Belt Replacement

1. Remove two belt cover retaining nuts (5). (Ref Drawing DCM0507 for steps 1, 3, & 4).
2. Remove Anti-Rotation tube (48). (Ref Drawing DHC2330).
3. Remove four ¼-20 HHCS (4) from belt cover halves (1 & 2).
4. Remove belt cover (1 & 2).
5. Loosen four compressor bracket bolts (4). (Ref Drawing DCM0703 for steps 3-13)
6. Remove four compressor bolts.
7. Without removing compressor drive sprocket lift and twist compressor assembly so that the belt can be slipped over the sprocket and removed.
8. Reverse procedure and slip new belt over sprockets → disconnect and reconnecting of the corresponding input drive yoke assy to remove belt and install new.
9. Replace and tighten four compressor-mounting bolts.
10. Rotate and inspect the belt to confirm it has been seated properly.
11. Install 3/8-16NC jackscrew (12) in compressor bracket (2) as shown in the lower left view of drawing DCM0703. OR tighten jackscrew as it is, in place
12. Apply pressure to the jackscrew until proper belt tension is achieved.
13. Once proper belt tension is achieved, tighten jam nut (8) to lock adjustment in place (Ref Drawing DCM0703 for steps 11-12).
14. Tighten four compressor bracket bolts (4), torque to 50 ft-lb.

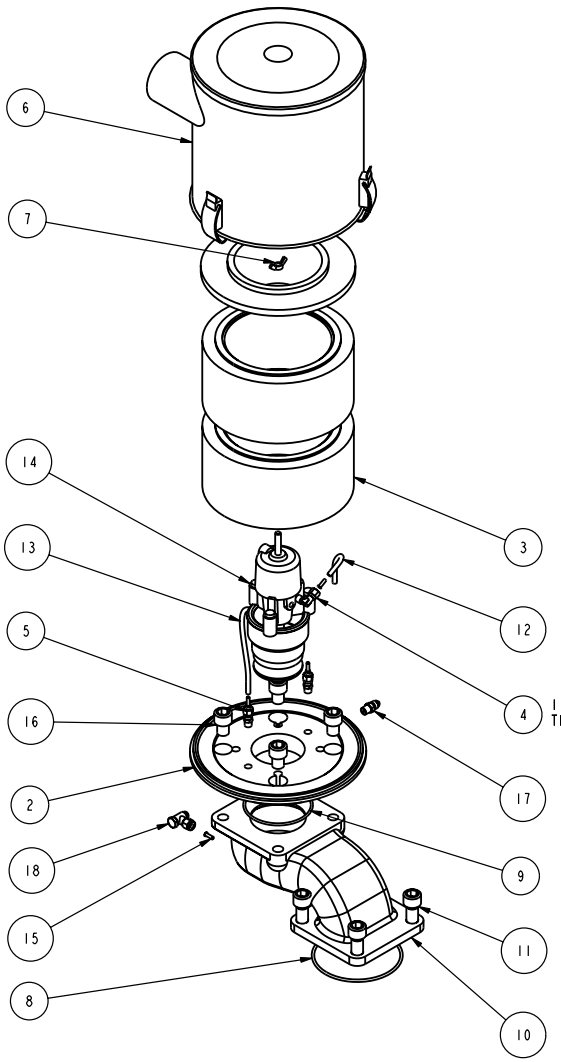
15. Rotate belt by hand and recheck tension.
16. Replace belt cover halves (1 & 2) feeding electrical power connection wires through cover opening and screw the clutch anti-rotation tube onto the anti-rotation post of the clutch in its corresponding groove on the belt cover (1 & 2). (Ref Drawing DCM0507 for steps 16-18)
17. Secure two halves of the belt cover together with four ¼-20 HHCS (4).
18. Secure belt cover with two retaining nuts (5).

Notes

NO.	DESCRIPTION	NOTE	PART NO.	QTY.	
2	ADAPTER - AIR INLET ASSEMBLY	•	1644900	1	
3	ELEMENT - AIR CLEANER	•	1122601	2	
4	FITTING - 6MM OD TUBE x .12 BSPT, 90	•	3503012	1	
5	FITTING - .12BSP X 6MM TUBE	•	3503001	2	(A)
6	HOUSING - AIR FILTER	•	1122501	1	
7	NUT - WING, M8-1.25	•	5403500	1	
8	O-RING - 4.62 x 4.88 x 0.12		3601219	1	
9	O-RING - ADAPTER PLATE	•	3601705	1	
10	OFFSET - CAFS, AIR INLET		3106700	1	
11	SHCS - M16-2 x 30MM, GR8.8		5401212	4	
12	TUBE - CONTROL, 6 X 4MM X 116MM	•	1101941	1	
13	TUBE - CONTROL, 6 x 4mm x 230MM	•	1101942	1	
14	VALVE - INLET, POSITIVE	•	5204801	1	
15	SLEEVE - FTG, 4MM X 6MM TU		3503004	4	
16	SHCS - M16-2 x 20MM, GR8.8	•	5401216	4	(B)
17	FITTING - .12 BSPTM X .25 JICM		3501559	1	(C)
18	FTG - 6MM TU x .12 BSPP, BANJO		3503007	1	

• THESE PARTS ARE COMPONENTS OF ASSEMBLY AZ00804 (TAMROTOR 309 214 97)

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	WAS 3503000 FITTING ADDED 1MM ORIFICE NOTE	25FEB02	2002-35	DWS
B	WAS 16Mx30MM, REMOVED 3601704 O-RING	03MAY02	2002-74	DWS
C	FTGS 17 & 18 WERE 3503001	10JUL02	2002-110	DWS



(A) 1.0mm ORIFICE HOLE THRU SIDE OF FITTING

MODEL NAME	MDL CREATED	SHEET	
AZ00803	APR 12, 1999	1/1	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. | PATTERN NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03, .000 ±.010, ANGLES ±1°

W.S. Darley & Co. CHIPPEWA FALLS, WI · MELROSE PARK, IL

DWG - ASSEMBLY, AIR INLET, CAFS TAMROTOR, AZ00803

DR'N DWS | DATE 09-Jun-99

CHKD TED | SCALE 1/4

TRCD

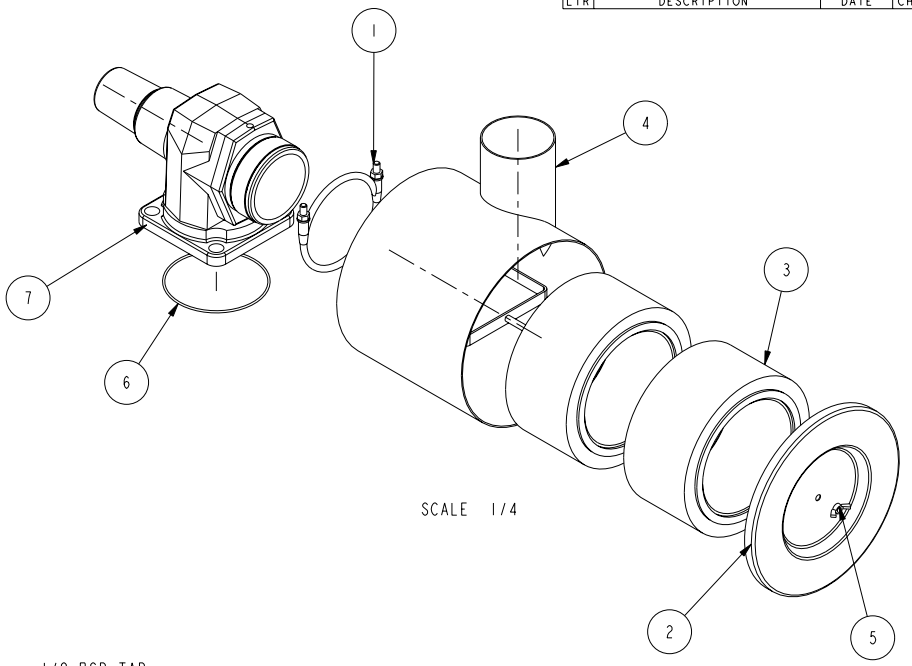
DCM0103

ALL DIMENSIONS IN INCHES UNLESS NOTED

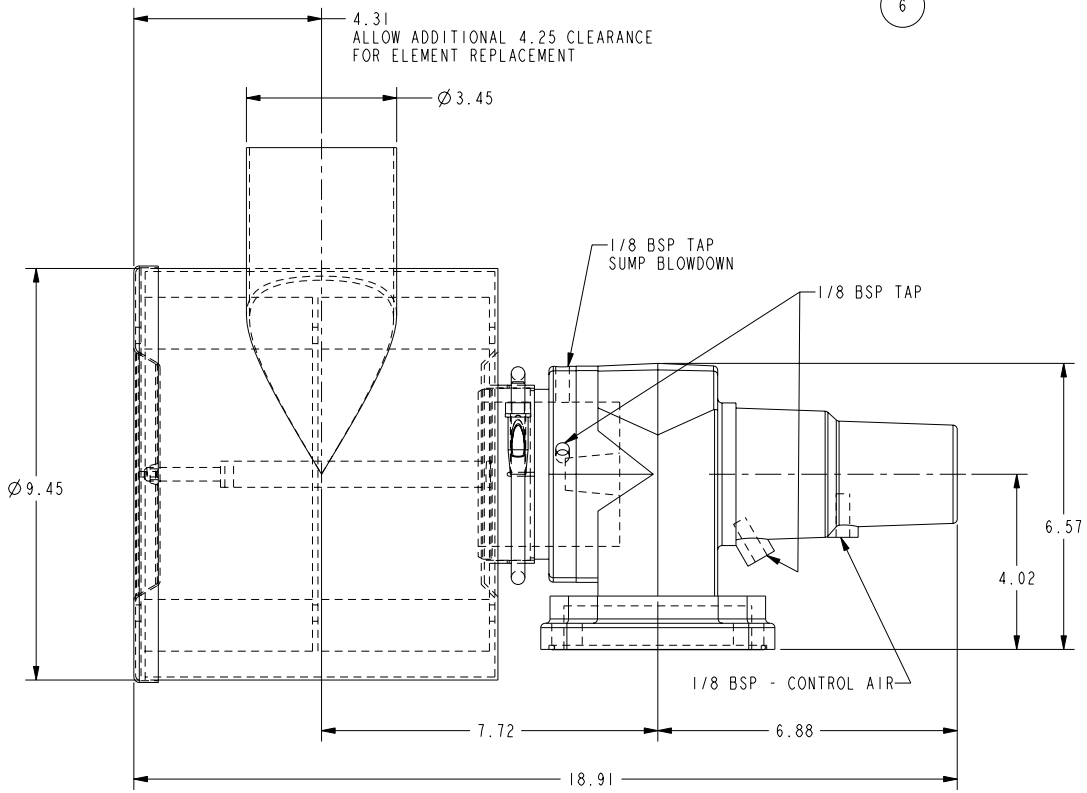
DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.
1	U-BOLT - AIR FILTER CLAMP	4406806	1
2	COVER - AIR FILTER	1122503	1
3	ELEMENT - AIR CLEANER	1122601	2
4	HOUSING - AIR CLEANER, HORIZ.	1122502	1
5	NUT - WING, M8-1.25	5403500	1
6	O-RING - 4.75 x 4.94 x 0.09	3601114	1
7	VALVE - INLET, HORIZONTAL	5204802	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



SCALE 1/4



NOTES:

1] POSITIVE CONTROL AIR INLET VALVE - SEE DCS0501 SCHEMATIC FOR CONTROL LINE CONNECTION DETAILS

2] REF ASSEMBLY AZ00704 (DWG DCM1400) FOR REMOTE AIR CLEANER MOUNTING COMPONENTS

OPTIONAL HORIZONTAL INLET VALVE

MODEL NAME	MDL CREATED	SHEET	
5204803	06-DEC-2000	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
CHIPPEWA FALLS, WI - MELROSE PARK, IL

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

VALVE - ASSY, INLET, E12, HORIZ.
REF. TAM. ASSY 503 619 01

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

DR'N DWS

CHK'D TED

TRC'D

DATE 21-Dec-00

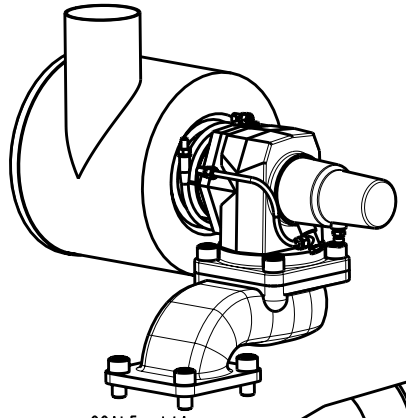
SCALE 1/2

5204803

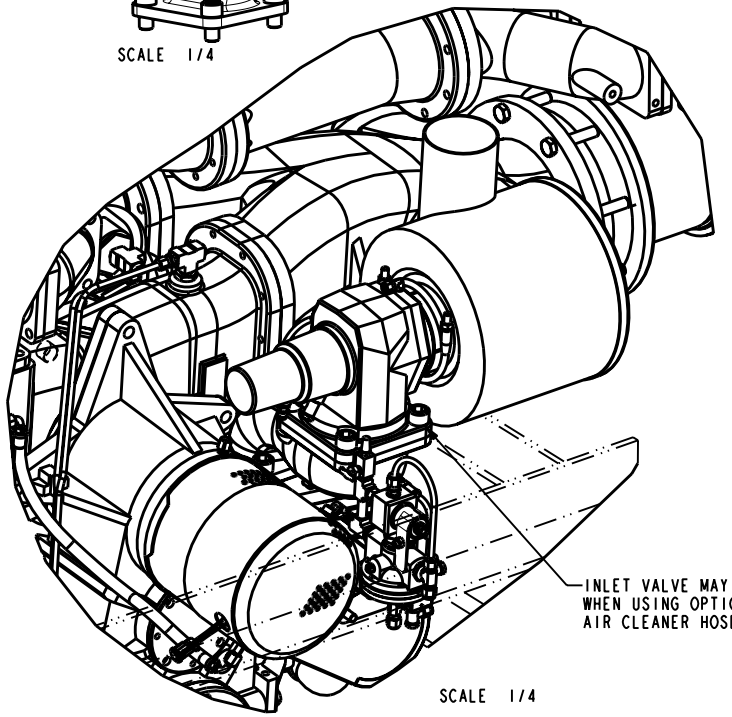
NAME:DWS OBJECT:5204803 DATE:19-Jan-05 08:40:44

NO.	DESCRIPTION	PART NO.	QTY.	
1	FITTING - .12 BSPT X 6MM HOSE, 90	3503000	2	
2	FITTING - .12 BSPTM X .25 JICM	3501563	1	(A)(B)
3	O-RING - 4.62 x 4.88 x 0.12	3601219	1	
4	OFFSET - CAFS, AIR INLET	3106700	1	
5	SHCS - M16-2 x 30MM, GR8.8	5401212	8	
6	FTG - SLEEVE, 4MM x 6MM TU	3503507	3	(D)
7	TUBE - CONTROL, 6x4x200MM	1101957	1	
8	VALVE - ASSY, INLET, E12, HORIZ.	5204803	1	
9	FTG - 6MM TU x .12 BSPP, BANJO	3503007	1	(C)

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	WAS 3503000 FITTING ADDED 1MM ORIFICE NOTE	25FEB02	2002-35	DWS
B	WAS 3503012 FITTING FOR 6MM TUBE COMPRESSION	02APR03	2003-45	DWS
C	3503007 WAS 3503000	23JAN04	2004-013	DWS
D	3503507 WAS 3503004	03/12/08	2008-080	RJG

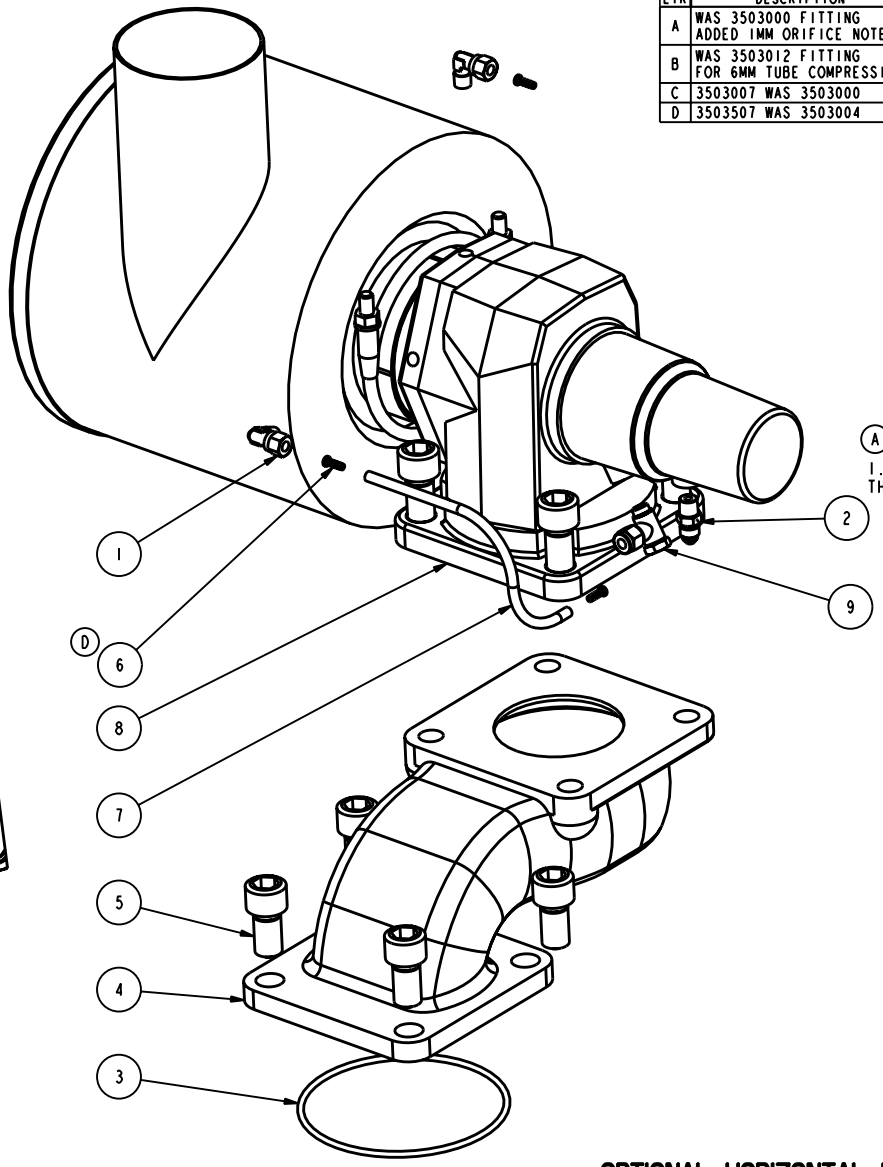


SCALE 1/4



SCALE 1/4

INLET VALVE MAY BE ROTATED 180° WHEN USING OPTIONAL REMOTE AIR CLEANER HOSE ASSEMBLY



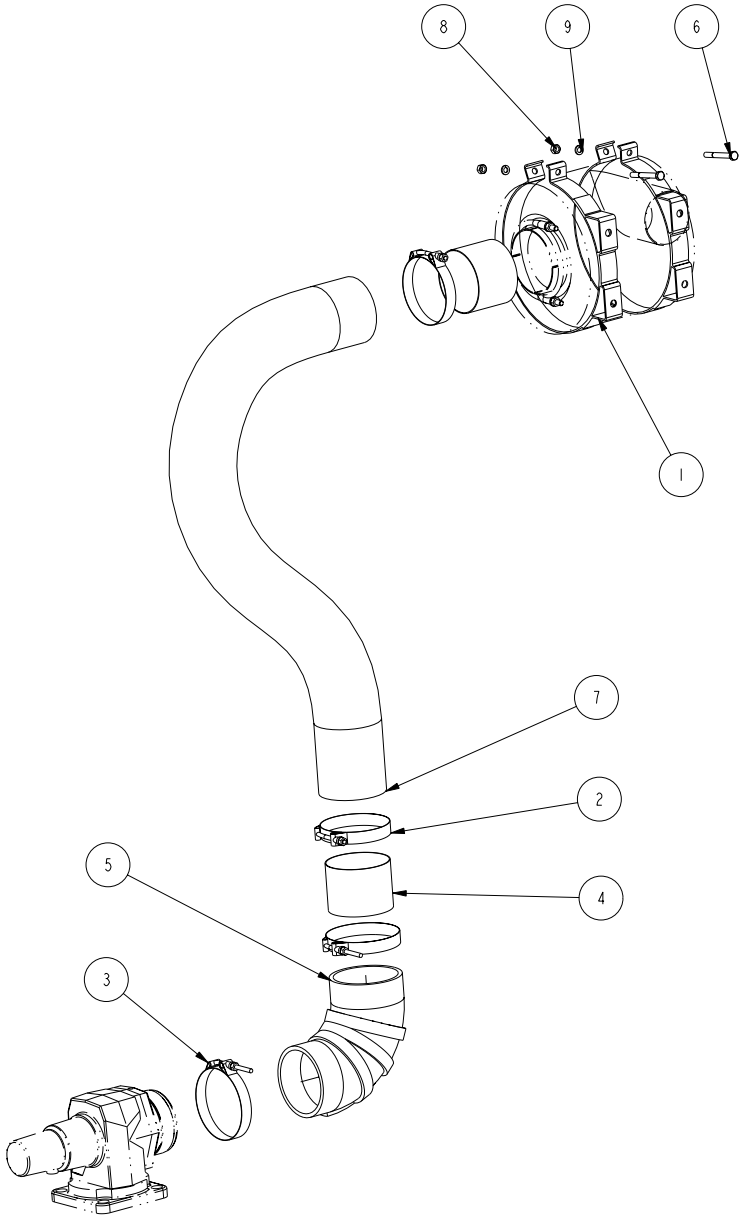
OPTIONAL HORIZONTAL INLET VALVE

				MODEL NAME	MDL CREATED	SHEET	
				AZ00806	06-DEC-2000	1/1	C
REMOVE SHARP EDGES	INCH [MILLIMETER]	THIRD ANGLE PROJECTION	OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±2°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI		
MATERIAL DESCRIPTION:		MATERIAL NO.	PATTERN NO.		DWG - ASSY, HOR. INLET VALVE W/OFFSET		
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT		DR'N DWS CHKD TED TRCD	DATE 15-Dec-00 SCALE 1/2	DCM1300	

NAME:RG OBJECT:DCM1300 DATE:12-Mar-08 13:30:59

NO.	DESCRIPTION	PART NO.	QTY.
1	BRACKET - MOUNTING, AIR FILTER	4025301	2
2	CLAMP - T-BOLT, 4.25"	4402623	2
3	CLAMP - T-BOLT, 4.50"	4402626	2
4	COUPLING - HOSE, 4.00 OD	4418600	2
5	ELBOW - 4.00 ID AIR INLET	4428400	1
6	HHCS - .313-18 x 2.75, GR5	5400025	2
7	HOSE - 4.00 x 72, 1.50 CUFFS	4402361	1
8	NUT - HEX, .313-18, GR2	5403001	2
9	WASHER - LOCK, 0.313 ID	3603502	2

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



OPTIONAL REMOTE AIR CLEANER HOSE AND BRACKET ASSEMBLY FOR HORIZONTAL INLET VALVE

MODEL NAME	MDL CREATED	SHEET	
AZ00704	13-DEC-2000	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
CHIPPEWA FALLS, WI - MELROSE PARK, IL

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

DWG - ASSY, AIR CLNR REMOTE

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

DR'N DWS
CHKD TED
TRCD

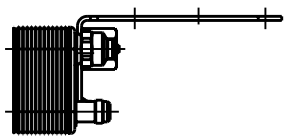
DATE 14-Dec-00
SCALE 3/16

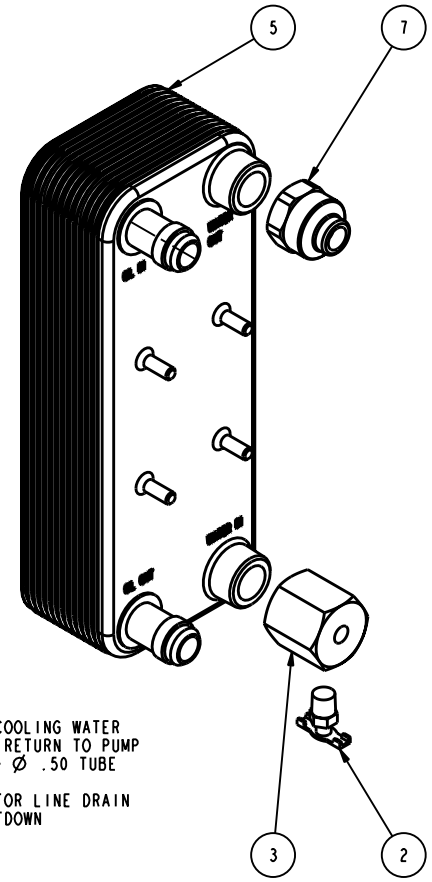
DCM1400

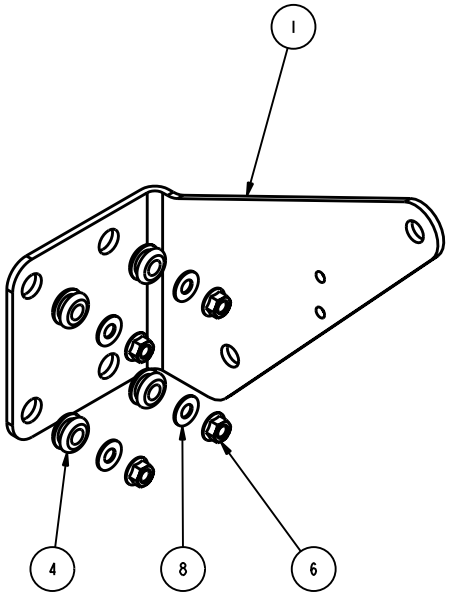
NAME:DWS OBJECT:DCM1400 DATE:19-Jan-05 09:11:35

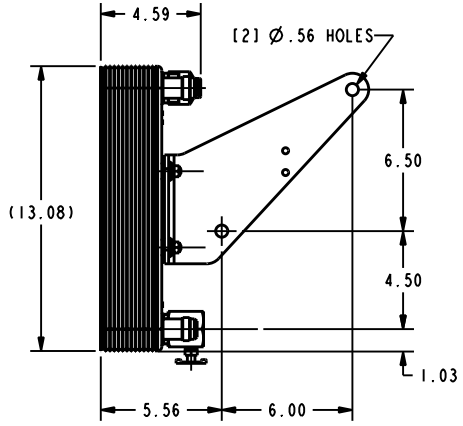
NO.	DESCRIPTION	PART NO.	QTY.
1	BRACKET - HEAT EXCH	4016500	1
2	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
3	FTG - 1.00 NPTF DRAIN TEE	3503005	1
4	GROMMET - .38 ID x .63 MTG OD	4401725	4
5	HEAT EXCH - LDMBC BRAZED PLATE	4215102	1
6	NUT - FLANGED, M8-1.25, TOPLOC	5403603	4
7	REDUCER - PIPE, 1.00 X 0.38	1080214	1
8	WASHER - FLAT, 0.31 ID, SST	3603812	4

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

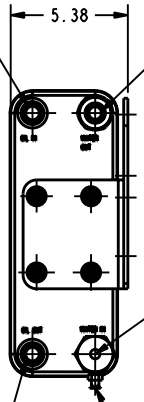








SCALE 1/4



3/4 JIC MALE OIL IN
FROM HYDRAULIC MOTOR
CASE DRAIN

3/8 NPT COOLING WATER
OUTLET - RETURN TO PUMP
SUCTION - Ø .50 TUBE

PROVIDE FOR LINE DRAIN
WHEN SHUTDOWN

1/4 NPT COOLING WATER
INLET FROM SELF CLEANING
SCREENED PUMP DISCHARGE
PORT

POSITION DRAIN PORT DOWN
CONNECT TO MULTIPLE DRAIN VALVE

3/4 JIC MALE OIL OUT
TO RESERVOIR PORT
NOTE: RETURN PORT MUST
BE BELOW FLUID LEVEL
OF RESERVOIR

MODEL NAME	MDL CREATED	SHEET	
AZ00608	11-APR-2008	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION:

MATERIAL NO. | PATTERN NO.

DWG - ASSEMBLY, HEAT EXCH.
HYDRAULIC SYSTEM COOLER

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

DR'N DWS
CHKD TED
TRCD

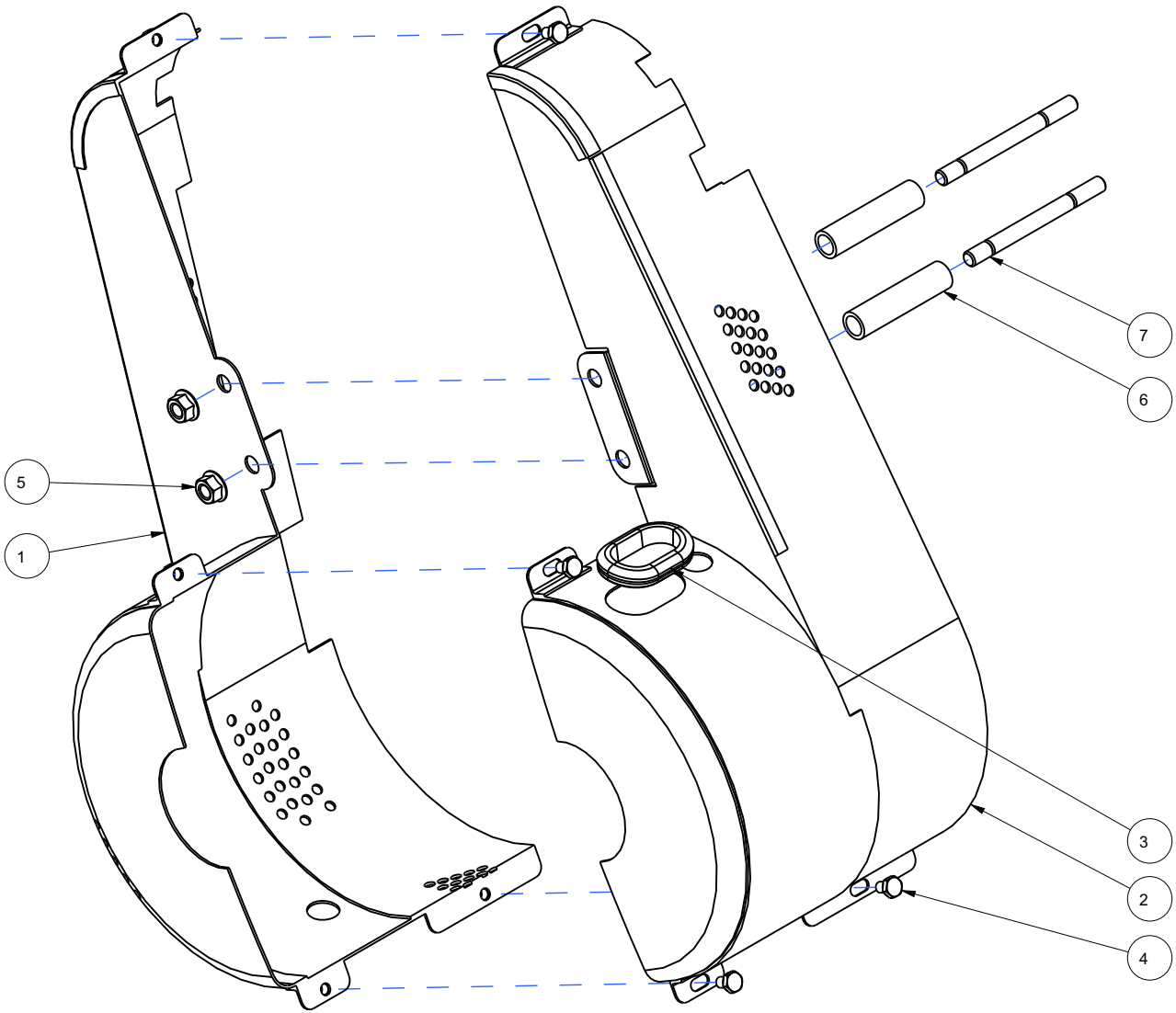
DATE 11-APR-08
SCALE 1/2

DCM0116

NAME:DWS OBJECT:DCM0116 DATE:11-Apr-08 16:12:00

NO.	DESCRIPTION	PART NO.	QTY.
1	COVER - BELT, ELECTRIC CLUTCH	2508510	1
2	COVER - BELT, ELECTRIC CLUTCH	2508511	1
3	GROMMET - 1.50 ID X 1.75 MTG OD	4401726	1
4	HHCS - .250-20 x 0.38, GR5	5400000	4
5	NUT - FLANGED TOP LOCK	5403468	2
6	SPACER - 0.49 x 0.68 x 2.82	3306721	2
7	STUD - 0.375-16 X 4.25, GR5	3606251	2

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL NAME	MDL CREATED	SHEET	
DCM0507	01/26/12	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: SEE TABLE

MATERIAL NO. -

PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - BELT COVER ASSY, HMBC SPLIT-BELT COVER, ELECT CLUTCH

DR'N RJG

CHKD -

TRCD

DATE 26-Jan-12

SCALE 1/2

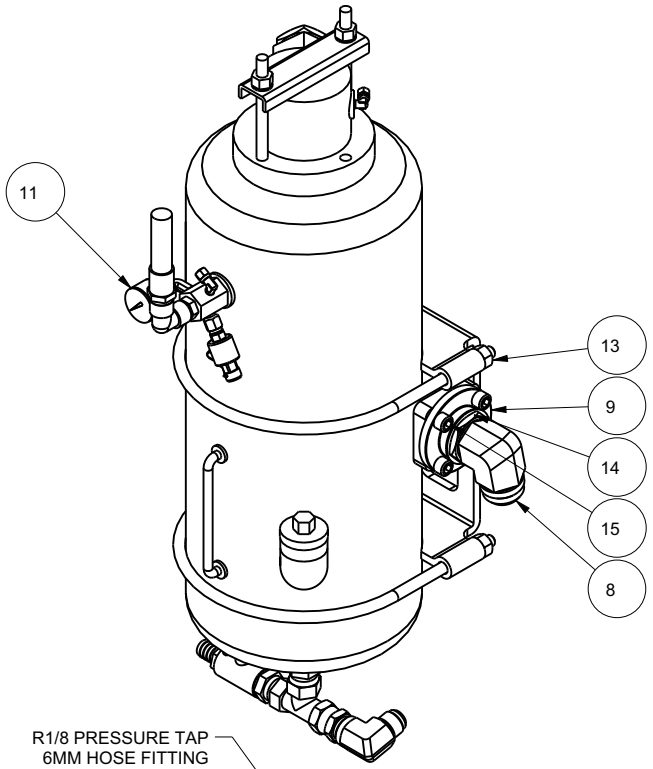
DCM0507

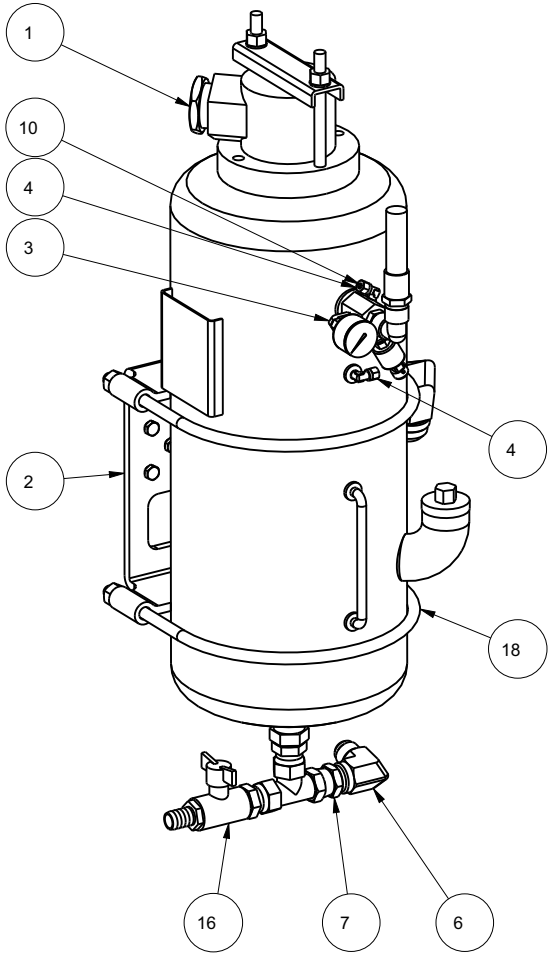
ALL DIMENSIONS IN INCHES UNLESS NOTED

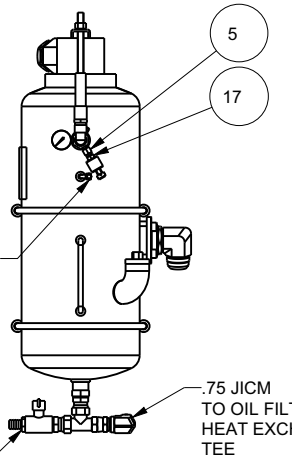
DO NOT SCALE PRINT

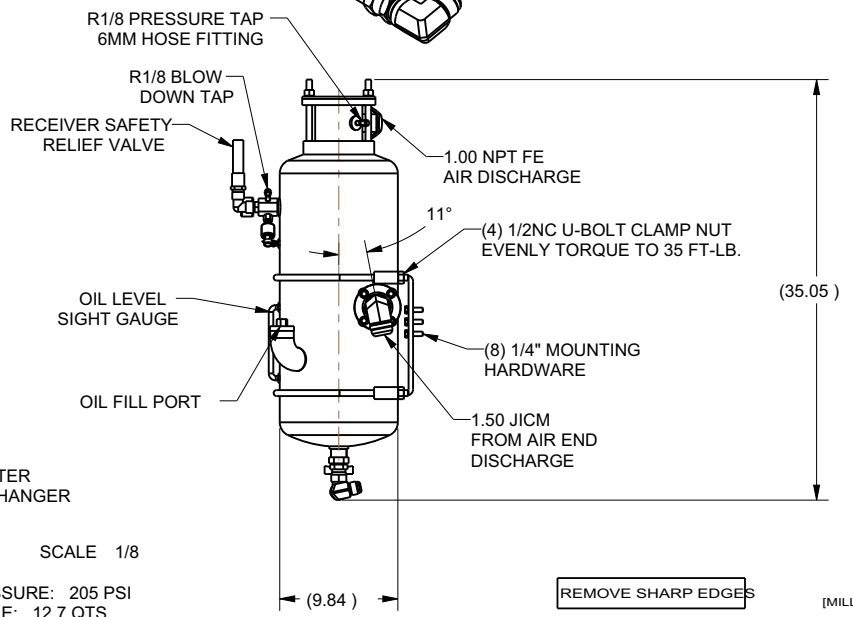
NO.	DESCRIPTION	PART NO.	QTY.
1	ADAPTER - 1.5 BSPTM x 1.0 NPTF	1602301	1
2	BRACKET - OIL RECEIVER TANK	4028108	1
3	ELBOW - PIPE, ST, 0.12, 90 DEG	1080835	1
4	FITTING - .12 BSPT X 6MM HOSE, 90	3503000	3
5	FITTING - .12 NPT M X .25NPTF	3501556	1
6	FITTING-.75 JICMx.75 NPTF, 90	3501551	1
7	FITTING-.75NPTMx.75BSPPS SWV	3501550	1
8	FITTING-1.50 JICMx1.50 NPS, 90	3501543	1
9	FLANGE - RECEIVER TANK INLET	1925300	1
10	FTG - SLEEVE, 4MM x 6MM TU	3503507	3
11	GAGE - AIR PRESS, 0-16 BAR	2603093	1
12	HHCS - .375-16 x 1.25, GR5	5400037	6
13	NUT - HEX, .500-13, HEAVY, GR2	5403018	4
14	O-RING - 2.38 x 2.56 x 0.09	3601123	1
15	SHCS - M12-1.75 x 30MM, GR8.8	5401213	4
16	TANK - OIL RECEIVER	4218600_P2	1
17	TRANSDUCER - PRESSURE, 300 PSI	4224500	1
18	U-BOLT - TANK MOUNTING	4406805	2
19	WASHER - LOCK, 0.250 ID	3603501	6

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D









SCALE 1/8

MAX. PRESSURE: 205 PSI
OIL VOLUME: 12.7 QTS.
APPROXIMATE WEIGHT: 140 LBS s/OIL

MODEL NAME	MDL CREATED	SHEET	
AZ01109	12/16/09	1/1	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. - | PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG - ASSEMBLY, RECEIVER TANK
PASS SIDE REAR, CAFS COMMANDER

DR'N RJG | DATE 16-Dec-09
CHKD MCR
TRCD
SCALE 1/4

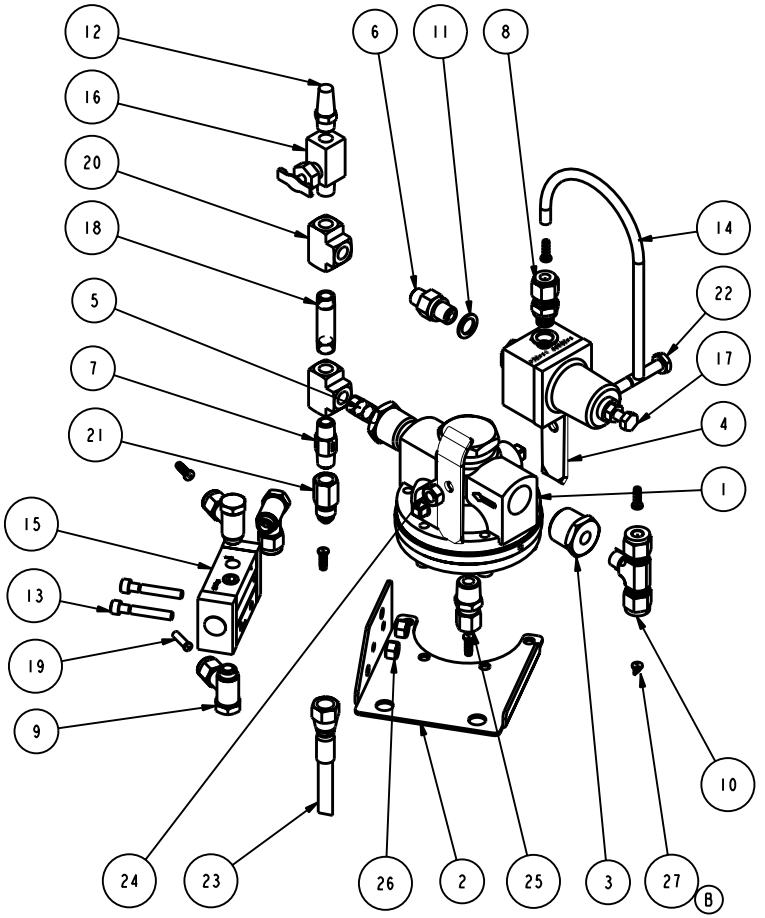
DCM0806

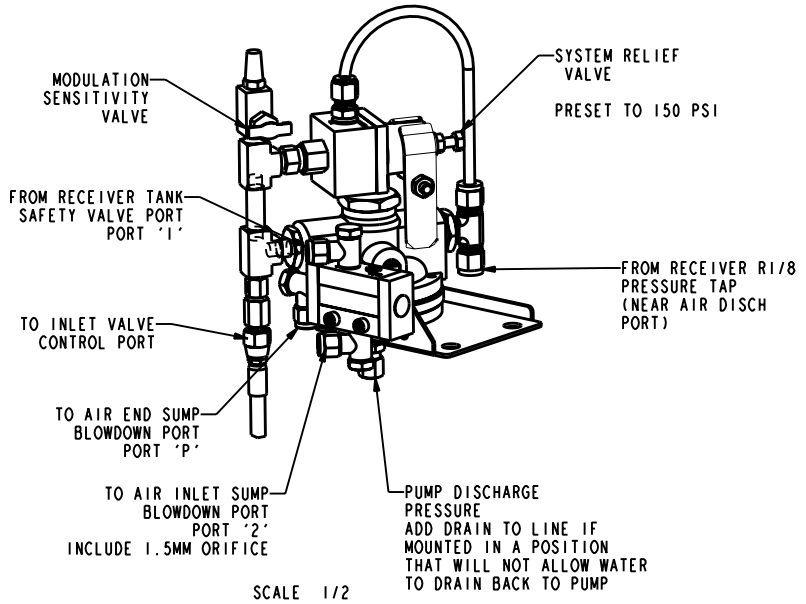
ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.	
1	BALANCED PRESSURE VALVE - CAFS	AZ00108	1	
2	BRACKET - CONTROL MODULE	4028301	1	
3	BUSHING - PIPE, 0.50 x 0.13 BR	1080650	2	
4	BRACKET - PRESSURE REGULATOR	4028900	2	
5	NIPPLE - PIPE, .12 CLOSE, BR	1081000	1	
6	FTG - .12NPTM X .12BSPPM	3503503	1	
7	FILTER - INLINE, .12 NPT DBL MALE	1124000	1	
8	FTG - 6MM OD TUBE x .12 BSPP	3503502	1	
9	FTG - 6MM TU x .12 BSPP, BANJO	3503007	3	
10	FTG - 6MM x 6MM x .12NPTM, TEE	3503501	1	
11	FTG - GASKET, TYPE RP	3503506	2	
12	MUFFLER - AIR EXHAUST	3503006	1	
13	SHCS - NO.10-24 x 1.25, SST	5401422	2	
14	TUBE - CONTROL ASSEMBLY	1101953	1	
15	VALVE - BLOW DOWN	5208301	1	
16	VALVE - NEEDLE, 0.12 x 0.12 BR	5203802	1	
17	VALVE - PILOT, PRESS REGULATOR	5208200	1	
18	NIPPLE - PIPE, .12 X 1.50, BR	1081053	1	
19	ORIFICE - 1.5MM x 4MM SLEEVE	3503018	1	(A)
20	TEE - PIPE, 1/8NPT BR	1080422	2	
21	FITTING - .12 NPT FE X .25 JICM	3501560	1	
22	HHCS - .250-20 x 1.75, GR5	5400007	1	
23	HOSE - CONTROL LINE, .25 X 36	4428600	1	
24	NUT - HEX, .250-20, NYLOC, SST	5403403	1	
25	TUBE FITTING - STR, .25 x .25	3500009	1	
26	NUT - HEX, 10-24, NYLOC, SST	5403506	2	
27	FTG - SLEEVE, 4MM x 6MM TU	3503507	6	(B)

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	WAS 3503002 1.0MM ORIFICE	14MAY03	2003-70	DWS
B	ADDED BARB FITTINGS	03/12/08	2008-080	RJG





SCALE 1/2

MODEL NAME	MDL CREATED	SHEET	
AZ01902	06-JUNE-2002	1/1	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: - | MATERIAL NO. | PATTERN NO.

TOLERANCE EXCEPT AS NOTED .00 ±.03, .000 ±.010, ANGLES ±1°

W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI

CAFS - PRESSURE CONTROL ASSY LDMBC, DISCH HD MNT

DR'N DWS | CHKD TED | TRCD | DATE 06-JUNE-02 | SCALE 1/2

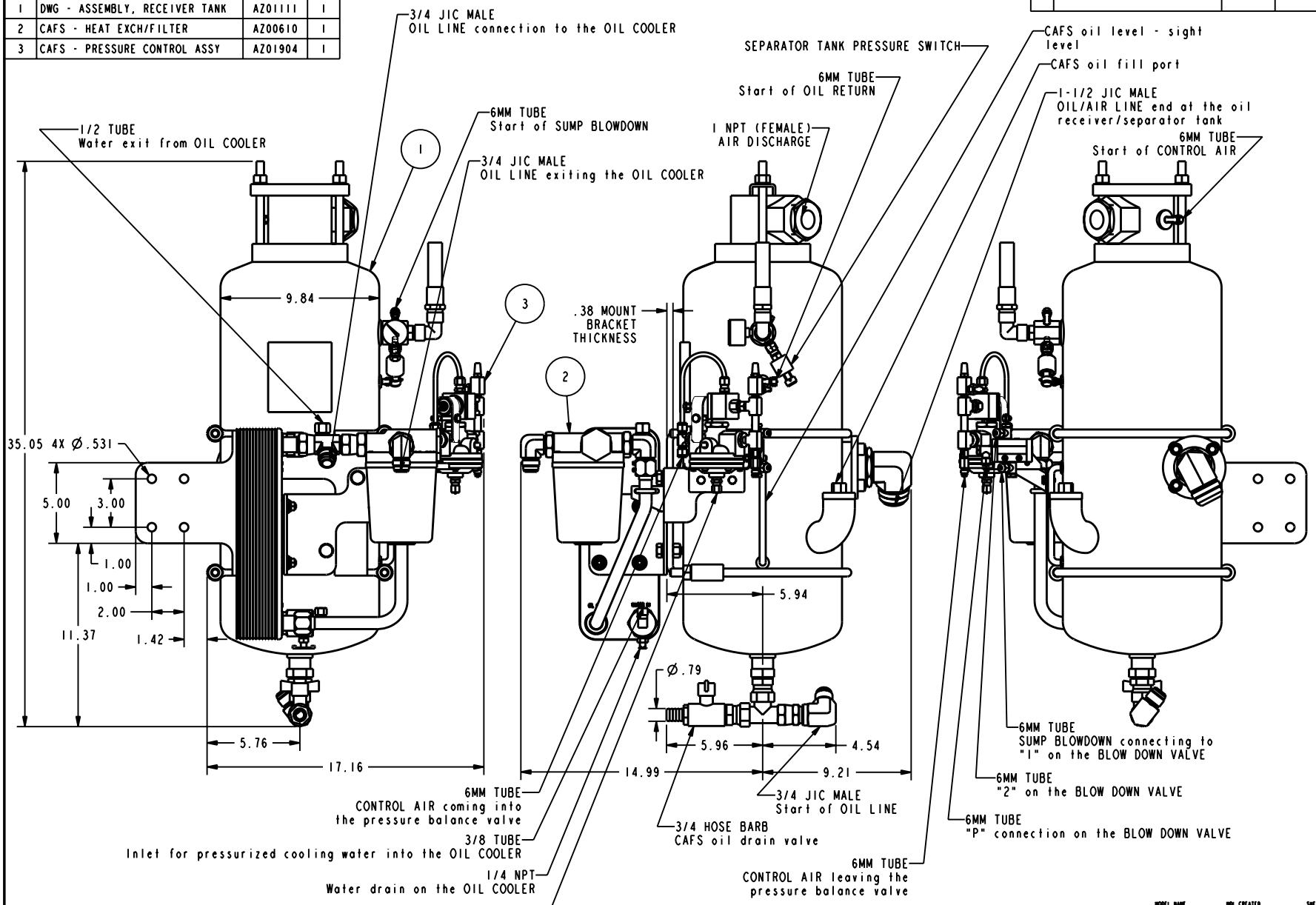
DCM1002

ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

NAME:RG OBJECT:DCM1002 DATE:12-Mar-08 08:52:52

NO.	DESCRIPTION	PART NO.	QTY.
1	DWG - ASSEMBLY, RECEIVER TANK	AZ01111	1
2	CAFS - HEAT EXCH/FILTER	AZ00610	1
3	CAFS - PRESSURE CONTROL ASSY	AZ01904	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:
1) ASSEMBLY MOUNTS VERTICALLY AS SHOWN.
2) REFER TO DRAWING DCS0503 FOR THE CAFS PLUMBING DETAILS.
3) REFER TO DRAWING DGS1606 FOR THE CAFS WIRING SCHEMATIC DETAILS.

MODEL NAME	MDL CREATED	SHEET	
AZ03201	11/24/10	1/1	C

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: SEE TABLE | MATERIAL NO. - | PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03, .000 ±.010, ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DRG - ASSEMBLY, AIR SEPERATION, OIL COOLING PRESSURE BALANCE, 220 CFM, KSPBC

DR'N RJG | DATE 11/24/10

CHKD MCR | SCALE 1/4

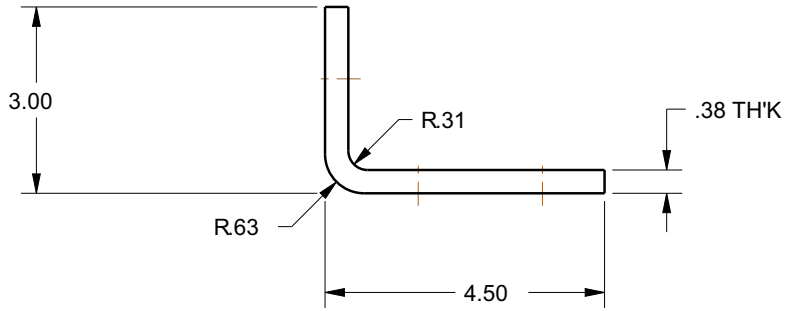
TRCD

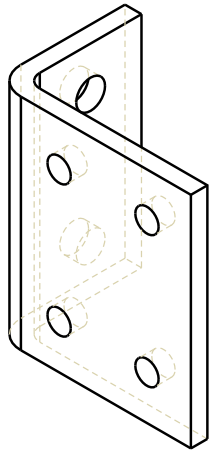
DCM1901

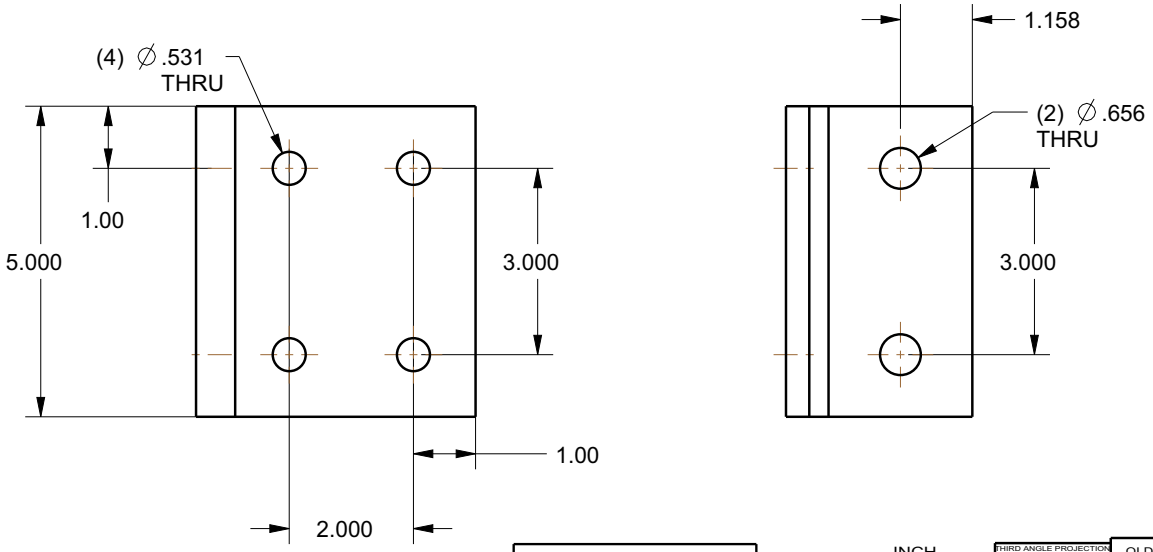
ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

NAME:RJG OBJECT:DCM1901 DATE:02-Dec-10 15:06:28

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D







NOTES:

1) POWDER COAT BLACK

MODEL	MDL CREATED	SHEET	
4037950	12/16/11	1/1	B

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: ~7.50 x 5.00 x .375 THICK A36 STEEL

MATERIAL NO. -

PATTERN NO. -

BRACKET - MOUNT, AZ03201 TO FRAME RAIL HMBC / KSPBC

DR'N RJG
CHKD -
TRCD

DATE 16-Dec-11
SCALE 1/2

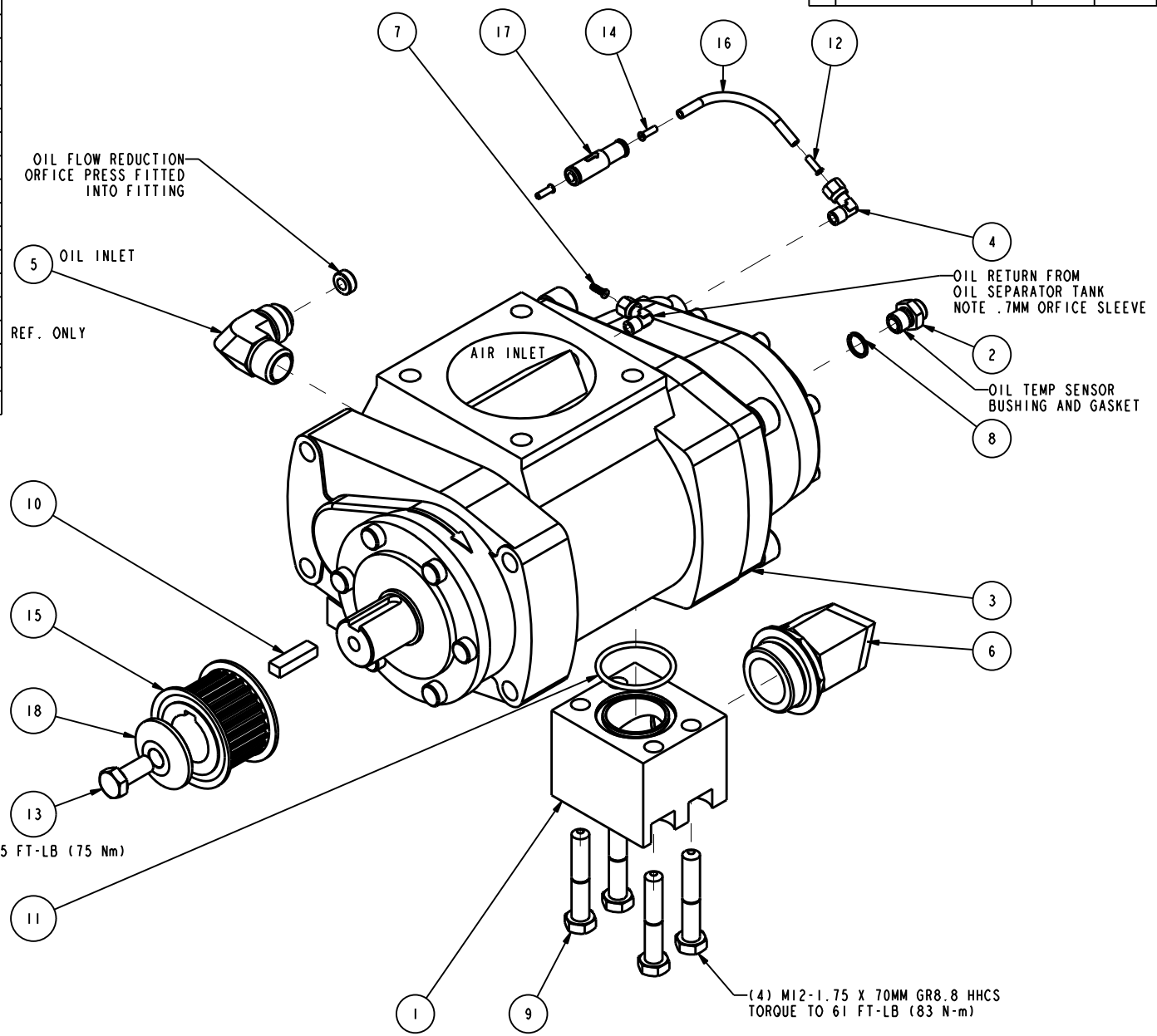
4037950

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.
1	ADAPTER - OIL/AIR RETURN, LOW PROFILE	1645300	1
2	BUSHING - THERMO SENSOR	1600601	1
3	COMPRESSOR - 225 CFM, MODIFIED	4420809	1
4	FITTING - .12 BSPT X 6MM HOSE, 90	3503000	2
5	FITTING - .75BSPTM x .75JICM, 90	3503010	1
6	FITTING-1.50 JICMx1.50 NPS, 90	3501543	1
7	FTG - SLEEVE, 4MM x 6MM TU	3503507	1
8	GASKET - BUSHING, COPPER	3822300	1
9	HHCS - M12-1.75 x 70MM, GR 8.8	5400328	4
10	KEY - 10MM x 8MM x 36MM	3602310	1
11	O-RING - 1.88 x 2.12 x 0.12	3601237	1
12	ORIFICE - 0.7MM X 4MM SLEEVE	3503003	1
13	HHCS - M12-1.75 x 30MM, GR 8.8	5400317	1
14	SLEEVE - FTG, 4MM X 6MM TU	3503004	2
15	SPROCKET - GATES POLY CHAIN, PINION	4819602	1
16	TUBE - OIL RETURN, 6x4MM x 100MM	1101954	1
17	VALVE - CHECK, 6MM TUBE	5208400	1
18	WASHER - SPECIAL, 0.53 IDx2.00	3603916	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL NAME	MDL CREATED	SHEET	
AZ00407	12/16/09	1/1	C

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & Co.
ITASCA, IL - CHIPPEWA FALLS, WI

DWG- ASSEMBLY, AIR END
TAMROTOR ENDURO 12, AZ00407

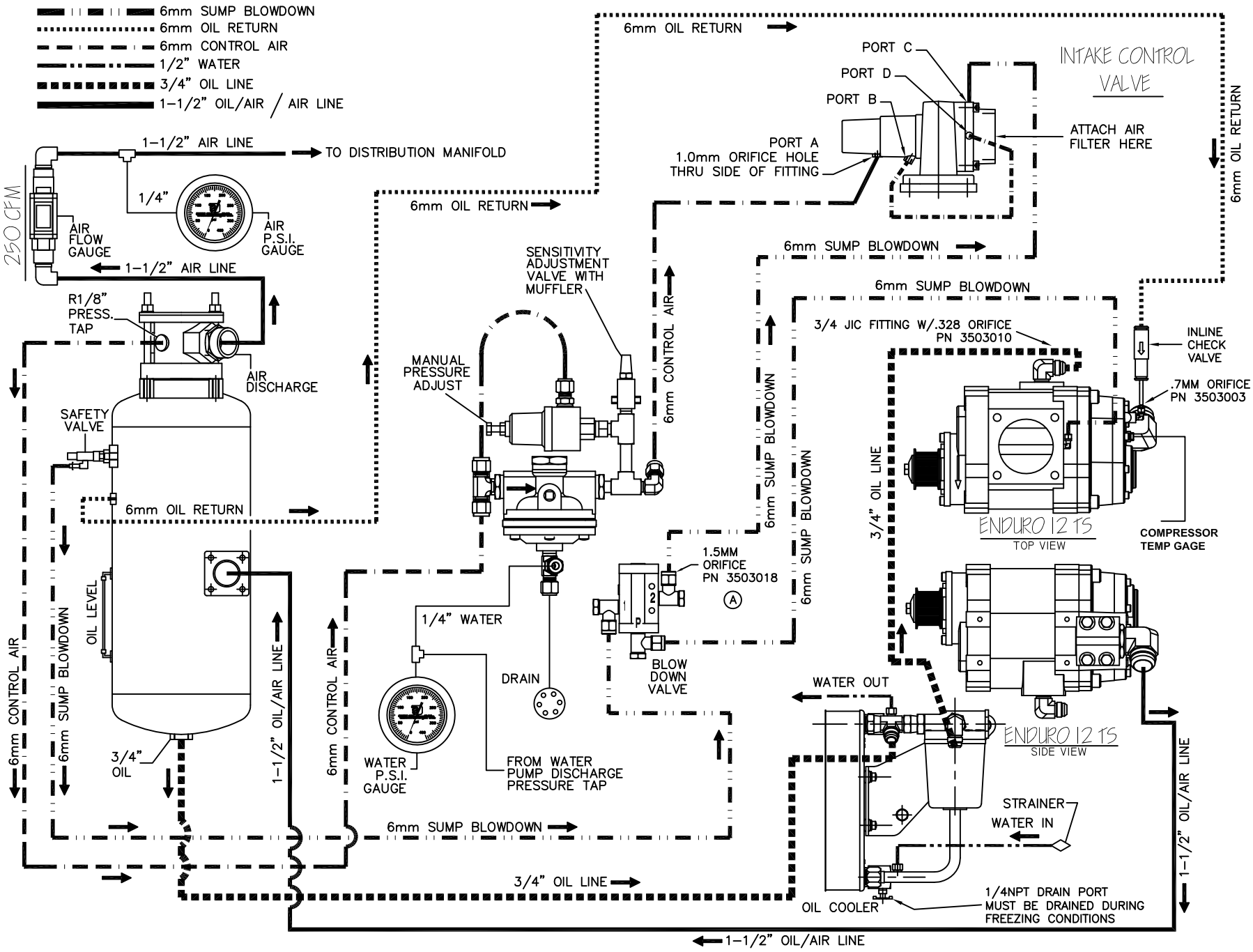
DR'N RJG
CHK'D MCR
TRC'D

DATE 16-Dec-09
SCALE 1/2

DCM0905

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT



W.S. DARLEY & CO.

DWG - COMPRESSOR SCHEMATIC
HMBC, ENDURO 12, HORIZ. INLET

RJG
03-26-2010

E 12 TS COMPRESSOR SCHEMATIC

DCS0504

Section 4

AutoCAFS Commander Control Module

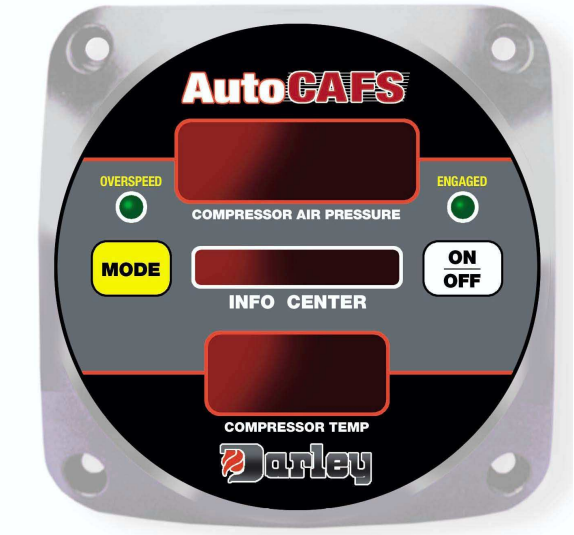
Operation and Installation Reference

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

AutoCAFS Commander

Compressed Air Foam System
Control Module
Operation and Installation



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Pump Manufacturing:

1051 Palmer St.
Chippewa Falls, WI. 54729
800-6347812, Fax (715) 726-2656

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Description:

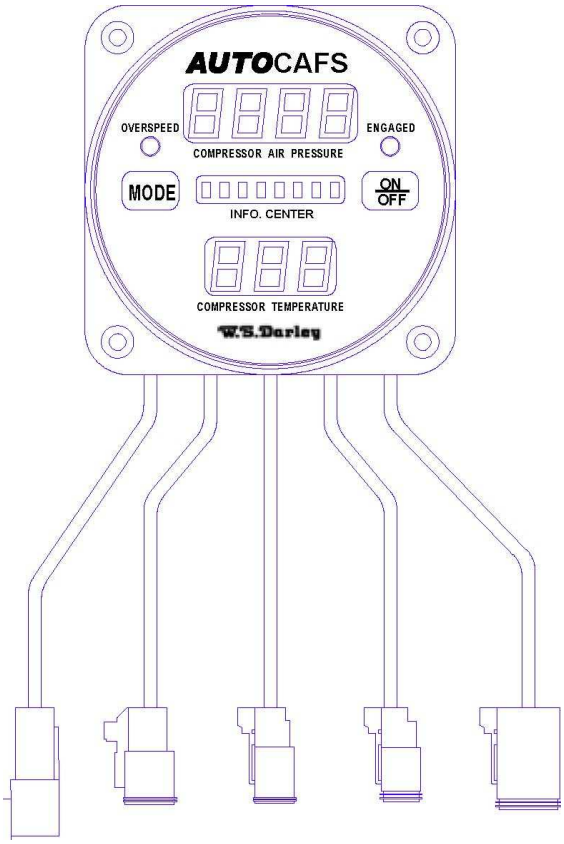
The Darley AutoCAFS Commander control is a programmed logic controller designed to simplify and safe-guard the start-up and operation of Darley compressed air foam systems.

The AutoCAFS Commander can be incorporated to monitor and control compressor operation on the Darley AutoCAFS II HMBC PTO Driven CAFS system, driven via an electric hot shift type PTO, as well as midship driven CAFS compressors.

The Commander continuously monitors system input speeds, pressures, and temperatures. By comparing these values to predetermined acceptable values, the Commander will allow compressor engagement if speeds, pressures and temperatures are within limits. Once the compressor has been engaged, the Commander monitors and displays compressor system temperature and pressure. If these values exceed a preset value, the Commander display exhibits a warning. If temperatures or speeds continue to increase to a higher preset value, the Commander will then automatically disengage the compressor.

Please review the following documentation for complete feature description, operation instructions and installation reference. **If you have further questions or concerns please contact W.S. Darley Pump Division at 1-800-634-7812 or W.S. Darley Apparatus Division at 1-800-527-0068.**

Darley AutoCAFS Commander



The AutoCAFS Commander system :

The system consists of the following components

1. The control unit
2. Air pressure sensor - 0-300 psi
3. Extension cables - 5 cables supplied
    a. power cable
    b. data bus cable
    c. electric clutch cable
    d. air pressure sensor cable
    e. I/O signal and audible warning cable
4. Temperature sender
5. Warning buzzer

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Features:

A) ***Power :***

12V or 24V

B) ***Programmable data using the MODE and ON/OFF buttons :***

-Calibrate RPM for Non-Electronic Engines 110
-Select air pressure reading to be PSI, kPA, or BAR 310
-Select ℉ or ℃ for compressor oil temperature rea ding..... 311
-Set the maximum engine RPM for engagement..... 313
-Set new engine RPM for over-speed warning..... 314
-Set new engine RPM for automatic disengagement……..... 315
-Set the compressor temperature overheat warning……..... 316
-Set the overheat cut-out temperature……..... 317
-Set the Air Flow @ 20 mA……..... 318
-Select system to turn ON automatically when Interlock is engaged…….. 321
-Set the "Soft start duty cycle" percentage…….. 322
-Set Temperature Sensor Type……..... 323
-Select On/Off for Terminating Resistor……..... 324
-Set output power to the clutch..... 325
-Set RPM reading for either Tech\CAN bus……..... 326

C) ***Default Parameters:***

Standard:

- 310 = **PSI**
- 311 = **℉**
- 313 = **900 RPM**
- 314 = **1550 RPM**
- 315 = **1850 RPM**
- 316 = **212 ℉**
- 317 = **240 ℉**
- 318 = **250 CFM**
- 321 = **OFF**
- 322 = **100% → ideal application = 65%**
- 323 = **A [analog] → optional B [digital] → requires physical change to wiring**
- 324 = **OFF → changing requires unit power down to take affect.**
- 325 = **100% → 50% can be opted for in cases of 24 VDC input and desired 12 VDC output.**
- 326 = **CAN bus (J1939) → Tech is an option**

European/China discrepancies from above defaults:

- 310 = **BAR**
- 311 = **℃**

D) ***Display :***

1. Compressor Air Pressure reading - 0-300 psi (0-2000 kPA, 0-20.0 Bar)
2. Compressor Oil Temperature reading - 0-250℉ (0- 120℃)
3. Engine RPM - 0-3000 RPM
4. Airflow in SCFM
5. Compressor operating hours - 0.1 hour increment up to 9999.9 hours
6. ON/OFF LED
7. OVERSPEED LED

E) ***Engine speed signal :***

Either from alternator pulse count or J1939 data bus. Default setting is J1939 data bus.

F) ***Transmission temperature :***

Thermostat with a single pole open contact.

G) ***Air pressure signal :***

From pressure transducer, 0-300 psi

H) ***Warnings :***

1. “HI RPM”
2. “COMP. HOT”
3. “BLOWDOWN”
4. “HI PRESS”
5. “OVERSPD”
6. “SHUTDOWN” - “COMP. HOT”
7. “SHUTDOWN” - “LO FOAM”
8. “SHUTDOWN” - “TRAN HOT”
9. “RPM >900”

I) ***Operating buttons :***

a. ON/OFF button
b. MODE button

J) ***Compressor operating hours :***

The timer is enabled each time the compressor is engaged. An internal memory will keep track of the total operating hours.

1. CONTROL UNIT

The control unit is the 'brain' for the AutoCAFS Commander system. It performs all the controls and also allows control only when all the necessary conditions are met. It also monitors the system and alerts the operator of any system faults or failures. There are several display windows and buttons on the control unit. As well the unit features a photovoltaic sensing overlay that auto dims the display LED's turning night conditions (low light) and increases the display brightness in day conditions (high light):

i) Compressor air pressure window - this is a 4 digits LED window. It will display the air pressure from 0 to 300 psi. (pressure in kPA and Bar will be displayed when selected)

ii) Compressor oil temperature window - this is a 3 digits LED window. It will display the compressor oil temperature from 0 to 250 degrees Fahrenheit. (temperature in Celsius will be displayed if selected)

iii) An information display window -8 characters alphanumeric display. This window will display the engine RPM, compressor operating hours, airflow, and also any faults or warnings occured during the operation.

iv) ON/OFF button - Turn the compressor ON and OFF. In order to turn the compressor on, the ON/ OFF button has to be pressed and held for 2 seconds. The green LED above the button will come on to indicate that the compressor is ON. This green LED will only come on if all the conditions are met and an electrical signal has been sent to engage the clutch. Press and hold the ON/OFF button for 2 seconds to turn off the system.

v) MODE button - the MODE button allows the operator to view the engine RPM, airflow, and compressor hours. Other information can be added in the future.

2. Pressure sensor

The pressure sensor is used to detect the air pressure in the compressor. It has a pressure range of 0-300 psi.

3. Extension cables

a. power cable: 5' long with 3 pins Deutsch connector
b. data bus cable: 12' long with 2 pin Packard connector
c. electric clutch cable: 12' long with 2 pin Deutsch connector
d. air pressure sensor cable: 12' long with 4 pin Deutsch connector
e. I/O signal and audible warning cable: 8 pin Deutsch connector with 10' cable for transmission thermostat, 14' cable with 3-pin Deutsch for compressor temperature sensor, and 4 - 8" long pigtails

4. Compressor temperature sensor

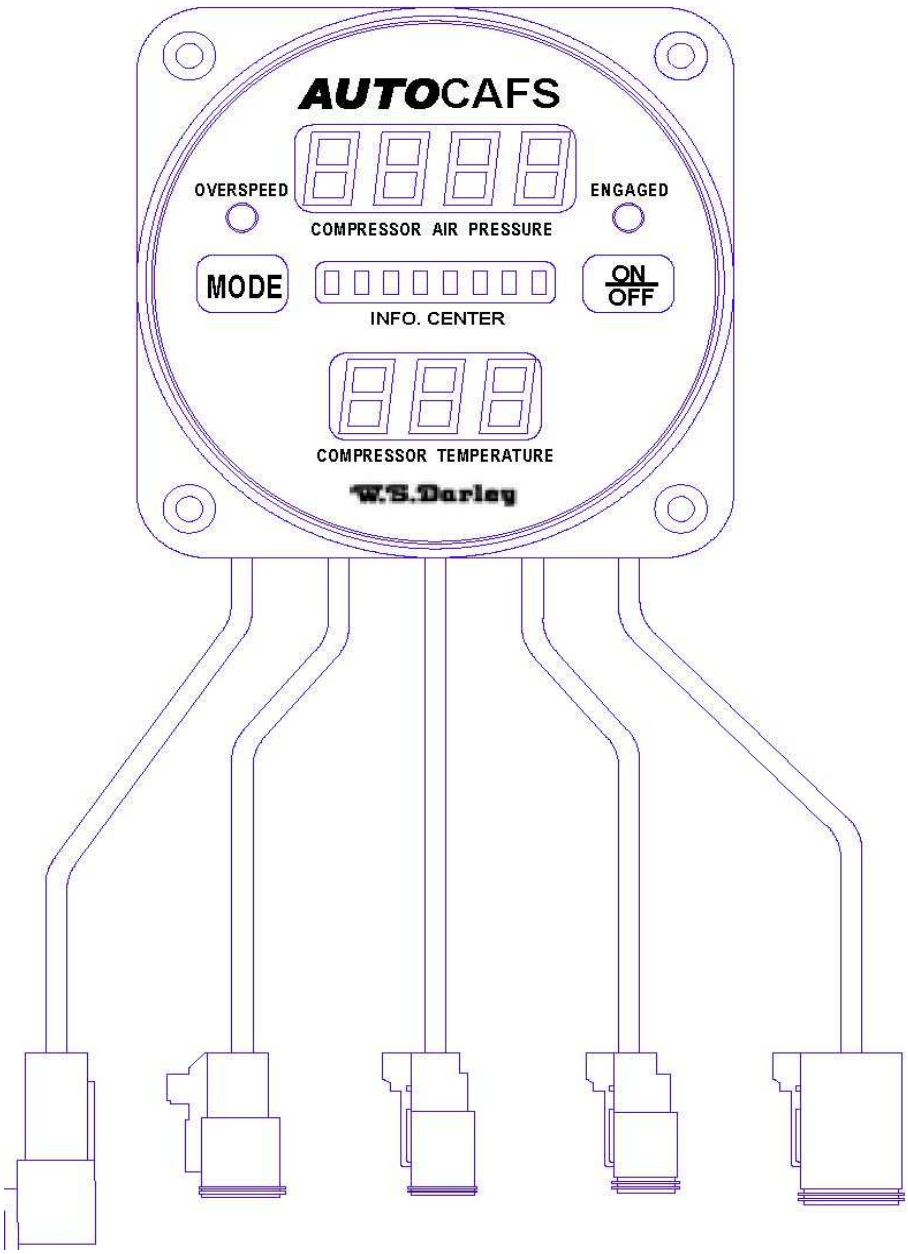
The temperature sensor supplied will be 1/8 NPT with a temperature range of 0℉ to 250℉

5. Warning buzzer

6. Transmission thermostat

Operations:

1. RPM must be 900 RPM or less to engage the compressor
2. Pressure must be less than 10 psi in order to engage
3. AUTO ON feature - the system will turn ON automatically when the Interlock is engaged and conditions and (2) above are met. The system can be turned off with the ON/OFF switch.
4. Automatic disengagement when RPM reaches set engine speed which correlates to 7000 RPM compressor rotor speed.
5. Overspeed warning when the engine RPM reaches and exceeds the set engine speed which correlates to 6600 RPM compressor rotor speed. The warning LED will go off when the engine RPM drops to ~50 RPM below the set warning point.
6. Oil temperature overheat warning at 212℉ (defau lt)
7. Compressor high temperature shutdown. Disengage the compressor at 240℉ (default)
8. Audible warning when the foam level is low. The compressor is also disengaged when the foam level in the tank is low.
9. Display messages when compressor engagement is not allowed
10. Display messages for any system fault:
    i. E3 - “NO RPM” - no RPM signal detected
    ii. E5 - “NO PRESS” - no pressure transducer detected
    iii. E10 - “NO TEMP” - no oil temperature sensor detected
11. Audible warning active when:
    i. RPM overspeed
    ii. Compressor oil temperature – overheat
    iii. Transmission temperature – overheat
    iv. Foam in tank is too low



Power
- 12/24V
- Ground
- Interlock

Data Bus
- J1939 (+)
- J1939 (-)
- Shield

Electric Clutch
- 12V/24V
- Ground

Pressure sensor
- 4 pin

I/O signals - 8 pin
- 12 VDC/24 VDC
- Ground
-Temperature signal
-Transmission thermostat
- Audible warning
- Low foam level warning
-Airflow (4-20 mA)
-Airflow (4-20 mA)

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

DISPLAY:

1. Compressor Air Pressure reading: Using 0-300 psi sensor, units of measure selectable
   a) 0-300 psi
   b) 0-2000 kPA
   c) 0-20 Bar

2. Compressor oil temperature reading:
   a) 0-250℉ or
   b) 0-120℃

   c. Dot matrix display:

Engine RPM - default display

RPM 1450

Airflow in SCFM

AIR 65

Compressor operating hours

HR. 1154

SWITCHES:

1. ON/OFF
   a. Active only when the 'INTERLOCK' is on
   b. Press and hold for 2 seconds to turn **ON** the air compressor
   c. Press and hold for 2 seconds to turn **OFF** the air compressor

2. MODE
   a. Toggle the information between engine RPM, airflow, and air compressor operating hours
   b. Use to get into the programming mode

Operations:

1*. Turn compressor ON*

a. 'INTERLOCK' is on - the system turns ON when initial start up conditions (c and d) are met.
b. OR ON/OFF button is pressed and held for 2 seconds
c. Air pressure is < 10 psi
d. Compressor oil temperature is < 212℉ (100℃)
e. Turn 'Engaged' LED on when the compressor is engaged. (After all conditions are met)

2. *Shut down compressor if:*

a. Engine RPM > set RPM in parameter 315. (E.g. 1850 engine RPM)
b. Compressor temperature > 240℉ (115℃)
c. Low foam level (input signal)
d. High transmission temperature (input signal)

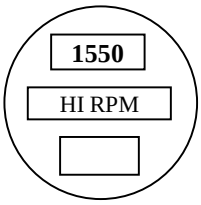
3. *System faults:*

a. E3 - no RPM data
b. E5 - no pressure transducer detected
c. E10 - no oil temperature sensor detected

4. System Warnings:

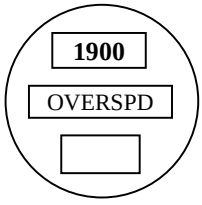
a. " HI RPM" –Code 315 RPM setting > RPM >=Code 314 RPM setting

Flash "HI RPM" and 1550



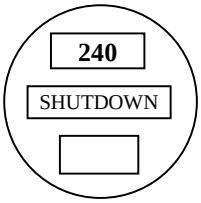
b. "OVERSPD" - RPM > Code 315 RPM setting

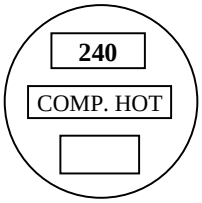
Flash "OVERSPD" and 1900



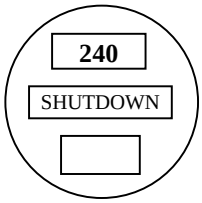
c. “COMP. HOT” - 212℉ (100) < Oil temperature < 24 0℉ (115)
Flash “COMP. HOT” and 220

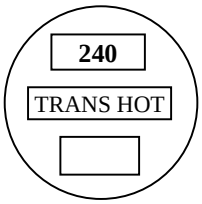
d. “SHUTDOWN”, “COMP. HOT” - Oil temperature > 240°F, Flash



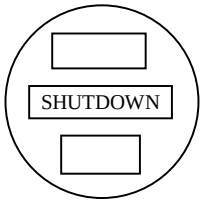


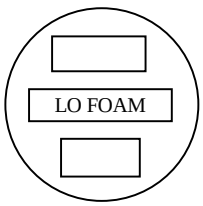
e. “SHUTDOWN”, “TRAN HOT” - From transmission temp. overheat input, Flash





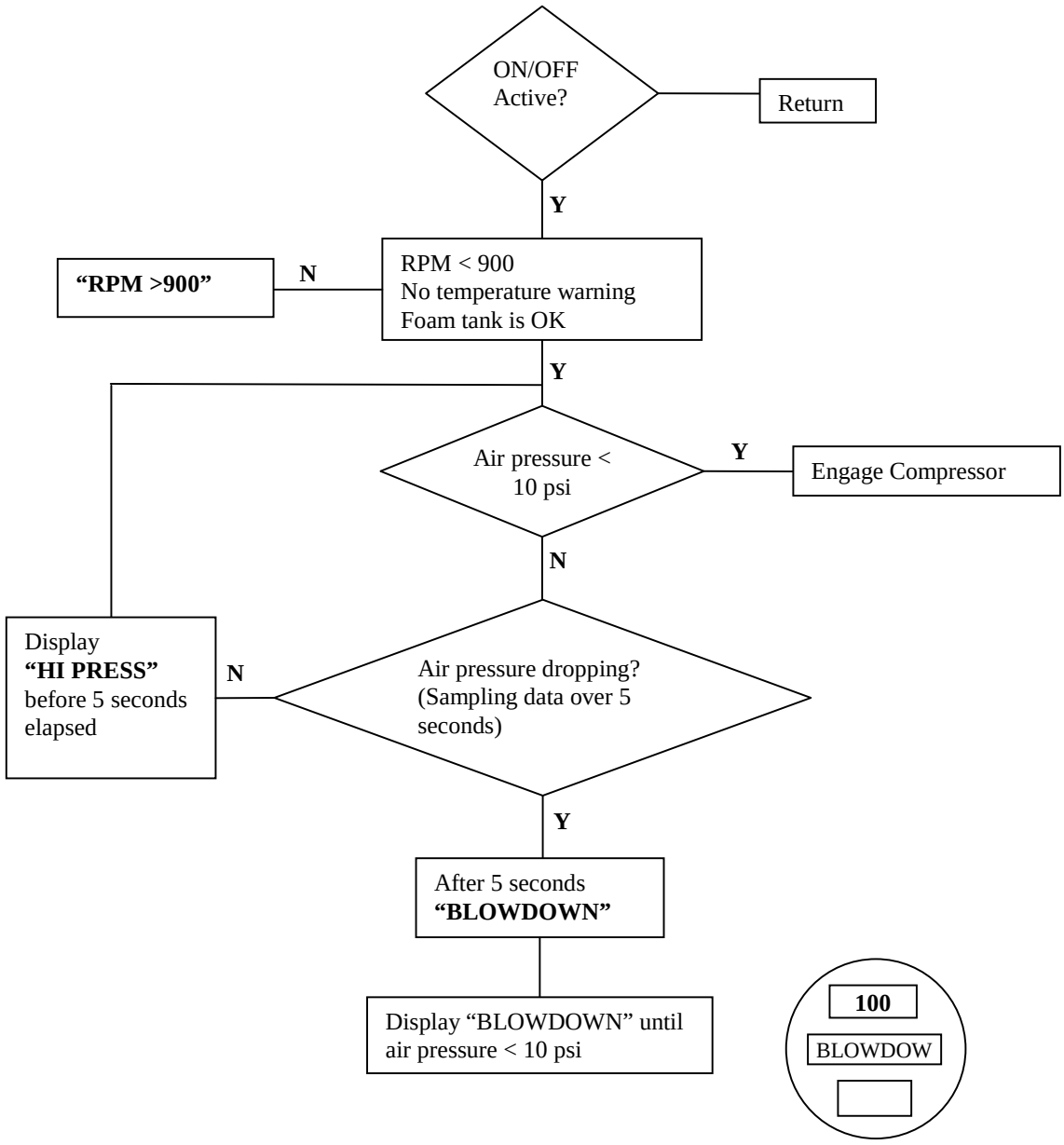
f. “SHUTDOWN”, “LO FOAM” - From Foam tank input, Flash





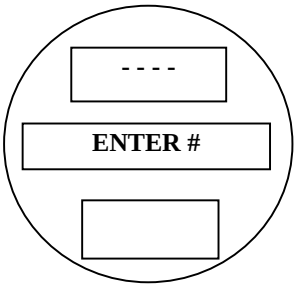
g. "BLOWDOWN" – Flash

I. When compressor pressure is > 10 psi
II. When an operator is trying to turn the compressor on



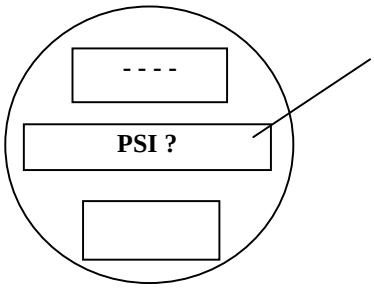
Codes

I. Press and hold “MODE” for 3 seconds to enter the data entry mode.

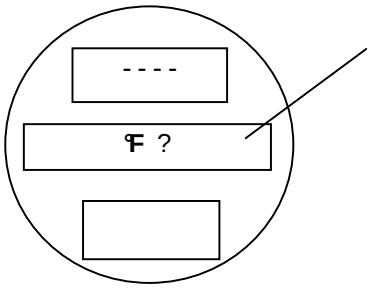


II. Press “MODE” and then “ON/OFF” to enter code
III. Use “MODE” to select the digit and “ON/OFF” to change the number
IV. Press and hold both “MODE” and “ON/OFF” for 3 seconds to exit

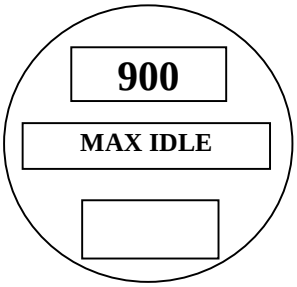
1. Select pressure to be in PSI, kPA, BAR - default to “PSI”
CODE - 310



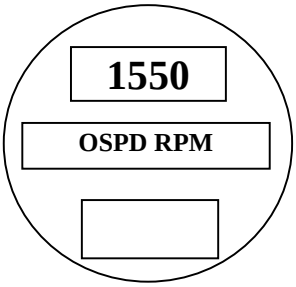
2. Select ℉ or ℃ for compressor oil temperature r eading - default to ℉
CODE - 311



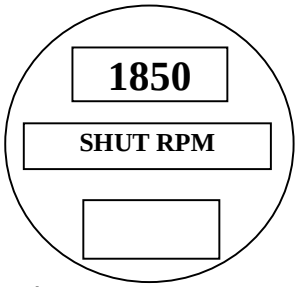
3. Set the maximum idle RPM allowed fro engagement – default = 900
CODE - 313



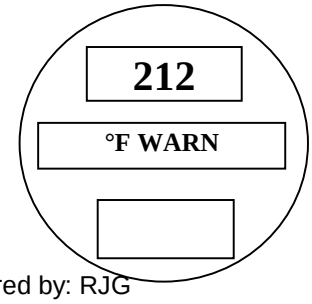
4. Set new pump RPM for overspeed warning – default = 1550
CODE – 314



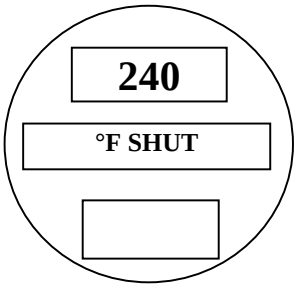
5. Set new pump RPM for automatic compressor disengagement – default = 1850
CODE – 315



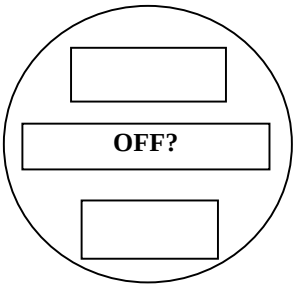
6. Set the compressor temperature overheat warning – default = 212 (100℃)
CODE – 316



7. Set the compressor overheat shut down temperature – default = 240 (115℃)
CODE – 317



8. Select system to turn ON automatically when Interlock is engaged
CODE - 321



INSTALLATION

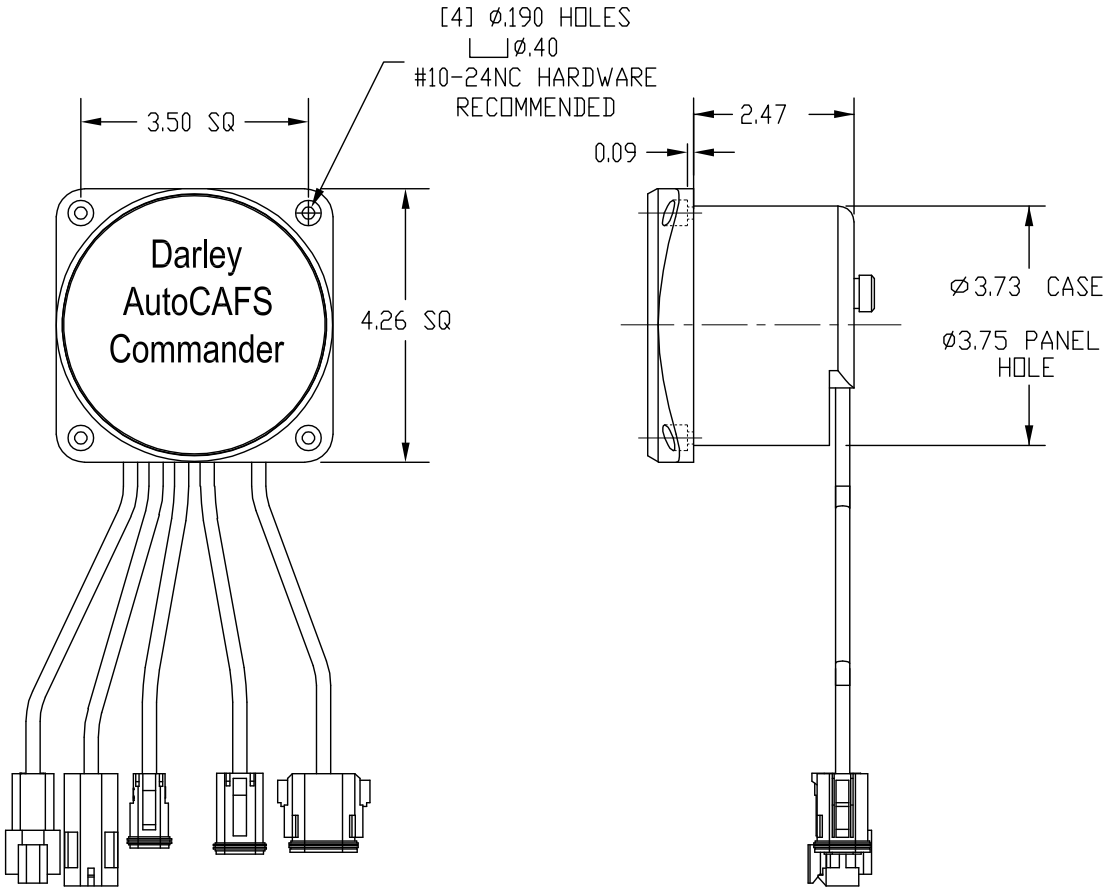
Install Control Module

Note: The control module should be mounted on the pump control panel.

1. Measure and mark mounting location for control module panel cutout and mounting screw holes. Make sure there is clearance behind the panel for the module and cables before cutting holes. Refer to the following diagram for layout and dimensions.

2. Cut out a 3.75 inch (95.25 mm) diameter hole and drill four holes for mounting screws.

3. Place control module in position and secure with four screws (#10-24NC mounting hardware is recommended).



Install Pressure Transducer

The air pressure transducer is mounted to a port on the air/oil separator tank below the main discharge pressure check valve. To correctly read air system pressure during operation as well as during system blow-down, the transducer must be connected to a port located before the system minimum pressure discharge check valve.

1. Mount the transducer in a 1/4-18 NPT threaded air pressure port. A 1/8 BSPP male x ¼ NPT female adapter is required for attachment to the HMBC separator tank.

   Caution: Do not use the main body that houses the electronics to tighten the pressure transducer. Damage to the transducer may occur.

2. Tighten the transducer with a wrench on the lower hex fitting.

3. Connect the pressure transducer cable from the control module to the pressure transducer.

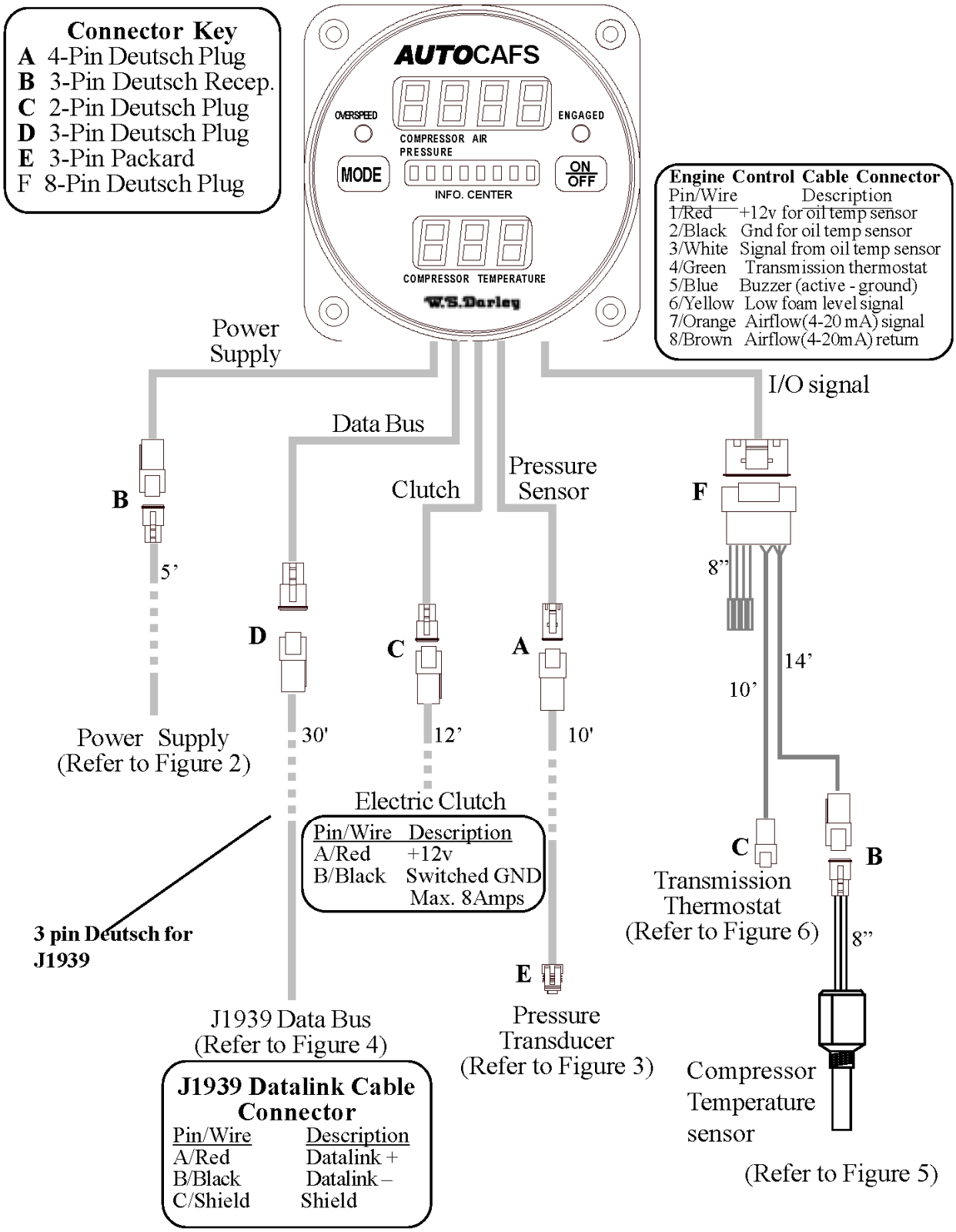


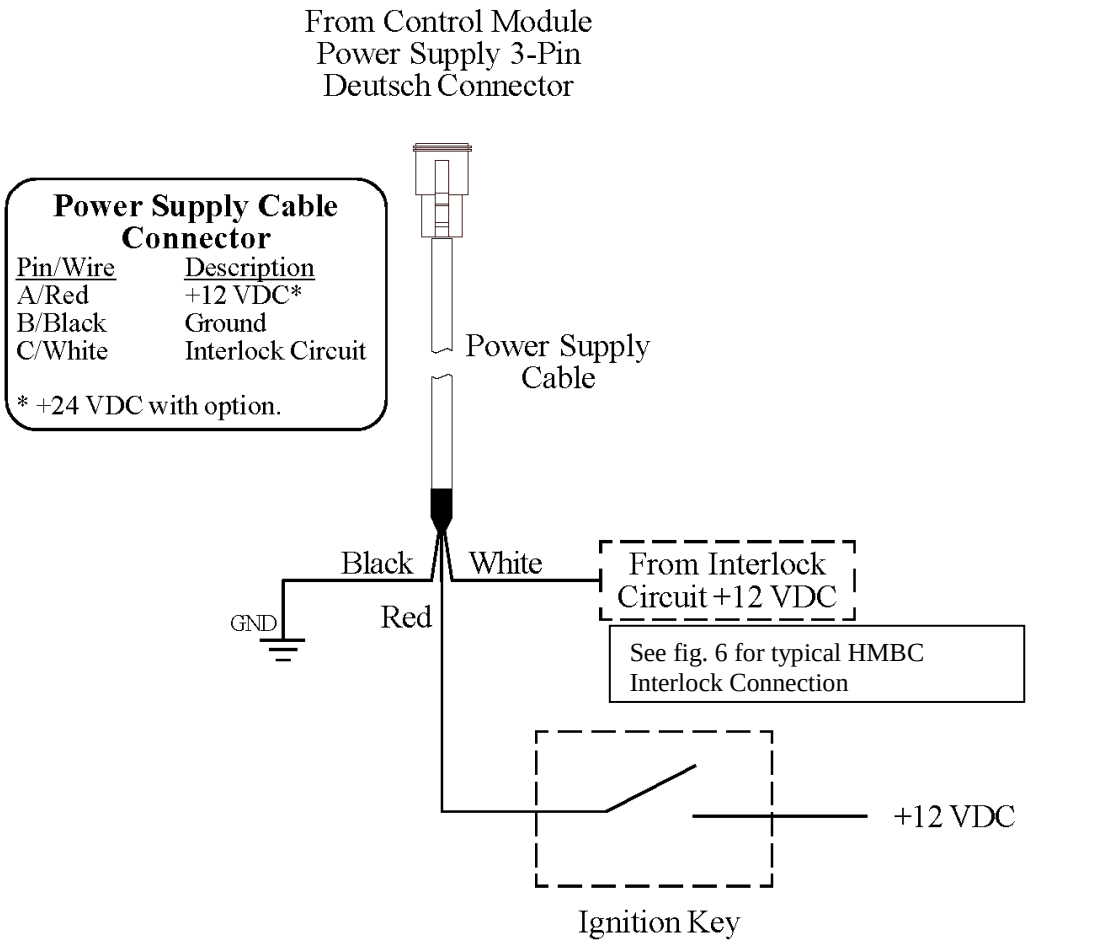
Figure 1. WS Darley AutoCAFS module wiring

WIRING

The following figures include the schematics, wiring diagrams, block diagrams, and cables for the AutoCAFS

Note: If optional 24 VDC unit is installed references to +12 VDC will be +24 VDC.

Power



Note: The interlock circuit will ensure that specific safety conditions are met before the compressor becomes operational. The interlock circuit may include relays, switches, and/or indicator lights for the following conditions:
- Parking Brake On
- PTO Engaged
- Transmission In Drive/Neutral

Figure 2. Power Supply Wiring

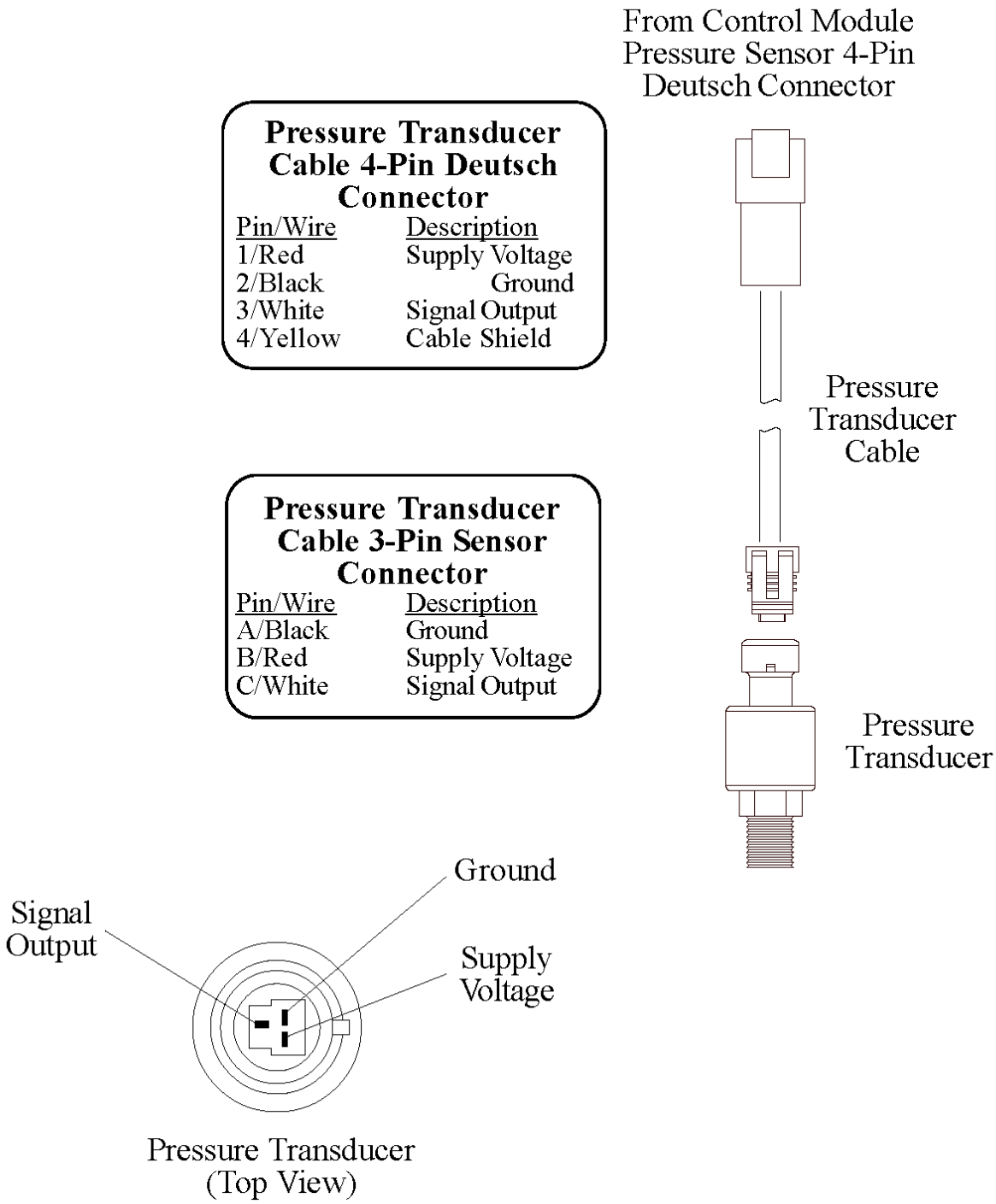


Figure 3. Pressure Transducer Wiring

J1939 Data Bus

Typical 9-pin Deutsch diagnostic connector.
Pin C-J1939 Datalink Positive
Pin D-J1939 Datalink Negative,
Pin E - Shield

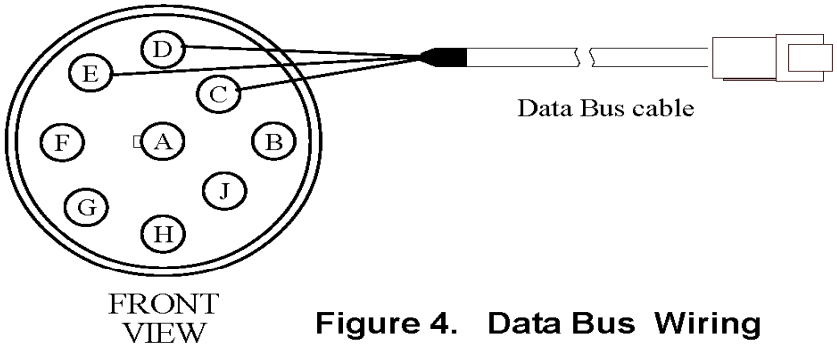
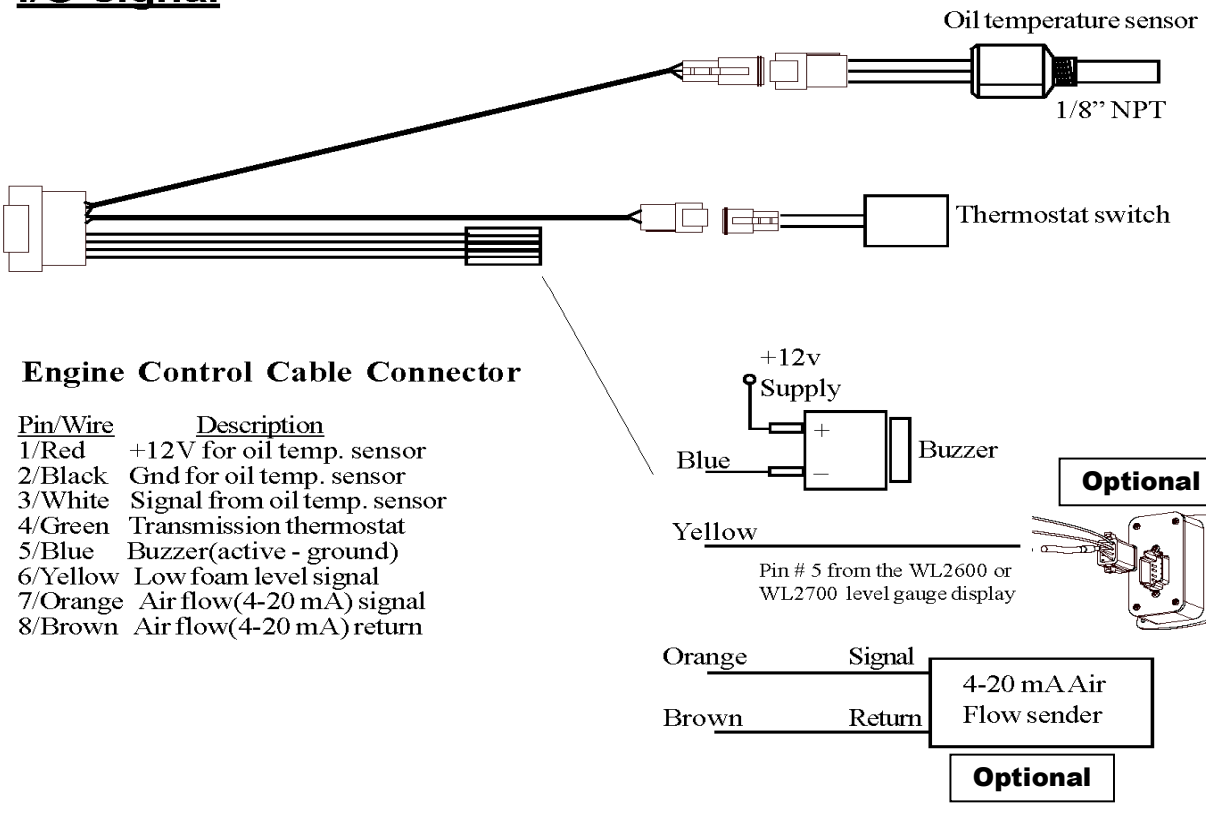


Figure 4. Data Bus Wiring

I/O signal



Engine Control Cable Connector

Pin/Wire	Description
1/Red	+12V for oil temp. sensor
2/Black	Gnd for oil temp. sensor
3/White	Signal from oil temp. sensor
4/Green	Transmission thermostat
5/Blue	Buzzer(active - ground)
6/Yellow	Low foam level signal
7/Orange	Air flow(4-20 mA) signal
8/Brown	Air flow(4-20 mA) return

Figure 5. Other Input/output wiring

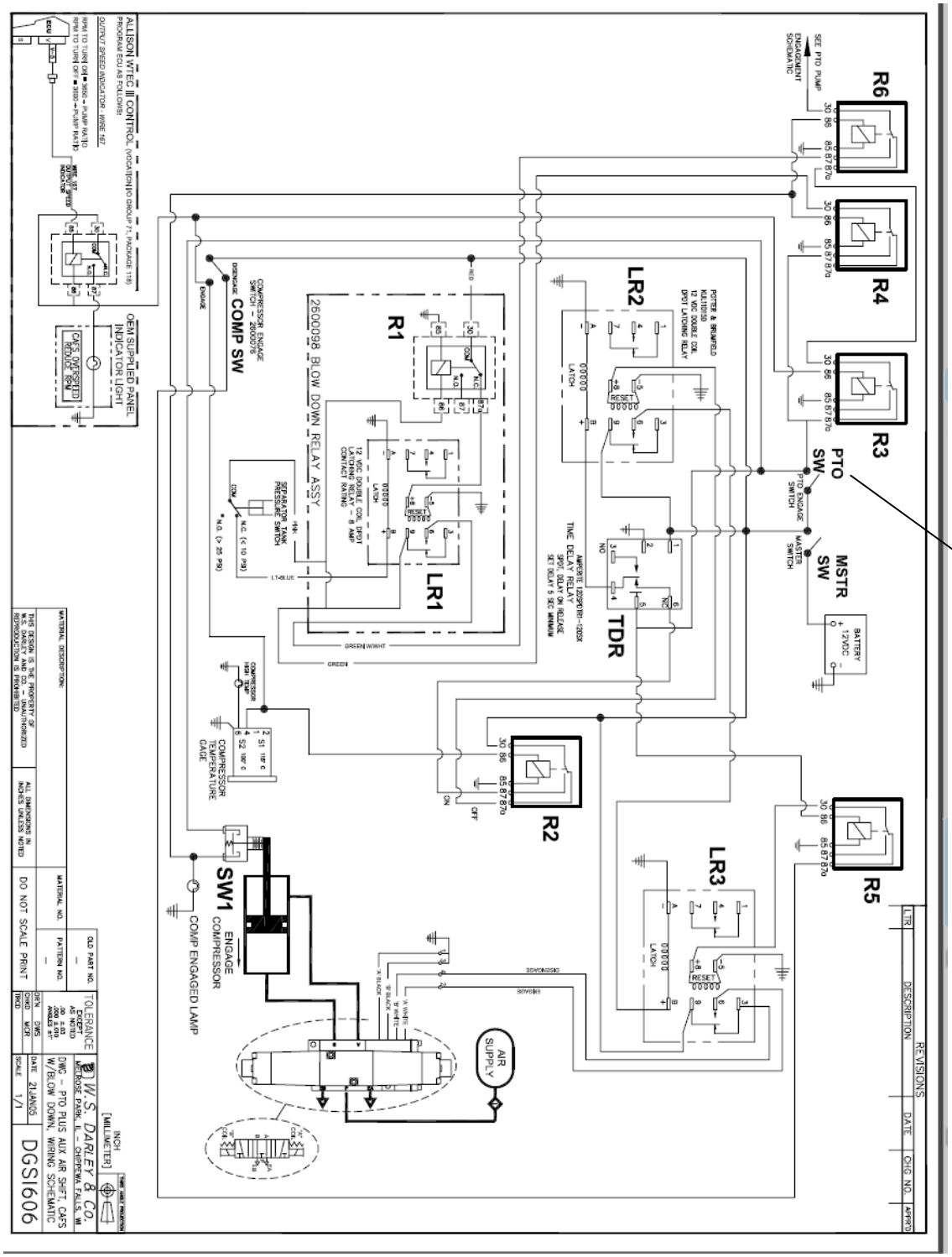


Figure 6. Typical Interlock Wiring

Interlock connection will reset AutoCAFS Commander if Allison shift is inadvertently moved from PTO engage during operation. Upon reset, the compressor must blow down and engine rpm must be reduced to an idle before compressor will re-engage.

Program Access Mode

When in the program access mode the digital display will show operator inputs, program options, and error codes. To gain access to the program features a three digit program code must be entered. Review the Program Code Descriptions or refer to Table 1. Program Code Quick Reference for the proper three digit code.

Note: There is a timeout feature that will return the program to normal operation in three seconds if input is not detected at the buttons.

Select Program Access Mode

Press the MODE button and hold it until the display shows four dashes. The program access mode is ready for a code number to be input. (Refer to Figure 7.)

Enter Program Code Number

Note: There is a time out feature that will return the program to normal operation in three seconds if input is not detected at the buttons.

1. Select the Program Access Mode (four dashes are shown in the display).
2. Press the ON/OFF button. The display will show the number 100 and the first digit 1 will flash. Each time the ON/OFF button is pressed the number will scroll up by 1. Set the first digit to the number desired.
3. Press the MODE button. The second digit shown in the display will flash. Each time the MODE button is pressed the number will scroll up by 1. Set the second digit to the number desired.
4. Press the ON/OFF button. The third digit shown in the display will flash. Each time the ON/OFF button is pressed the number will scroll up by 1. Set the third digit to the number desired.

When a valid three digit program code is entered the display will show a program value or an option. If an invalid code is entered the display will show an error code.

Note: When a valid code has been entered and the display shows a programmed value or an option, the timeout feature is disabled.

Change Values or Options

Press the MODE button to select the digit that is to be changed. The digit will flash. Press the ON/OFF button to change the digit or the option choice.

Exit Program Access Mode

Press both the MODE and then ON/OFF buttons and hold until four dashes are shown in the display. Release the buttons and enter a new code or after 3 seconds the program will timeout and return to normal operation.

TABLE – 1

Code Number	Settings	Default value
3-1-1	To select °F or °C	°F
3-1-0	To select PSI, kPA, Bar	PSI
3-1-3	Set max. engine RPM for engagement	900 engine RPM
3-1-4	High RPM for warning only	1550 pump RPM
3-1-5	High RPM for disengagement	1850 pump RPM
3-1-6	To set Oil Temp. warning only	212°F
3-1-7	To set Oil Temp. for disengagement	240°F
3-2-1	To set 'Auto ON' function	OFF
3-1-8	To set Air flow @ 20mA	250
1-1-0	To calibrate the RPM for Non electronic Engines.	
3-2-2	To set the 'Soft start duty cycle' percentage	100%
3-2-3	To select the Temperature sensor type	A (Analog)
	(A= Analog use JP2, B= Digital use JP1)	
3-2-4	Terminating resistor.	OFF
	(Needs the unit to be re-powred)	
3-2-5	CLUTCH 50% or 100%	100%
	(Select 50% if 12V Clutch used with 24V supply.)	
3-2-6	RPM reading from Tech\CAN bus	CAN bus(1939)

Section 5

Foam Proportioner

The following text is a generic description of the operating procedures for a FoamPro Model 2001 foam proportioner. Please refer to the manual supplied with your apparatus for specific operating instructions for your unit.

This apparatus has been fitted with a compressed air foam system. In addition to the main UL pump, there are two basic subsystems that comprise a compressed air foam system on an apparatus. Number one is the addition of a foam concentrate proportioner to inject foam concentrate into the discharge side of the water pump. Number two is the addition of an air compressor system to supply compressed air for making foam. Operation of the apparatus with only the foam concentrate proportioner functioning will result in the apparatus functioning as a conventional foam equipped unit. Various nozzles and devices may be used to create and discharge foam. Operation of the apparatus with proportioner and air compressor engaged will result in the engine being capable of creating compressed air foams. Compressed air foams are generally applied through smooth bore type nozzle devices. By adjusting water flow, water pressure, air flow, air pressure, foam types, and foam concentrations; this apparatus is capable of fighting multiple types of fire scenarios.

The air compressor has a rated capacity of 220 cfm (cubic feet per minute). It attains this capacity at an engine rpm that is dependent upon your PTO gear ratio. The air compressor is driven via a high performance synchronous belt that is engaged via a high torque capacity multiple disk electric clutch. The pump gear ratio and compressor sprocket ratios are designed to provide a simultaneous performance of ~440 GPM @ 125 PSI of water and 220 CFM @ 125 PSI air. It is important to remember that during operations from a pressurized hydrant source, engine RPM will be slower; therefore compressor output will be reduced. If high compressor flows are required, operate from draft or from the booster tank. Engine RPM will then be high enough to assure adequate compressor performance. Another option is to turn on the discharge relief valve, set it for the desired pressure, and throttle pump up to the necessary RPM for maximum compressor output.

The benefits of compressed air foam use are variable, but they are directly proportionate to the knowledge of the user. Please read and understand this operations manual before operating the unit.

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Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
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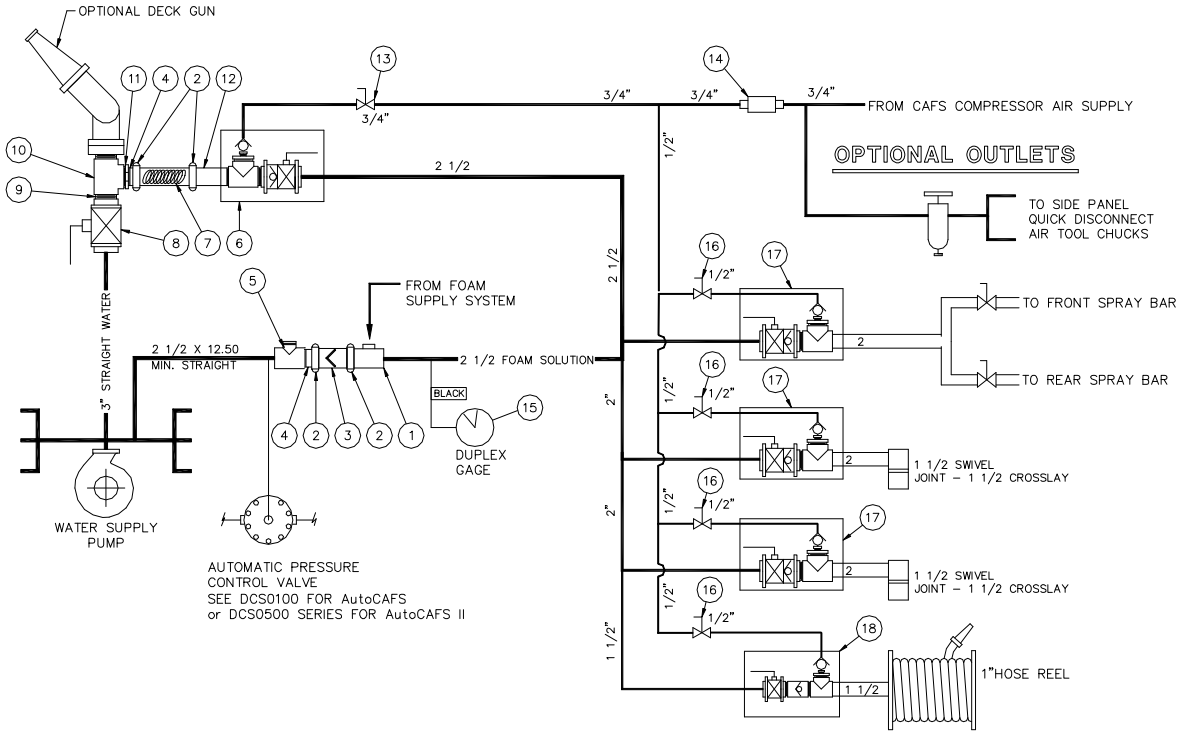

Example of Typical Compressed Air Foam Schematic

FoamPro Electronic Foam Proportioner

This unit is equipped with a FoamPro 2001 automatic, electronic, discharge side, foam proportioning system.

The foam proportioner is a built in, fully self contained, flow meter based, direct injection system.

There are five basic units that make up the system.
They are: the injection pump, motor, paddle-wheel type flowmeter, injection fitting, and the panel mounted, digital, push button, control module unit.

An optional three way “Foam Supply Valve” may be installed behind an access door on the side pump panel. It has four (4) basic functions. 1) On Position - To allow foam to travel from the foam tank to the FoamPro pump, 2) Off Position - to shutoff the foam tank for cleaning of the strainer, 3) to serve as an overboard pickup hose, and 4) Drain Position - to drain the foam tank using the overboard pick-up/drain hose.

To utilize the overboard pickup hose the hose must first be primed. Step 1) insert hose into pail of foam, 2) Next turn cal/inject valve on FoamPro discharge fitting to calibrate/flush position. Run FoamPro pump in “Simulated Flow” mode to prime. See Hypro manual for instructions. Switch cal/inject valve to inject.

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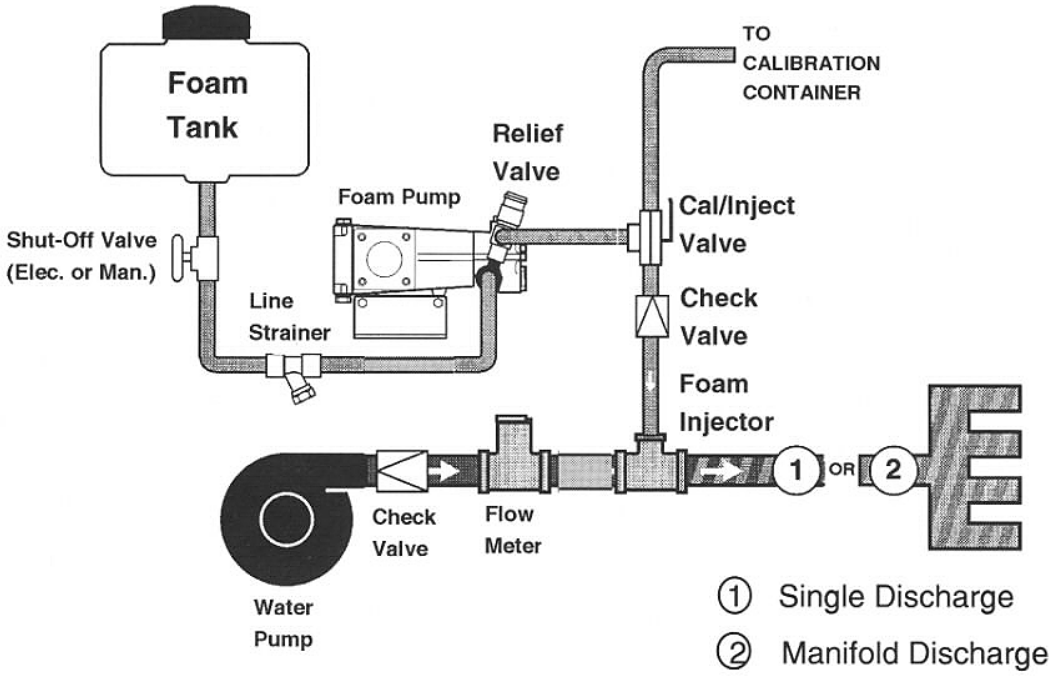
The unit operates by sensing water flow. The Paddle wheel flowmeter sends a signal to the control unit displaying this flow. If the unit is turned on, the microprocessor control sends a signal to the injector motor to begin injecting foam concentrate into the plumbing based on the percentage set at the control module.

FoamPro 2001 Basic System Layout

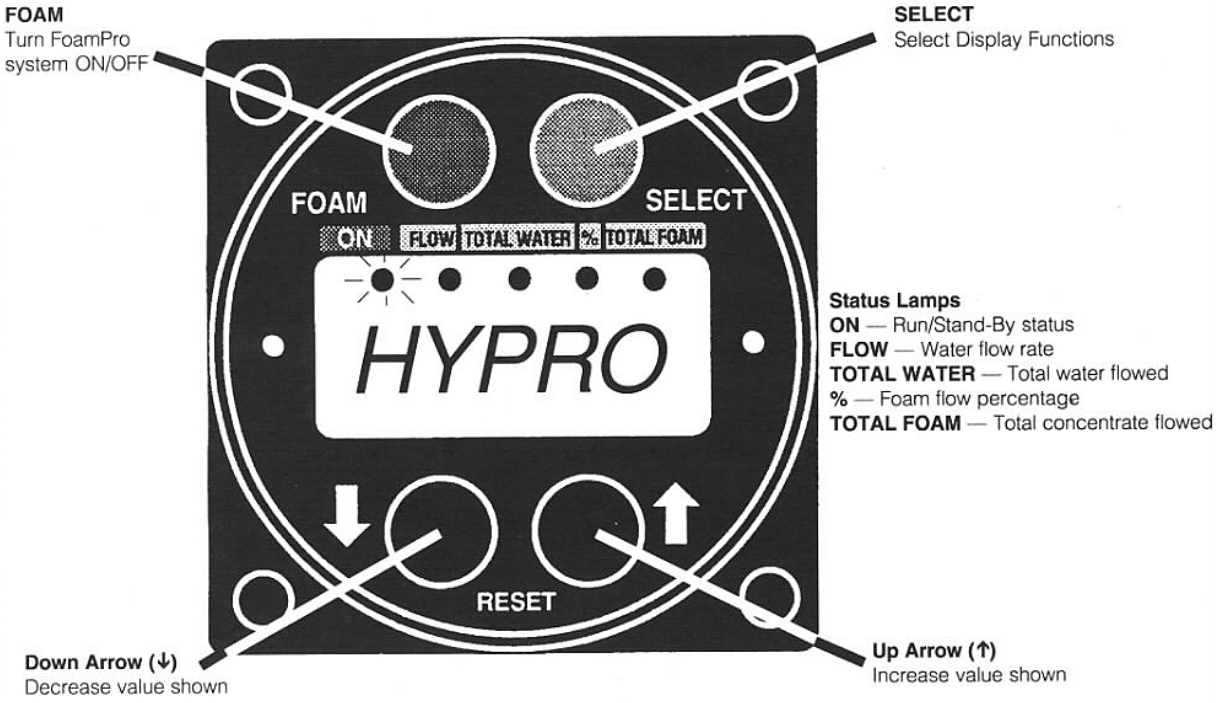


This system allows for continuous operation without interruption of foam concentrate flow. If the level of foam in the supply tank is reaching empty, a low concentrate (LO CON) warning will flash on the display. The tank then must be refilled within two minutes or the unit will automatically shut down to avoid doing damage to the injector pump. If the unit has shut down a no concentrate (NO CON) message will be displayed. The foam percentage to water ratio is adjustable from 0.1% to 9.9% in .1% increments. Weather affects viscosity of the concentrates and therefore, the ratio can be adjusted to user's choosing.

The micro-processor based, panel mounted control unit can perform multiple functions. It performs the basic function of turning the unit on or off. It also has two buttons with up/down arrows to adjust the injection percentage ratio of the foam to water. These buttons also play a part in the initial set up of the units calibration. With the selector button in the upper right hand corner of the unit, four functions can be accomplished.

Selector Button Functions

1)**Flow Mode**: Displays present water flow out any of the CAFS discharges even if the foam system is not turned on.
2)**Total Water Mode**: Displays total water flowed since the unit began to flow water.
3)**Percentage (%) Mode**: Displays the present ratio that foam will be injected at, if the unit was turned on.
4)**Total Foam Mode**: Displays the total amount of foam, rounded off to the nearest gallon, injected since the unit was last turned on.



The following chart gives the approximate water treatment capacities and relative flow times for various foam concentration settings. Chart is based on a water flow rate of 120 GPM and a single tank capacity of 30 gallons.

Meter Setting	US Gallons Treated	Flow Time - 30 Gal Tank
0.1%	30000	250 min.
0.2%	15000	125 min.
0.3%	10000	83.3 min.
0.5%	6000	50 min.
1.0%	3000	25 min.
3.0%	1000	8.3 min.

TO GET FOAM **:**

1) Push the red on/off button.
2) The foam percentage default is set at 0.3%, adjust if desired.

TO FLUSH SYSTEM **:**

1) Turn off the foam system by pushing the red on/off button. The red light below the button will go off.
2) Flow water out of the foam discharge for 2 minutes.

To drain unit of water when in freezing weather, turn dual tank selector switch, if so equipped, to flush(center)position, and open all pump drains. Refer to Hypro 2001 installation/operators manual for other specific operation or maintenance information.

Section 6

Operation of Apparatus Compressed Air Foam System

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
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SECTION 6 – Operation of Apparatus Compressed Air Foam System

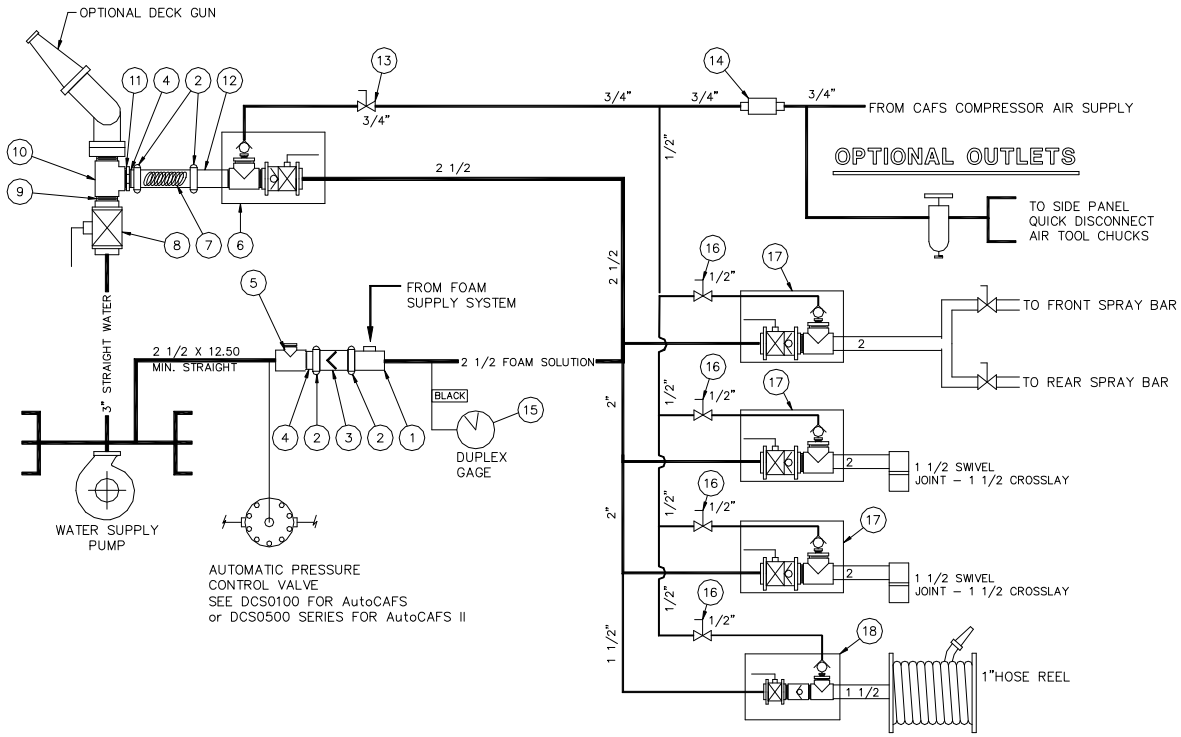
This apparatus has been fitted with a compressed air foam system. In addition to the main UL pump, there are two basic subsystems that comprise a compressed air foam system on an apparatus. Number one is the addition of a foam concentrate proportioner to inject foam concentrate into the water on the discharge side of the water pump. Number two is the addition of an air compressor system to supply compressed air for generating foam.

Operation of the apparatus with only the foam concentrate proportioner functioning will result in the apparatus functioning as a conventional foam equipped unit. Various nozzles and devices may be used to create and discharge foam.

Operation of the apparatus with proportioner and air compressor engaged will result in the engine being capable of creating compressed air foam. Compressed air foam is generally applied through smooth bore devices.

It is important to remember that during operations from a pressurized hydrant source, engine RPM will be slower causing the compressor output to be reduced as well. If high airflow is required, operate from draft or from the booster tank. Engine RPM will then be high enough to ensure adequate compressor performance. Another option is to turn on the discharge relief valve, set it for the desired pressure, and throttle pump up to the necessary RPM for maximum compressor output.
The benefits of compressed air use are variable, and are directly proportional to the knowledge of the user. Please read and understand the operations manuals before operating the unit.

Typical Compressed Air Foam Schematic



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Approved by: MCR
Revised by: RJG

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The following chart gives the approximate water treatment capacities and relative flow times for various foam concentration settings. This chart is based on a water flow rate of **120 GPM** and a single foam concentrate tank capacity of **30 gallons**.

Meter Setting	US Gallons Treated	Flow Time - 30 Gal Tank
0.1%	30000	250 min.
0.2%	15000	125 min.
0.3% standard	10000	83.3 min.
0.5%	6000	50 min.
1.0%	3000	25 min.
3.0%	1000	8.3 min.

TO START FOAM FLOW:

1) Push red on/off button. (Hypro FoamPro 2001 & 2002 only)
2) The foam percentage default is set at 0.3%; adjust as desired.

TO FLUSH SYSTEM:

1) Turn off the foam system.
2) Flow water out of the foam discharge for 2 minutes.

To drain water from unit during freezing weather, turn dual tank selector switch to flush (center) position (as applicable), and open all pump drains.

Compressed Air Foam System Operation

1) Referring to PUMP Shifting Procedures detailed in Section I, shift water pump to ENGAGED position.
2) Engage the air compressor by pressing and holding the AutoCAFS Commander ON/OFF button down for 2 seconds. Note: The compressor can be switched on before or after the pump is engaged, however, do not engage compressor when engine is turning faster than 900 rpm. Reduce engine rpm before engagement. An interlock has been implemented to limit engagement rpm to 900 rpm.
3) Establish water flow in main pump. Open tank to pump valve and tank refill valve slightly to provide water circulation through pump.

⚠CAUTION ***The air compressor is cooled by water supplied by the fire pump and circulated through a water/oil heat exchanger. Water circulation must be established before or immediately following compressor engagement to assure proper cooling. Also, if water is continually circulated back to tank, cooling water will be heated. Operating with a continuously refreshed water supply eliminates this concern.***

Note: ***A temperature sensor is incorporated into the AutoCAFS Commander Control module to avoid compressor over heating which may result in rotor seizure. If compressor temperature rises above normal operating***

temperature to 212°F, a warning, 'COMP HOT' will flash on the Commander display panel. If temperature warning is indicated, shut down the compressor as soon as practical. The compressor can be switched off (DISENGAGED) at any time or input speed. Check for adequate water flow through heat exchanger. Check for adequate oil level in separator tank.

⚠WARNING ***If compressor temperature continues to rise to 240°F, the compressor will be automatically disengaged.***

4) Turn on the foam proportioning system. When a FoamPro 2001 or 2002 is enabled, a red indicator light will be on steady. Light will flash as foam is injected. If a FoamPro 1601 system is used then upon turning the system "on" the red low foam indicator light will flash once to inform that the system is enabled.

⚠CAUTION

- **Do not over speed compressor - Input RPM should not exceed that required to produce rated air flow of 220 cfm at 150 psi maximum pressure.**
- **Disengage air compressor when service testing or performing UL test on CAFS equipped vehicle.**

Automatic Balanced Air Pressure Control

Air pressure will match water pressure up to 150 PSI if pump input speed is adequate to maintain flow rate setting. Note: Do not exceed 175-PSI pump pressure while compressor is engaged. Maximum air pressure has been factory preset to 150 PSI. (To avoid compressor over-speed, the AutoCAFS Commander control is programmed to provide a visual speed warning at the set engine RPM under CODE 314. Additionally the Commander is programmed to disengage the compressor at the set engine RPM under CODE 315 in the AutoCAFS Commander Settings.)

NOTE: Oil Separator Tank Safety Relief Valve - 200 psi.

5) Increase engine speed to the desired operating pressure using the throttle or governor control provided. Common CAFS operating pressures range from 100 - 150 PSI. NFPA standard recommends 125 PSI.

6) Slowly open the CAFS discharge valve that is desired. Open completely to first fill the hose with foam solution. Then close the valve to approximately 1/3 open.

7) Open the accompanying airflow valve approximately 50% full open or turn the toggle switch "ON" to activate the preset airflow to the desired CAFS discharge.

8) Monitor the water and air flow rates on the flow meters and adjust to desired ratio. A one to one mix is a good ratio to start with. That is for example: 40 GPM to 40 CFM. If a higher water flow is used then the foam will be wetter. If a higher airflow is used then the foam will be dryer. Many operating guideline variables exist. A variety of standard operating procedures may be necessary to meet different incident objectives. For example: a drier (shaving cream type foam) will be necessary to provide exposure protection. It can be achieved by using a low flow rate of water (25gpm) and a higher flow rate of air (40 cfm). To achieve a large fire knockdown, higher

flow rates of water (60 gpm) will be more desirable. At water flow rates over 50 gpm, airflow rates should be used at about an equal one to one ratio for best results.

Foam Type	*Hose size*	*Foam Solution GPM*	*Air Flow CFM*
Very Dry - Fluffy	**1”**	**10 GPM**	**25 CFM**
Dry to Medium	**1”**	**20 GPM**	**20 CFM**
Medium to Wet	**1”**	**25 GPM**	**10 CFM**
Very Dry - Fluffy	**1-1/2” or 1-3/4”**	**15 GPM**	**60 CFM**
Dry	**1-1/2” or 1-3/4”**	**20 GPM**	**60 CFM**
Medium	**1-1/2” or 1-3/4”**	**40 GPM**	**60 CFM**
Wet	**1-1/2” or 1-3/4”**	**60 GPM**	**60 CFM**
Very Wet	**1-1/2” or 1-3/4”**	**70 GPM**	**50 CFM**
Dry	**2-1/2”**	**50 GPM**	**100 CFM**
Medium	**2-1/2”**	**80 GPM**	**100 CFM**
Wet	**2-1/2”**	**120 GPM**	**100 CFM**

The above rates are based upon having a large ball shutoff and a large smooth bore tip approximately equal to the hose size. Fog nozzle tips will almost always limit flow rates, and usually reduce the flow of air. Dry foam types are next to impossible to achieve with fog nozzles. High gallonage fog nozzles do work very well for interior attack if solution flow gpm is high from 50-70 gpm and airflow rates are moderate 40-60 CFM.

9) Monitor the booster tank level and temperature during prolonged operation from tank only.

10) Monitor compressor temperature. Normal operating temperature is 170°F-185°F. If compressor temperature rises above normal operating temperature to 212°F, the Commander display will flash ‘COMP HOT’. If temperature warning is indicated, shut down the compressor as soon as practical. The compressor can be switched off (DISENGAGED) at any time or input speed.

⚠WARNING ***If compressor temperature continues to rise to 240°F, the compressor will be automatically disengaged.***

Steps for Shutdown

1) Close air valves.
2) Reduce pressure to idling condition.
3) Flush foam system per instructions.
4) If desired, use air to expel water from hose lines during freezing weather.
5) Disengage compressor.

⚠CAUTION ***Avoid immediate restart of compressor after shutdown. Allow a 1-minute minimum time period between compressor shutdown and restart for system blow–down.***

Compressed Air for Air Tool Usage

1) Using standard shifting procedures shift the compressor and fire pump to the 'ENGAGED' position. **NOTE:** Water pump must be engaged and running to utilize air compressor for operating air tools.
2) Establish water flow in main pump. Open tank to pump valve and tank refill valve slightly to provide water circulation through pump.
3) Air pressure for operating air tools is automatically balanced with the water pump pressure. Maximum 150 PSI.
   ***NOTE:** Output capacity of air compressor is determined by pump RPM. Higher RPM's may be required to flow desired output if high flow rates are necessary.*
4) Monitor airflow and pressure. Increase engine speed if necessary to supply needed air volume.
5) Monitor the booster tank temperature during prolonged operation from tank only.
   ***REMEMBER:** The air compressor lubrication system is water cooled by main water pump. If water is continually circulated back to tank, cooling water will be warmed.*
6) Monitor compressor temperature. Normal operating temperature is 170°F-185°F. If compressor temperature rises above normal operating temperature to 212°F, the Commander display will flash 'COMP HOT'. If temperature warning is indicated, shut down the compressor as soon as practical. If air end temperature continues to rise to 240°F, the compressor will be automatically disengaged. Check for adequate water flow through heat exchanger. Check for adequate oil level in separator tank. ***Important reminder:** The air compressor can be disengaged (shifted out of gear) at any time if the need arises.*

⚠CAUTION ***Engaging of compressor must be done only when pump input shaft is less than 900 rpm.***

Usable Hose and Flow Rate Combinations

A proportioner setting of .3% is usually adequate for making compressed air foam in hose lines. Setting the proportioner for a lesser percentage will yield "wetter" appearing foam. Setting the proportioner to a higher percentage will yield "drier" appearing foam. Setting the proportioner too low (below .2%) may result in pulsation (water slugs) in the hose. This is due to not having enough concentrate in solution to form foam in the hose.

Much has been made over the ability of compressed air systems to create foam of shaving cream consistency. This foam is very stable and possesses a long drain time. However, the firefighter must make sure that this type of foam will release enough water to suppress fire if it is used in a direct attack. This "shaving cream" foam usually is only suited to defensive operations involving barrier, of fuel pre-treatment operations.

WARNING ***A compressed air foam hose possesses a pneumatic character in its performance due to the presence of the compressed air. This effect reveals itself most visibly in the surge of product at the time the hose is opened. This is a release of stored energy due to the compressibility of the foam in the hose. This effect may be detrimental if the firefighter is not prepared for the energy release. For this reason, valves must be opened slowly to dissipate the energy in a controlled manner***.

Hose Lays

Hose Diameter	Water GPM	Air CFM	Tip	Pressure	Hose Length
1"	20	20	3/4"	125-150	>200'
1"	15	15	1/2"	125-150	>400'
1 1/2"	30-40	30-40	1"	110-150	>800'
1 1/2"	50-60	50-60	1.25"	110-150	>400'
1 3/4"	30-40	30-40	1"	110-150	>1400'
1 3/4	50-60	50-60	1.25"	110-150	>700'

On short hose lays (less than 200') of 1 3/4" hose the operator may establish flows of up to 70 gpm water and 60 cfm air. This is a very effective initial attack flow for structural fires.

The figures above are based on making mid range foam in terms of "wetness" and drain time. Using a smaller tip will yield wetter foam with some increase in reach. Using a larger tip will yield drier foam with an accompanying decrease in reach.

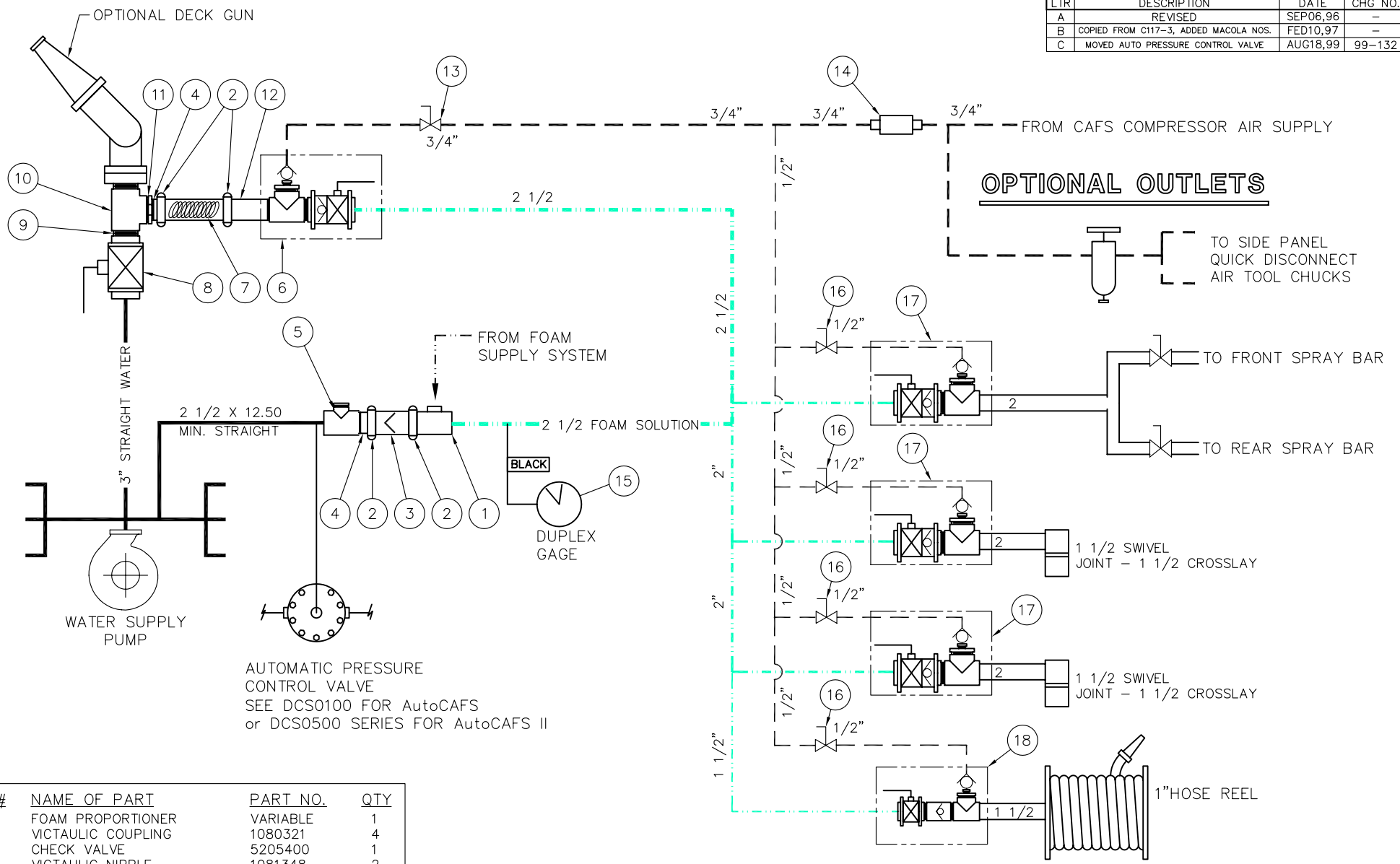
The foam concentrates designed for use on class B fires will work well with a compressed air foam system. The primary benefit of compressed air over nozzle aspiration lies in the extended drain times that compressed air foams exhibit and the increased discharge distance.

The drain time is usually measured as a "quarter drain" time. This is the time that it takes for foam to have 25% of the water drain from the bubble structure. Some aspirated foams have a quarter drain time as fast as two minutes. Compressed air foam made with the same concentrate ratio may have a quarter drain time of up to fifteen minutes. A long quarter drain time is very important on incidents involving un-ignited fuel, where water run-off from tactical operations is a problem.

A long quarter drain time is also desirable during many operations involving class A foam. Defensive operations involving exposure protection of fire line construction are two primary tactics that utilize the long quarter drain time of compressed air foam. The long quarter drain time allows the firefighter to position water on the subject fuel for an extended period of time. This characteristic coupled with the active fuel-wetting characteristic of class A foam makes a very good fire barrier.

NOTES

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REVISED	SEP06,96	–	DWS
B	COPIED FROM C117-3, ADDED MACOLA NOS.	FED10,97	–	DWS
C	MOVED AUTO PRESSURE CONTROL VALVE	AUG18,99	99-132	DLL



REP#	NAME OF PART	PART NO.	QTY
1	FOAM PROPORTIONER	VARIABLE	1
2	VICTAULIC COUPLING	1080321	4
3	CHECK VALVE	5205400	1
4	VICTAULIC NIPPLE	1081348	2
5	2 1/2" FLOW METER	2603027 VAR	1
6	CHECK VLV ASS'Y – 2 1/2"	AZ00116	1
7	MIXER	4422401	1
8	3" INLINE VALVE	5203100	1
9	3" CLOSE NIPPLE	1081239	1
10	3" BRASS TEE	1080436	1
11	3x2 1/2 BRASS BUSHING	1080645	1
12	2 1/2 X 6 S.S. VIC NIPPLE	1081349	1
13	3/4" AIR FLOW VALVE ASS'Y	AZ00111	1
14	AIR FLOW METER, 150 CFM	2603023	1
15	DUPLEX GAGE	2603059	1
16	1/2" AIR FLOW VALVE ASS'Y	AZ00110	4
17	CHECK VLV ASS'Y – 2"	AZ00115	1
18	CHECK VLV ASS'Y – 1 1/2"	AZ00114	1

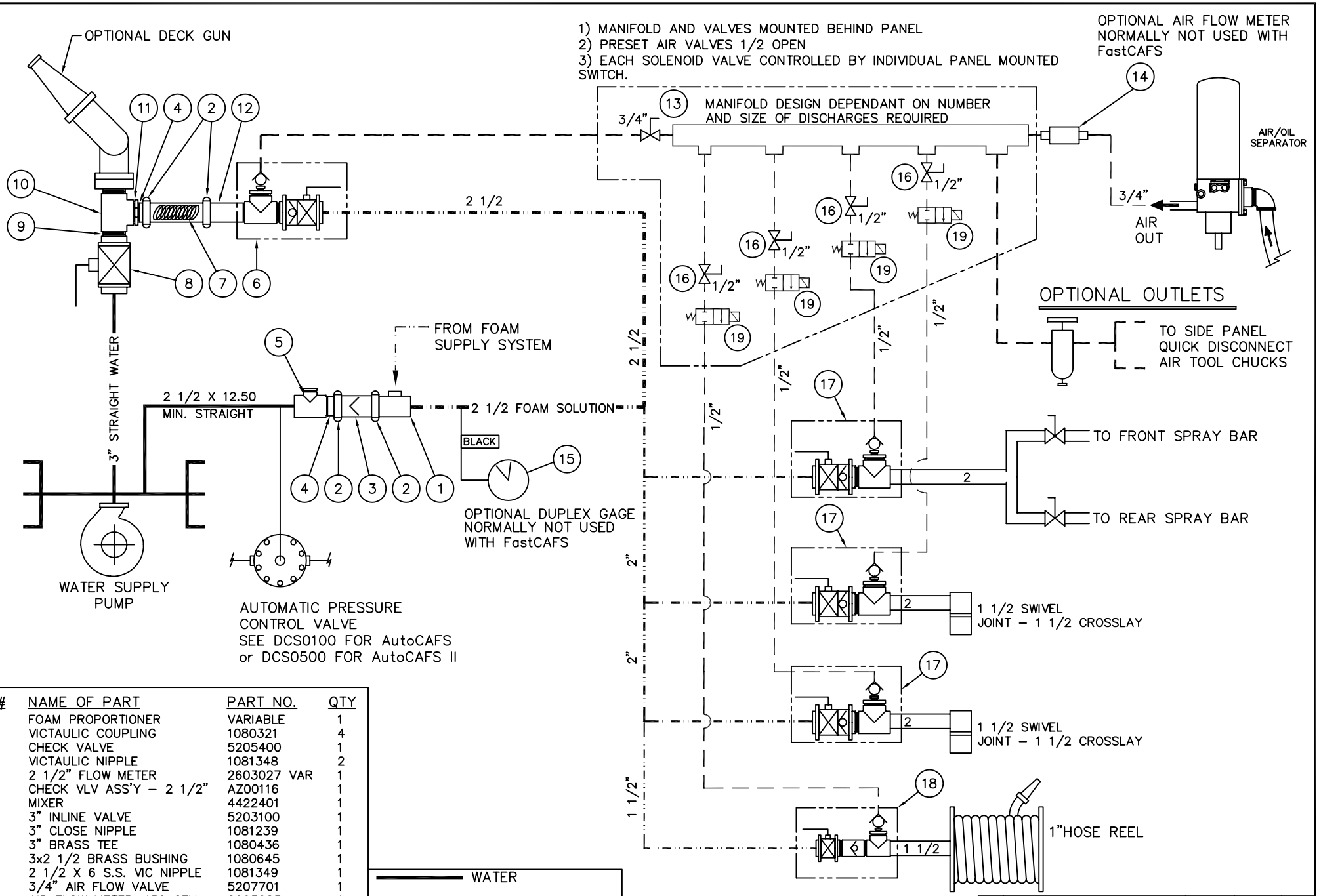
WATER

WATER OR FOAM SOLUTION

AIR

NOTE:
ALL PIPING DOWNSTREAM FROM FLOW METER MUST BE FLUSHABLE, BRASS, OR 316 STAINLESS STEEL

MATERIAL DESCRIPTION:	MATERIAL NO.	OLD PART NO. / PATTERN NO.	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
			DR'N DWS CHKD TRCD	CAFS SCHEMATIC
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	DATE FEB10,97 SCALE 1/2	DCS0200



REP#	NAME OF PART	PART NO.	QTY
1	FOAM PROPORTIONER	VARIABLE	1
2	VICTAULIC COUPLING	1080321	4
3	CHECK VALVE	5205400	1
4	VICTAULIC NIPPLE	1081348	2
5	2 1/2" FLOW METER	2603027 VAR	1
6	CHECK VLV ASS'Y – 2 1/2"	AZ00116	1
7	MIXER	4422401	1
8	3" INLINE VALVE	5203100	1
9	3" CLOSE NIPPLE	1081239	1
10	3" BRASS TEE	1080436	1
11	3x2 1/2 BRASS BUSHING	1080645	1
12	2 1/2 X 6 S.S. VIC NIPPLE	1081349	1
13	3/4" AIR FLOW VALVE	5207701	1
14	AIR FLOW METER, 150 CFM	2603023	1
15	DUPLEX GAGE	2603059	1
16	1/2" AIR FLOW VALVE	5207700	4
17	CHECK VLV ASS'Y – 2"	AZ00115	1
18	CHECK VLV ASS'Y – 1 1/2"	AZ00114	1
19	SOLENOID VALVE, N.C. – 1/2"	5207500	4

WATER

WATER OR FOAM SOLUTION

AIR

NOTE:
ALL PIPING DOWNSTREAM FROM FLOW METER MUST BE FLUSHABLE, BRASS, OR 316 STAINLESS STEEL

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	MOVED AUTO PRESS. CONTROL VALVE	8/18/99	99–132	DLL

OLD PART NO. | PATTERN NO. | MATERIAL NO. | MATERIAL DESCRIPTION:

TOLERANCE EXCEPT AS NOTED
FRAC DIM ±.01
.00 ±.01
.000 ±.005
ANGLES ±1°

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

FastCAFS SCHEMATIC

DR'N DWS
CHKD
TRCD

DATE APR20,99
SCALE 1/2

DCS0201

ALL DIMENSIONS IN INCHES UNLESS NOTED

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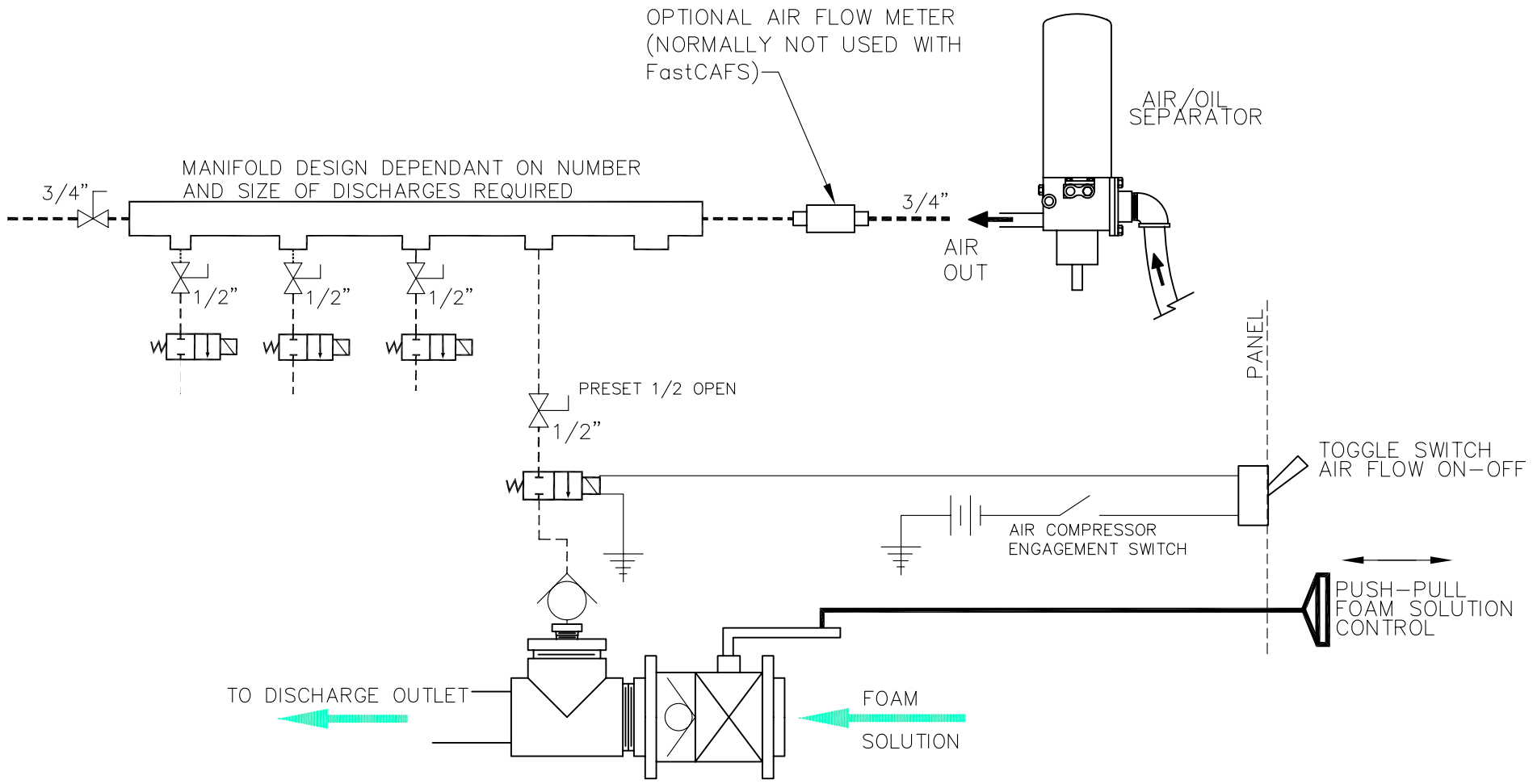


1) MANIFOLD AND VALVES MOUNTED BEHIND PANEL
2) PRESET AIR VALVES 1/2 OPEN
3) EACH SOLENOID VALVE CONTROLLED BY INDIVIDUAL PANEL MOUNTED SWITCH
4) AIR PRESSURE CONTROL VALVE SYSTEM IS MOUNTED BEHIND PANEL PRESET TO DESIRED OPERATING PRESSURE

INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

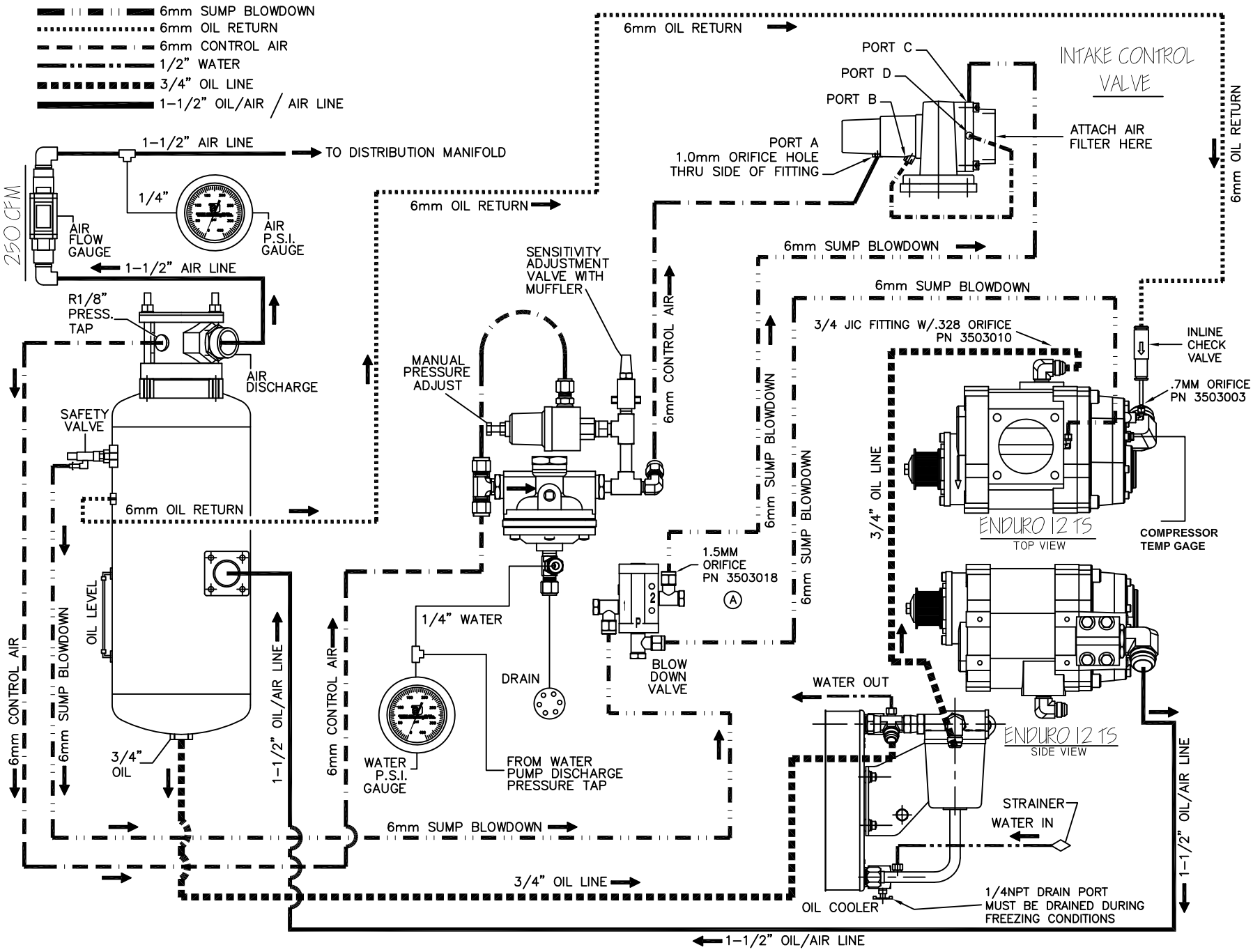
		OLD PART NO. —	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°
MATERIAL DESCRIPTION: —	MATERIAL NO. —	PATTERN NO. —	DR'N DWS CHKD — TRCD
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

INSTR – FastCAFS ASSEMBLY
—

DATE APR20,99
SCALE 1/16

1205510



W.S. DARLEY & CO.

DWG - COMPRESSOR SCHEMATIC
HMBC, ENDURO 12, HORIZ. INLET

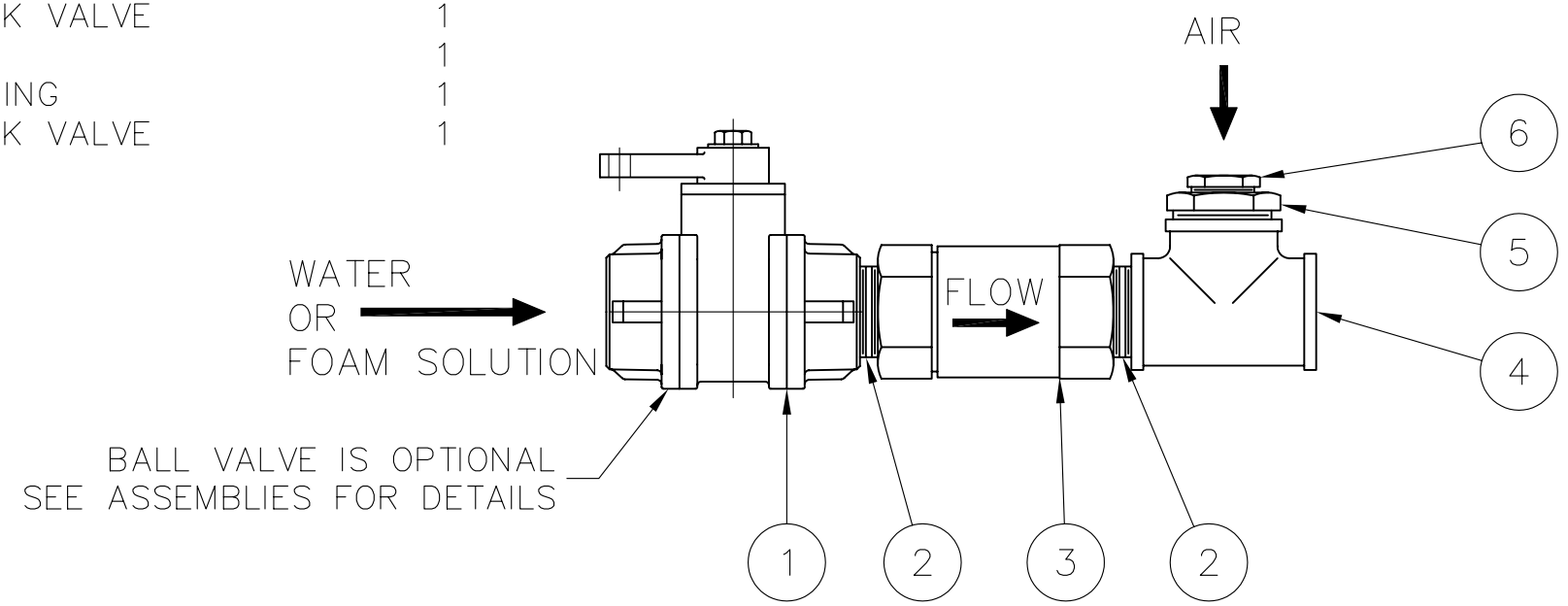
RJG
03-26-2010

E 12 TS COMPRESSOR SCHEMATIC

DCS0504

REP#	NAME OF PART	QTY
1	BALL VALVE	1
2	CLOSE NIPPLE	2
3	CHECK VALVE	1
4	TEE	1
5	BUSHING	1
6	CHECK VALVE	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:

DO NOT MOUNT IN AN ATITUDE THAT WILL TRAP WATER ABOVE CHECK VAIVE #3

PROVIDE DRAIN TAPS WHERE REQUIRED

BALL VALVE, CHECK VALVE, AND AIR INLET TEE CAN BE MOUNTED AT ANY DISTANCE RELATIVE TO EACH OTHER AS LONG AS CHECK VALVE IS INSTALLED TO ELIMINATE AIR FEEDBACK INTO WATER/SOLUTION LINE

REF. AZ00114

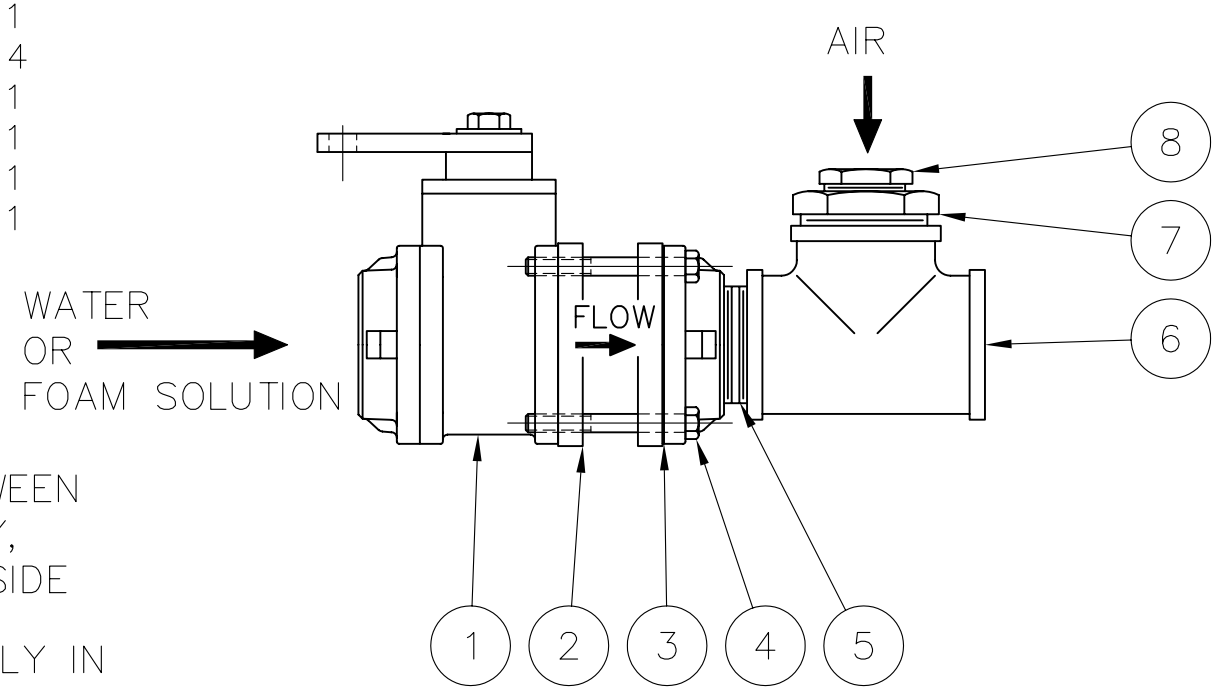
OLD NO.	TOLERANCE EXCEPT AS NOTED	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
C151	FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	1 1/2" CHECK VALVE ASSEMBLY
MATERIAL DESCRIPTION:	MATERIAL NO. / PATTERN NO.	DR'N DWS / CHKD / TRCD
		DATE MAR10,94 / SCALE 1/4
		DCM0300

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

REP#	NAME OF PART	QTY
1	BALL VALVE	1
2	CHECK VALVE	1
3	GASKET	1
4	HEX HD CAP SCREW	4
5	CLOSE NIPPLE	1
6	TEE	1
7	BUSHING	1
8	CHECK VALVE	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



NOTES:
POSITION CHECK VALVE #2 BETWEEN VALVE FLANGE AND VALVE BODY, INCLUDING GASKET ON FLANGE SIDE

TIGHTEN #4 CAP SCREWS EQUALLY IN A CROSSING PATTERN
TORQUE TO 25–30 FT.LBS.

DO NOT MOUNT AT AN ATTITUDE THAT WILL TRAP WATER ABOVE CHECK VALVE #2

PROVIDE DRAIN TAPS WHERE REQUIRED

REF. AZ00115
AZ00116

OLD NO.	TOLERANCE EXCEPT AS NOTED	W.S. DARLEY & CO.
C152	FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	MELROSE PARK, IL – CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION:	MATERIAL NO.	PATTERN NO.	2" & 2 1/2" CHECK VALVE ASSEMBLY
			DR'N DWS
			CHKD
			TRCD
			DATE MAR10,94
			SCALE 1/4

DCM0301

ALL DIMENSIONS IN INCHES UNLESS NOTED

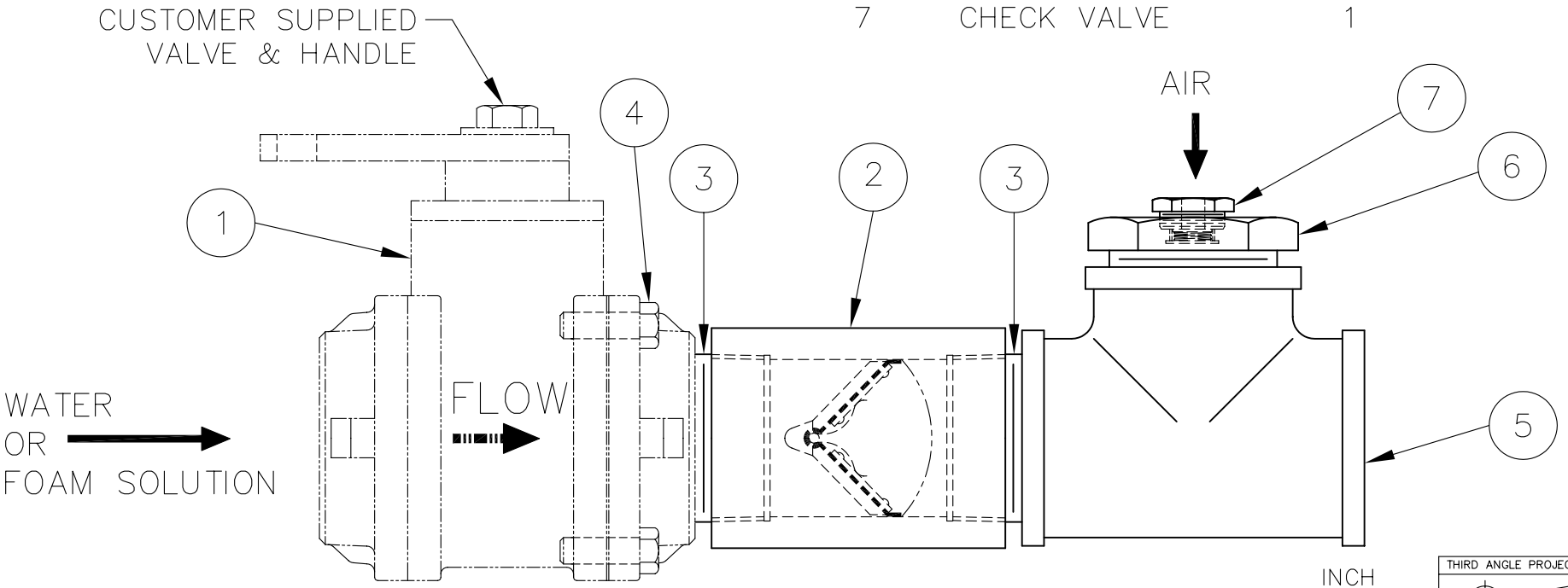
DO NOT SCALE PRINT

NOTES:

1) POSITION CHECK VALVE #2 BETWEEN VALVE FLANGE AND TEE.
2) TIGHTEN #4 CAP SCREWS EQUALLY IN A CROSSING PATTERN TORQUE TO 25–30 FT.LBS.
3) DO NOT MOUNT AT AN ATTITUDE THAT WILL TRAP WATER ABOVE CHECK VALVE #2
4) PROVIDE DRAIN TAPS WHERE REQUIRED

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REP#	NAME OF PART	QTY
1	BALL VALVE	1
2	CHECK VALVE	1
3	CLOSE NIPPLE	2
4	HEX HD CAP SCREW	4
5	PIPE TEE	1
6	BUSHING	1
7	CHECK VALVE	1



INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

REF. – AZ00128

OLD PART NO. –

MATERIAL DESCRIPTION: –

MATERIAL NO. –

PATTERN NO. –

TOLERANCE EXCEPT AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°

DR'N DLL
CHKD DWS
TRCD

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

4" CHECK VALVE ASSEMBLY
–

DATE 2/12/99
SCALE 1/4

DCM0302

ALL DIMENSIONS IN INCHES UNLESS NOTED

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AutoCAFS II TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Air compressor will not engage	• Pump input rpm is too fast • Separator tank pressurized • Circuit Breaker/Fuse open • Faulty/loose control connections • Compressor over heated • Clutch coil failure • AutoCAFS Commander failure	• Reduce throttle setting • Allow time for blow-down • Check blow-down valve and pressure sensor switch • Reset – diagnose and correct cause • Inspect and repair • Find cause and correct • Replace clutch • Replace
Air Compressor will not make any air pressure or air pressure is too low	• Air compressor is not engaged • Air compressor pressure limiting valve - set too low • RPM of engine too low to support the flow of air being discharged	• Engage air compressor using proper shifting procedures • Adjust pressure setting raise the air pressure (red needle) to 150 psi • Increase engine RPM - relief valve may need to be used to hold pump pressure within range
Air pressure too low to run air tools from idle through 1200 rpm range	• Independent air tool regulator set too low • Pump rpm too low, water/air pressure low	• Raise regulator pressure by pulling up on knob and turning clockwise • Increase engine rpm
CAFS over speed indicated 'HI RPM'	• Engine RPM too fast	• Reduce throttle setting to normal operating speed.

Compressor Overheating 'COMP HOT'	• Oil temperature has exceeded the recommended maximum operating temperature of approx. 212 °F • Water pump has not been circulating water and has overheated • Oil/Water heat exchanger has water supply blocked, either the supply line, return line, or the heat exchanger body has a blockage • Thermo-valve in oil filter mounting block has failed or has become obstructed • Oil level low • Oil filter blocked	• Disengage air compressor, if fire fighting - return to conventional water or foam solution fire fighting practices • Circulate fresh water through the water pump so that the heat exchanger receives cool water flow through it to cool the oil. • Remove the water return line on the suction side of the pump, try to locate the source of the blockage, remove obstruction • Remove obstruction from thermo-valve or replace oil filter mounting block/thermo-valve housing WSD # 4420902 • Add oil • Replace

Transmission High Temp Shutdown
 	
'TRANS HOT'
	• Pump transmission lubricant level incorrect
	• Pump transmission bearing failure
	• Compressor Clutch slipping
	  • Clutch voltage low, must be 12/24 VDC +10% -0%
	  • Clutch disc contamination
	  • Clutch disc wear
	• Compressor clutch dragging when disengaged
		• Inspect and correct
		• Rebuild transmission
		• Check voltage and correct
		• Inspect and clean clutch discs
		• Replace clutch discs
		• Inspect and replace clutch disc springs

Compressor Automatically Disengages	• Compressor overheated above 240°F
	• Input RPM too fast
	
	• Transmission Overheated
		• See above
		
		• Disengage compressor switch
		  • Reduce throttle setting to idle
		  • Wait 1 minute for system blow down
		  • Engage compressor switch
		• See above

Air pressure continually rises and cannot be controlled - without opening an air flow valve to dump excess pressure	• Check for loose connection in ¼" air pressure control line to the air inlet valve • Plugged control line or orifice	• Tighten all hose fittings and air pressure control line connections • Clean lines and orifices • **NOTE:** lowering control pressure into inlet valve will result in air compressor building pressure
Hose line is erratic, jumping all over, hard to hang onto the line	• Condition known as "Slug flow" Created by lack of foam solution or too low of % - water and air do not mix without foam added	• Eliminate airflow in line until foam concentrate can be introduced at the proper rate of 0.3%. Some foam concentrates may require special consideration or attention. (i.e. higher %)
Foam is too dry, - Can't soak into anything or absorb much heat	• Ratio of air to water is too high or a very long hose line is being used • Foam percentage is too high	• Increase water flow or decrease air flow, or slightly close nozzle • Lower the percentage using the gray down ⇩ arrow button
Foam is too wet and runny, - Not making shaving cream type foam	• Ratio of water to air is too high • Foam percentage is too low • Incorrect Nozzle on hose line, fog nozzles break up bubbles • Kink in hose or too short of run of hose (100 ft minimum)	• Reduce water flow/increase air flow • Be sure proportioner is set at least 0.3% and use good foam • Nozzle must be full flow with a large smooth bore tip • Straighten out kink in hose or add lengths to the hose line
Insufficient air output	• Air filter dirty • Oil separator blocked • Intake valve faulty • Manual pressure valve faulty or incorrectly set • Faulty balance valve • RPM is too low	• Replace • Replace • Inspect & repair • Inspect & reset • Inspect, clean, repair • Increase RPM

Receiver tank safety valve blows at 200 psi	• Air pressure control valve is set too high	• Adjust control valve (see section 2)
Valve blows at less than 200 psi	• Safety valve is defective	• Replace safety valve
Oil consumption high	• Oil level in hydraulic oil reservoir tank is too high	• Check and adjust oil level with compressor off
Oil is coming out of hand lines / air tool chucks	• Oil/Air Separator cartridge has become clogged or defective	• Replace Separator cartridge
	• Too much condensation in the oil	• Inspect oil, drain and replace
	• Oil return line or orifice clogged	• Clean
	• Wrong type oil	• Drain all components and hoses, replace oil with correct type
	• Oil leak	• Repair
Air compressor surges which raises and lowers rpm, pressure, and also cfm flow of air	While air is flowing, the air inlet modulator valve opens and closes to keep air pressure in the proper range. This is most noticeable in the 20 - 80 cfm range.	This is a normal and required occurrence. The surging should be at a rate fast enough to keep air pressure from falling too low. Adjustment to the surge cycle can be accomplished by turning the needle valve on pressure control assembly
Compressor drive overloaded at startup (system still pressurized at startup)	• System blow down has not been completed	• Allow at least 1 minute from shutdown to startup for system blow down
	• Faulty blow down valve	• Replace
	• Faulty separator tank pressure sensing valve	• Replace
	• Intake valve leaking or open	• Inspect and Repair

FOAM PROPORTIONER SECTION		
Foam pump runs but produces no foam flow	Foam pump is not primed	See foam pump priming (page 20 in FoamPro manual)
Foam pump loses prime, makes a chattering noise	• Air leak in suction hose or fittings • Suction line is blocked or kinked • Clogged suction strainer	• Fix leaks • Remove suction hose and check for loose lining. Inspect for blockage or remove kinks • Clean strainer
No characters in the digital display	• The main power switch on the motor is not turned on • Cables are defective or installed improperly	• Turn on power toggle switch • Inspect cables and secure connections or replace if defective

System is powered up and the foam on/off switch has been pressed but the foam pump will not run	• No water is flowing in any of the foam discharges • Flow meter is obstructed or defective • Foam tank level sensor is sending low foam level signal • Control cable is defective	• Flow water out a desired foam discharge • Remove obstruction or replace flow meter • Fill foam tank if low or repair level sensor if it is incorrectly operating • Check connections or replace cable
LO. CON appears in the digital display	• Foam concentrate level in tank is low • Low level tank sensor is incorrectly sensing low level	• Refill concentrate tank with the proper foam type • Repair or replace level sensor
NO. CON appears in the digital display This automatically happens 2 minutes after LO.CON appears in display	• Foam concentrate level in tank is empty • Tank level sensor is incorrectly sensing empty tank level	• Refill concentrate tank with the proper foam type • Repair or replace level sensor
Foam pump runs full speed when main power circuit is turned on	• Poor ground either to motor driver or mounting bracket • Bad motor driver box	• Make sure screws are tight and that good ground is maintained • Replace motor driver box
Display shows a ?	• Flow meter is sensing water flow, but the rate is too low for precise proportioning	• This is common at start up and shut down of water flow. Check flow meter or flow more water.
System returns to standby mode or HYPRO appears in display momentarily while pumping	• Insufficient power supply • Current resistance in wiring circuits	• Inspect and correct power and ground connections and wiring • Make sure a minimum 8 AWG wire is used to install to battery

Class A Foam References

The National Wildfire Coordinating Group (NWCG) has sponsored the publication of the following items produced by the NWCG Working Teams. Copies of each of these items may be ordered from the National Interagency Fire Center (NIFC). To order, mail or fax a purchase order or requisition to:

National Interagency Fire Center
ATTN.: Supply
3905 Vista Avenue
Boise, Idaho 83705

FAX 208-387-5573

Orders must be from agencies or organizations, not private individuals. Use the "NFES" number for the item(s) you are ordering. Do not send money, checks, or money orders with the order. Phone orders are not accepted. You will be billed the cost of the item(s) after the items are sent. Orders from other than Federal wild land fire agencies or State land protection agencies will receive an 18% surcharge on the bill. Transportation charge, other than mail, will also appear on the bill. Questions regarding ordering procedures can be addressed to the NIFC Supply Office, 208-387-5542. Questions regarding billing procedures can be addressed to NIFC Finance Office, 208-387-5533.

PLEASE NOTE THAT THE NIFC FIRE CACHE PERFORMS INVENTORY DURING THE MONTH OF JANUARY. ORDERS ARE NOT PROCESSED DURING INVENTORY. ORDERS RECEIVED DURING THIS INVENTORY PERIOD ARE DATE STAMPED AND PROCESSED IN THE ORDER THEY WERE RECEIVED.

ESTIMATED PRICES ARE SHOWN FOR SOME OF THE ITEMS. ACTUAL PRICES WILL NOT BE KNOWN UNTIL ITEMS HAVE BEEN RECEIVED. ACTUAL COSTS WILL BE CHARGED WHEN FILLING ORDERS.

PLEASE INSURE THAT ALL ORDERS HAVE CORRECT NFES #'S FOR THE ITEMS BEING ORDERED.

INTRODUCTION TO CLASS A FOAM, 1989

13:00 minute videotape, VHS size only

NFES 2073
First of a videotape series dealing with foam use. This tape is a brief introduction to class A Foam technology covering foam chemistry, foam generating equipment, and examples of foam application. PMS 445-1.

THE PROPERTIES OF FOAM, 1993

15:00 minute videotape, VHS size only

NFES 2219

Second in a videotape series about class A foam. Explains how class A foam enhances the abilities of water to extinguish fire and to prevent fuel ignition. Basic foam concepts including drain time, expansion and foam type are explained. This revised 1993 version differs from the original 1992 videotape only in the way "foam types" are categorized. The original 1992 version described foam types as "foam solution, fluid, dripping and dry." The 1993 revision of the video describes foam types as "foam solution, wet, fluid and dry." PMS 445-2.

CLASS A FOAM PROPORTIONERS, 1992

23:10 minute videotape, VHS size only

NFES 2245
Third in a videotape series about class A foam. Explains how common foam proportioner devices, which add a measured amount of foam concentrate to a known volume of water, work. Advantages and disadvantages are presented. PMS 445-3.

ASPIRATING NOZZLES, 1992

10:13 minute videotape, VHS size only

NFES 2272
Fourth in a videotape series about class A foam, the difference between low and medium expansion nozzles, and appropriate uses for each nozzle. PMS 445-4

COMPRESSED AIR FOAM SYSTEMS, 1993

20:00 minute videotape, VHS size only

NFES 2161
Fifth in a videotape series about class A foam. Describes equipment, including water pumps, air compressors, drive mechanisms, and nozzles, used to generate compressed air foam. Presents rules of thumb for simple and reliable foam productions. Explains procedures for safe operation. Compares compressed air foam to air-aspirated foam. Presents advantages and disadvantages of the system.

FOAM VS. FIRE, PRIMER, 1992

NFES 2270
This 9-page publication covers the basics of using class A foams and discusses their adaptability to present application equipment. First is a series of three "Foam vs. Fire" publications. PMS 446-2.

FOAM VS FIRE, CLASS A FOAM FOR WILD LAND FIRES, 1993

NFES 2246
This 28-page publication explains how to get the most fire fighting punch from water by converting water to class A. foam. Discusses how and why foam works. Explains drain time, expansion ratio, foam type, proportioning, aspirating nozzles and compressed air foam systems. Also discusses application for direct attack, indirect attack, mop up, structure protection, and safety considerations. Slightly revised from 1992 edition to

clarify foam types and descriptions. Second in a series of three "Foam vs. Fire" publications. PMS 446-1.

For those who would like a list of training materials and other publications available from NIFC, please order:

NFES 3362 1994 NWCG NFES Publications Catalog
(Available April 1, 1994)

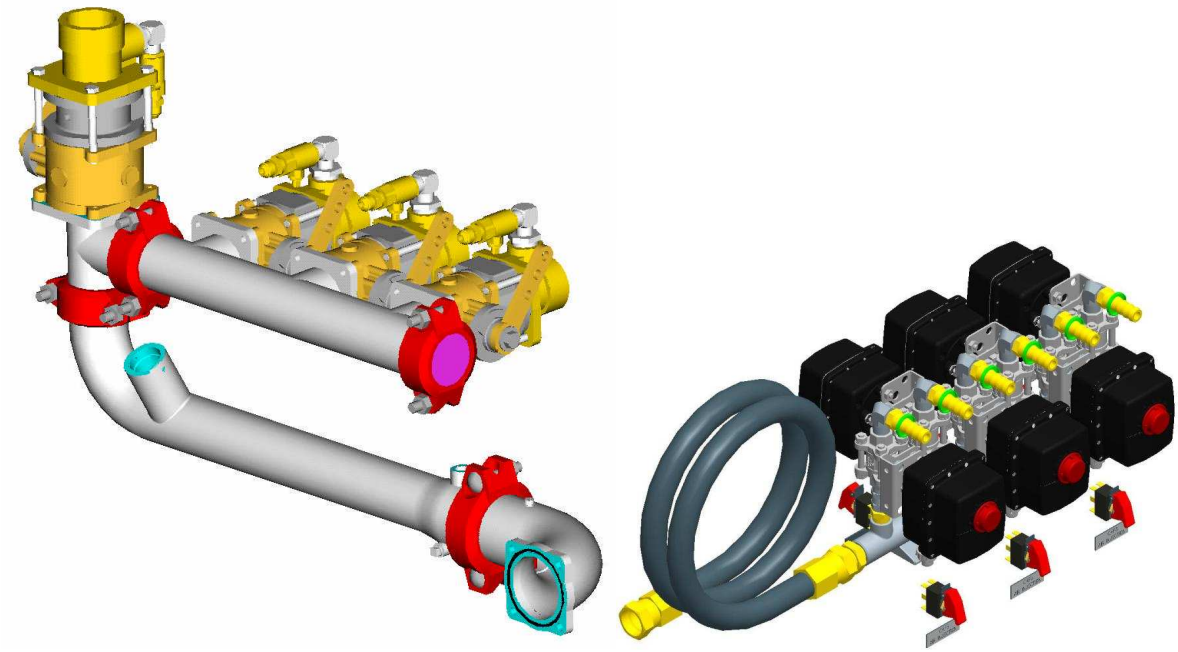
Appendix

- ***FOAM MANIFOLD PARTS AND CONFIGURATION***
- ***ELECTRIC CLUTCH MAINTENANCE AND REPAIR GUIDE***
- ***AutoCAFSII TEST REFERENCE GUIDE***
- ***DETAILED SPECIFICATIONS***

FOAM MANIFOLD

CONFIGURATION and PARTS GUIDE

Including Darley AutoCAFS *AIR* (Air Injection Regulator)
Air distribution manifold assembly



Introduction:

The Darley CAFS manifold system is a complete package offering all the components required to equip your apparatus with injection ports and check valves for foam concentrate and compressed air injection. For foam only applications, a complete manifold assembly may be configured to include a foam concentrate back flow check valve, foam concentrate injection port, FoamPro flow meter port, and a number of 2” and 2 ½” outlet ports. The addition of CAFS discharge valve assemblies and air discharge distribution components complete the system for compressed air foam operation. All components are integrated with a stainless steel modular piping system.

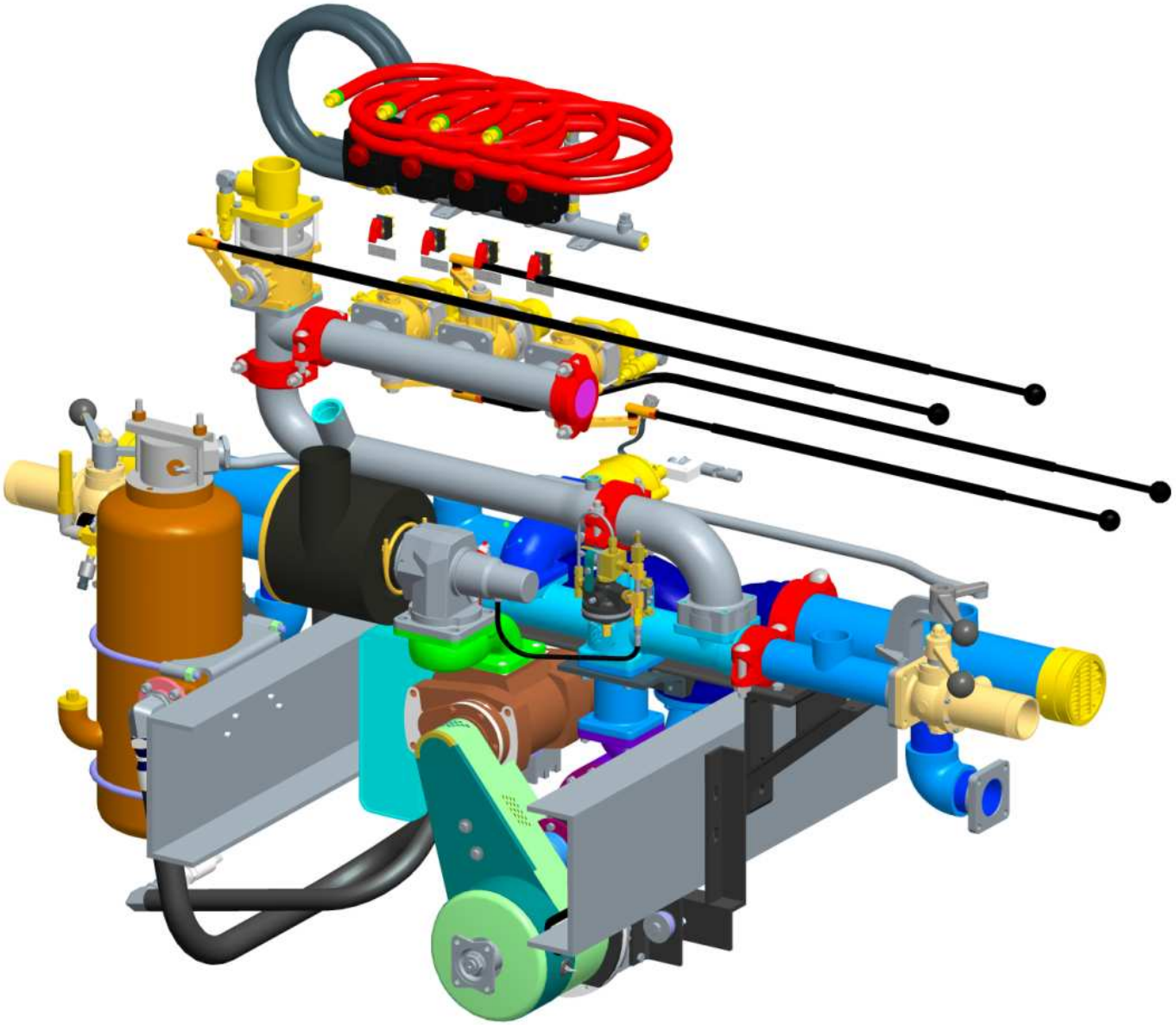
The foam manifold is readily adaptable to all CAFS installations.

In addition, a *FastCAFS* air distribution valve assembly is available for complete "motorized" electric valve control of individual air injection ports. This actuated electric valve provides for smooth air injection flow rate resulting in smooth, no-shock operation. The FastCAFS air distribution assembly incorporates a stainless steel manifold with 5 to 6 ports and (1) 12VDC "motorized" electric valve for each CAFS discharge valve assembly. An optional air flow meter may be mounted directly to the outlet port of the oil separator tank for air flow measurement and air valve calibration. A long primary air hose is provided for connection of the distribution manifold to the air flow meter, providing flexible remote mounting in the pump compartment.

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Manifolding



Notes: *The manifolding shown is a standard configuration. The first manifolding elbow which is fastened to the discharge head flange can be oriented to the drivers side, passenger side (shown), front of the truck or rear of the truck upon request. From the first manifolding elbow on, Darley can provide other manifolding options and can offer custom manifolding through engineering upon request.*

Prepared by: RJG
Approved by: MCR
Revised by: RJG

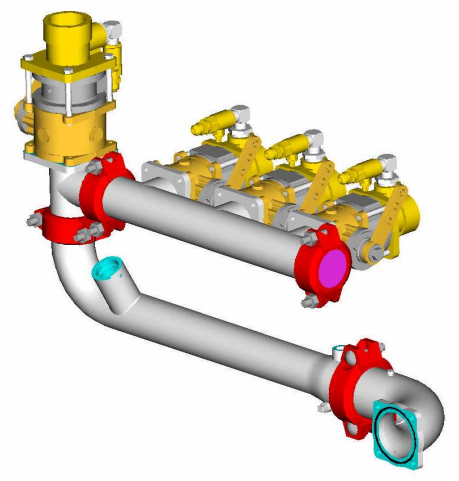
Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

Three basic options are available for manifold configuration.

Option 00 – Drawing DCM1500, (2) Flange for 2 ½" CAFS Valve, (3) Flange for 2" CAFS Valve – Extensions may be rotated to position valves in a horizontal or vertical orientation.

Option 01 – **Standard OEM Configuration** - Drawing DCM1501, (1) 2 ½" flange for CAFS Valve, (3) Flange for 2" CAFS Valve – Extensions may be rotated to position valves in a horizontal or vertical orientation. Additional (3) outlet manifold extension can be optionally added for expansion.

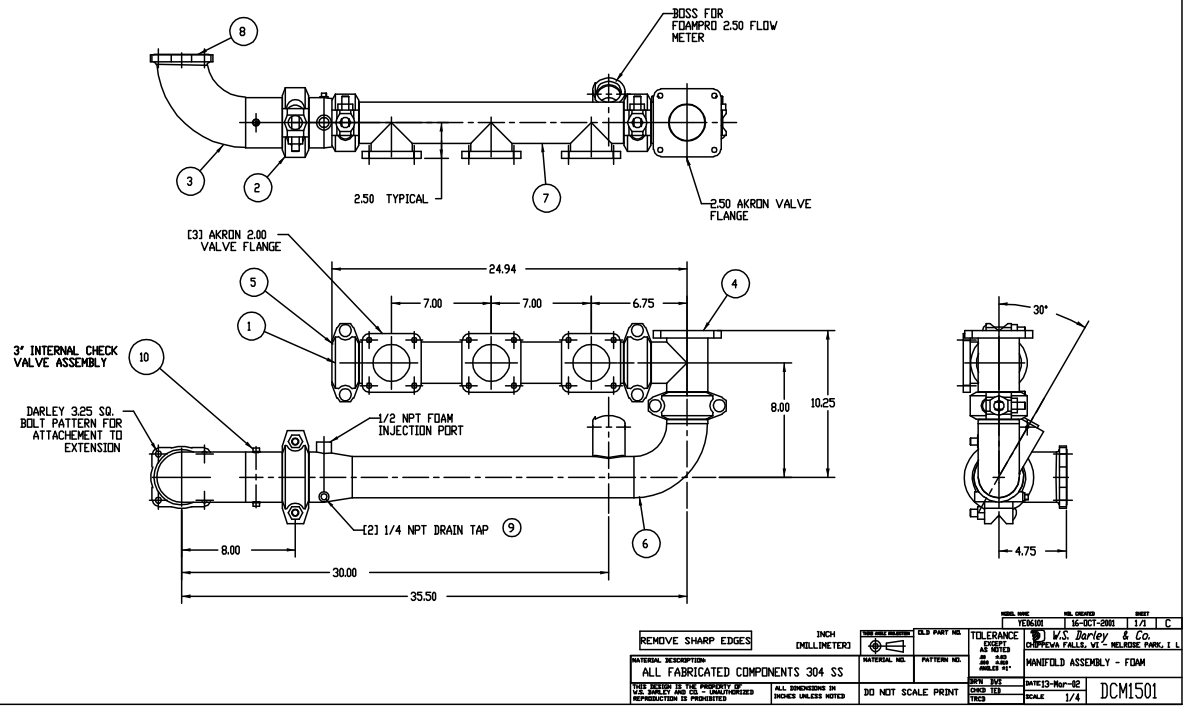
Option 02 – Drawing DCM1502, (2) 2 ½" victaulic rolled groove, (3) 2" victaulic rolled groove.



Option 01 – OEM Standard

NO.	DESCRIPTION	PART NO.	QTY.
1	COUPLING - 2.50 RIGID VIC	1080353	3
2	COUPLING - 3.00 RIGID VIC	1080354	1
3	ELBOW - FOAM MANIFOLD	3106900	1
4	ELBOW - FOAM MANIFOLD RISER	3107100	1
5	END CAP - VICTAULIC, 2.50	1002900	1
6	EXTENSION - FOAM MANIFOLD	3107000	1
7	EXTENSION - FOAM MANIFOLD	3107300	1
8	O-RING - 3.75 x 4.00 x 0.12	3601210	1
9	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
10	VALVE - CHECK, 3" INTERNAL KIT	5208700	1

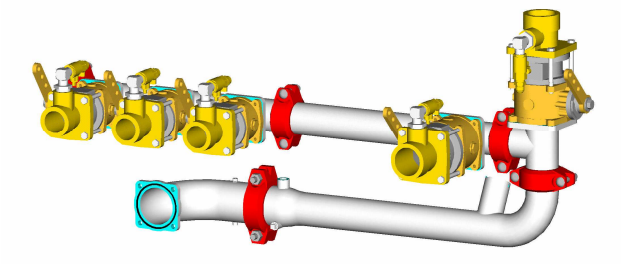
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



REMOVE SHARP EDGES	INCH [MILLIMETER]	OLD PART NO.	TOLERANCE EXCEPT AS NOTED	YEM.101	16-OCT-2001	1/1	C
MATERIAL DESCRIPTION: ALL FABRICATED COMPONENTS 304 SS		MATERIAL NO. / PATTERN NO.		W.S. Darley & Co. CHIPPEWA FALLS, WI - MELROSE PARK, I L	
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	DRN DAS / CHKD TED / TRCG	MANIFOLD ASSEMBLY - FOAM	DATE 13-Mar-02 / SCALE 1/4	DCM1501

Prepared by: RJG
Approved by: MCR
Revised by: RJG

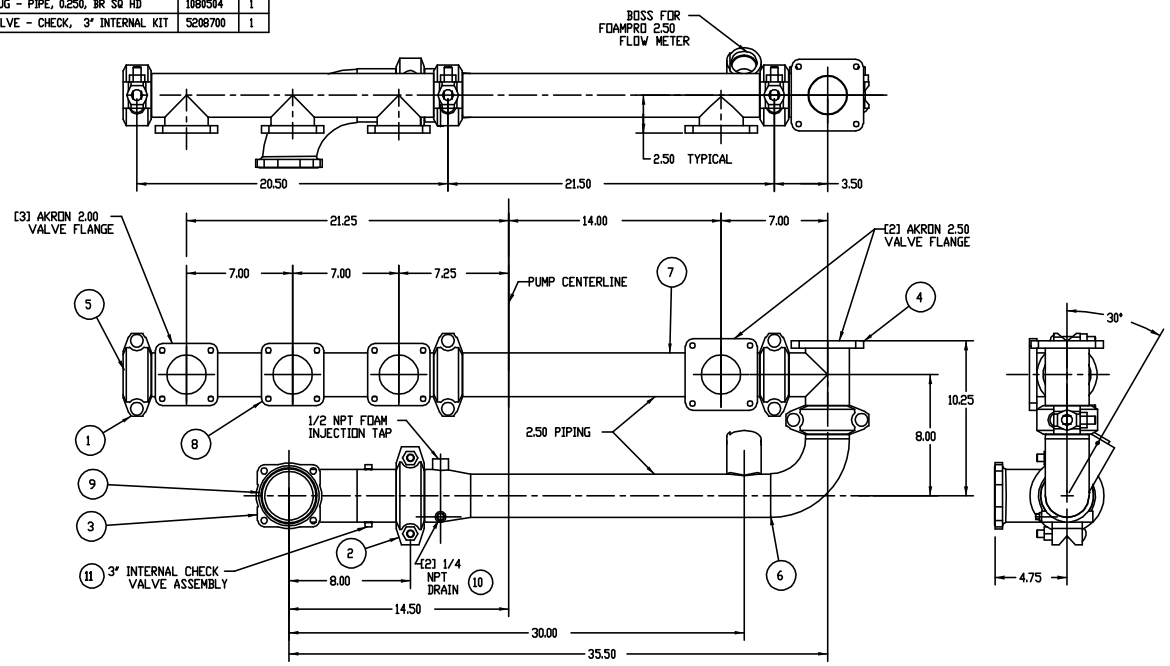
Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc



Option 00

NO.	DESCRIPTION	PART NO.	QTY.
1	COUPLING - 2.50 RIGID VIC	1080353	4
2	COUPLING - 3.00 RIGID VIC	1080354	1
3	ELBOW - FOAM MANIFOLD	3106900	1
4	ELBOW - FOAM MANIFOLD RISER	3107100	1
5	END CAP - VICTAULIC, 2.50	1002900	1
6	EXTENSION - FOAM MANIFOLD	3107000	1
7	EXTENSION - FOAM MANIFOLD	3107200	1
8	EXTENSION - FOAM MANIFOLD	3107300	1
9	O-RING - 3.75 x 4.00 x 0.12	3601210	1
10	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
11	VALVE - CHECK, 3" INTERNAL KIT	5208700	1

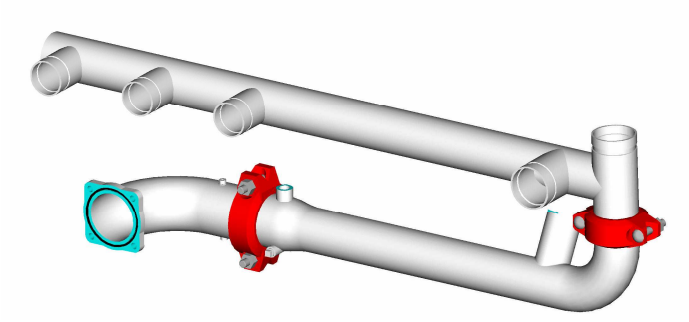
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



REMOVE SHARP EDGES	INCH [MILLIMETER]	OLD PART NO.	TOLERANCE EXCEPT AS NOTED	W.S. Darley & Co. CHIPPEWA FALLS, WI - MELROSE PARK, I L	MODEL NAME: YED6100
MATERIAL DESCRIPTION: ALL FABRICATED COMPONENTS 304 SS		MATERIAL NO.	PATTERN NO.	MANIFOLD ASSEMBLY - FOAM	DRN BVE DATE 25-Jan-02
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	CHKD TEB TRCD	SCALE 1/4	DCM1500

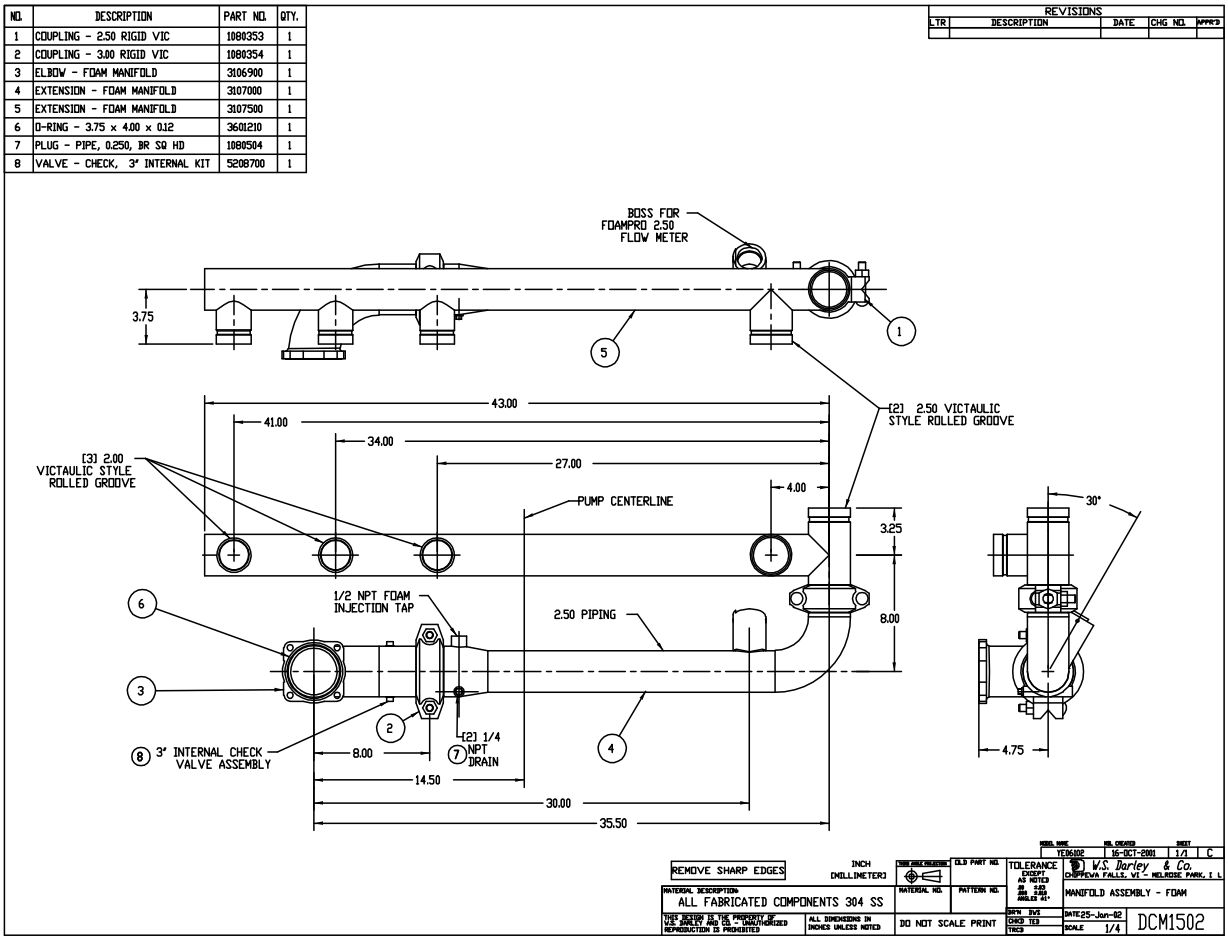
Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc



Option 02

NO.	DESCRIPTION	PART NO.	QTY.
1	COUPLING - 2.50 RIGID VIC	1080353	1
2	COUPLING - 3.00 RIGID VIC	1080354	1
3	ELBOW - FOAM MANIFOLD	3106900	1
4	EXTENSION - FOAM MANIFOLD	3107000	1
5	EXTENSION - FOAM MANIFOLD	3107500	1
6	O-RING - 3.75 x 4.00 x 0.12	3601210	1
7	PLUG - PIPE, 0.250, BR SQ HD	1080504	1
8	VALVE - CHECK, 3" INTERNAL KIT	5208700	1



This manifold assembly would be used in applications where it is desired to run extension piping from the manifold to individual flow meters (not supplied). OEM supplied Akron x victaulic flange is required to attach CAFS valve assembly to manifold.

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
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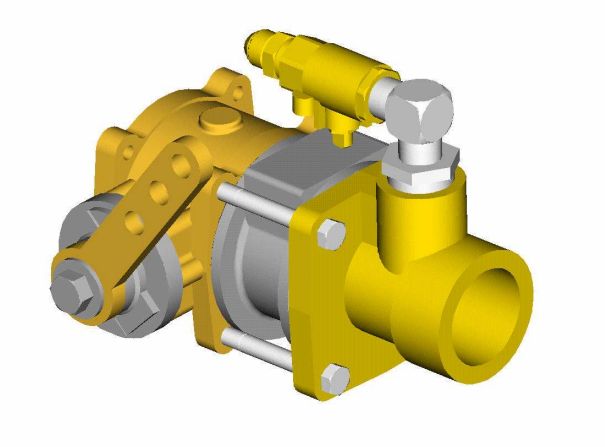
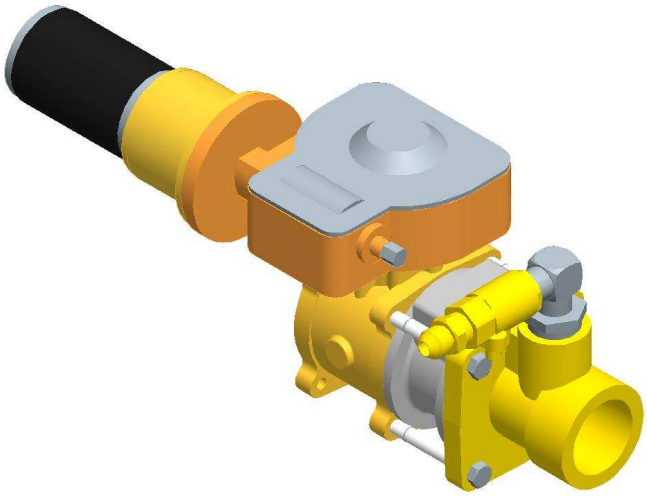
CAFS Discharge Valve Assemblies:

Darley CAFS discharge valve assemblies incorporate a foam solution check valve, air inlet check valve, and an adjustable air inlet flow control valve. The CAFS valve assemblies are available in 2" and 2 ½" sizes. Use a 2" valve assembly for crosslays and preconnects. A 2 ½" CAFS valve assembly is applicable to 2 ½" discharge lines or deck guns. For dimensional information on the 2" valve assembly, part number AZ02500, refer to drawing DCM0303. For the 2 ½" assembly, part number AZ02600, refer to drawing DCM0304.

The standard OEM Manifold, DCM1501, is configured for (1) 2 ½" and (3) 2" CAFS valve assemblies. If additional valves are required, please indicate total number of valves desired on the Option-Pricing form.

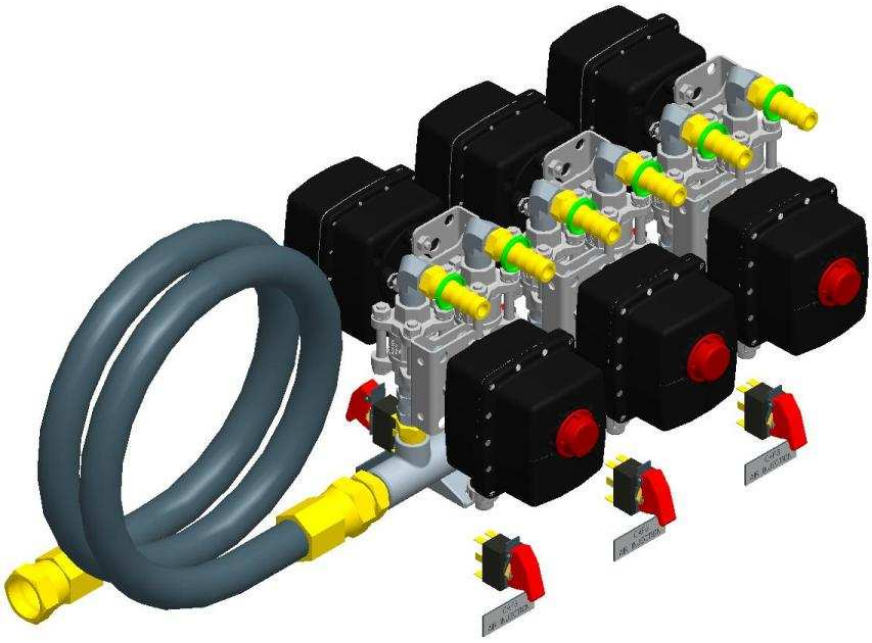


Optionally, the CAFS discharge valve assembly is available complete with an integrated electric valve actuator and panel control. For dimensional information on the actuated 2" valve assembly, part number AZ02700, refer to drawing DCM0305. For the 2 ½" assembly, part number AZ02800, refer to drawing DCM0306.



CAFS Air Distribution Valve Assemblies:

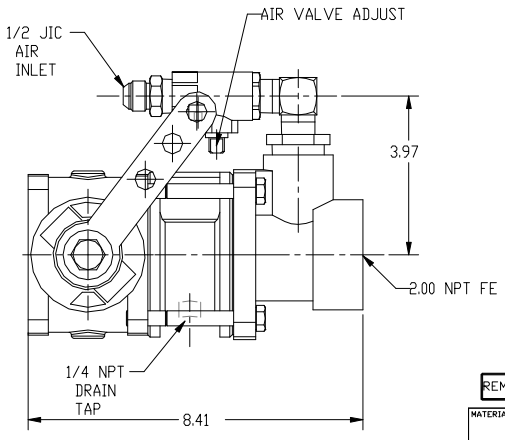
Darley AutoCAFS ***AIR*** (**A**ir **I**njection **R**egulator) air distribution manifold assembly, AZ02302, is available for complete “motorized” valve control of individual air injection ports. The AutoCAFS ***AIR*** distribution assembly incorporates a stainless steel manifold with 6 ports for the application (1) 12VDC air distribution actuated valve for each CAFS discharge valve assembly. Optionally, assembly AZ02303 includes an air flow meter which is mounted directly to the outlet port of the compressor system oil separator tank for air flow measurement and air valve calibration. A 72” primary air hose is provided for connection of the distribution manifold to the air flow meter, providing flexible remote mounting in the pump compartment. Please refer to DCM1701 for dimensional information.

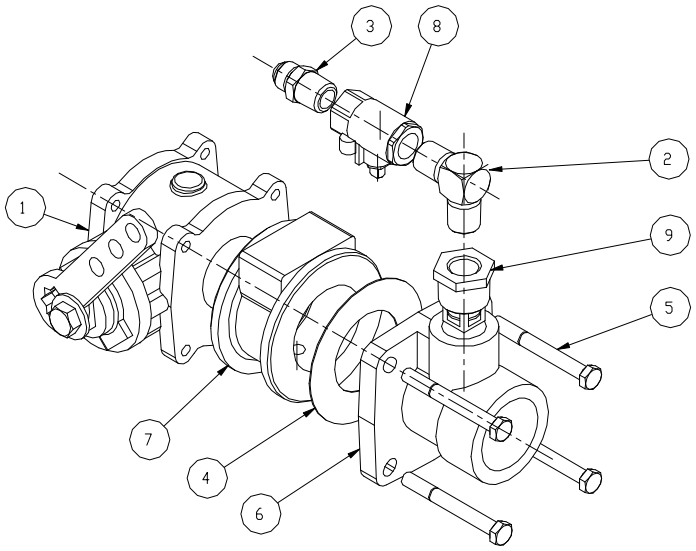


Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

NO.	DESCRIPTION	PART NO.	QTY.
1	BODY - AKRON VALVE, 2.00	5202901	1
2	ELBOW - PIPE, .50 NPT DBL MALE	1080736	1
3	FITTING - .50 NPTM x .50 JICM ADAPTER	3501526	1
4	GASKET	3806306	1
5	HHCS - .375-16 x 3.25, GR5	5400045	4
6	NIPPLE - FOAM INJECTION, 2.00	1925800	1
7	VALVE - 2.00 CHECK, MODIFIED	5204601	1
8	VALVE - CAFS AIR FLOW, 0.50	5207700	1
9	VALVE - CHECK, 0.50" DURABLO	5204400	1





REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

DR'N DWS | CHKD TED | TRCD

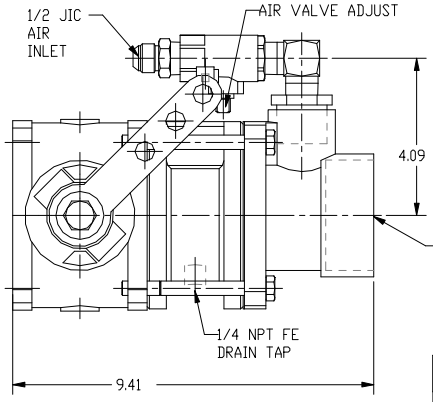
MODEL NAME	MDL CREATED	SHEET
AZ02500	28-FEB-2002	1/1 B

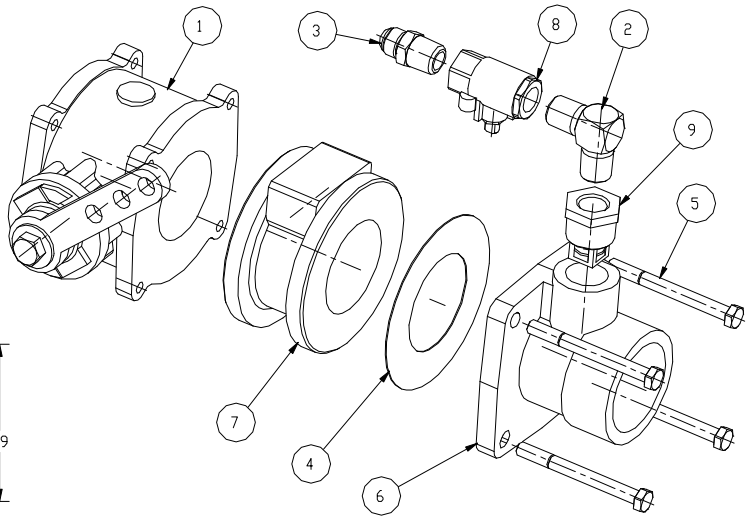
W.S. Darley & Co.
MELROSE PARK, IL - CHIPPEWA FALLS, WI

CAFS - 2.00 CHECK VALVE ASSY

DATE 08-Mar-02 | SCALE 1/2 | DCM0303

NO.	DESCRIPTION	PART NO.	QTY.
1	BODY - AKRON VALVE, 2.50	5203002	1
2	ELBOW - PIPE, .50 NPT DBL MALE	1080736	1
3	FITTING - .50 NPTM x .50 JICM ADAPTER	3501526	1
4	GASKET	3806307	1
5	HHCS - .375-16 x 3.75, GR5	5400047	4
6	NIPPLE - FOAM INJECTION, 2.50	1925801	1
7	VALVE - 2.50 CHECK, MODIFIED	5205101	1
8	VALVE - CAFS AIR FLOW, 0.50	5207700	1
9	VALVE - CHECK, 0.50" DURABLO	5204400	1





REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

DR'N DWS | CHKD TED | TRCD

MODEL NAME	MDL CREATED	SHEET
AZ02600	28-FEB-2002	1/1 B

W.S. Darley & Co.
MELROSE PARK, IL - CHIPPEWA FALLS, WI

CAFS - 2.50 CHECK VALVE ASSY

DATE 11-Mar-02 | SCALE 1/2 | DCM0304

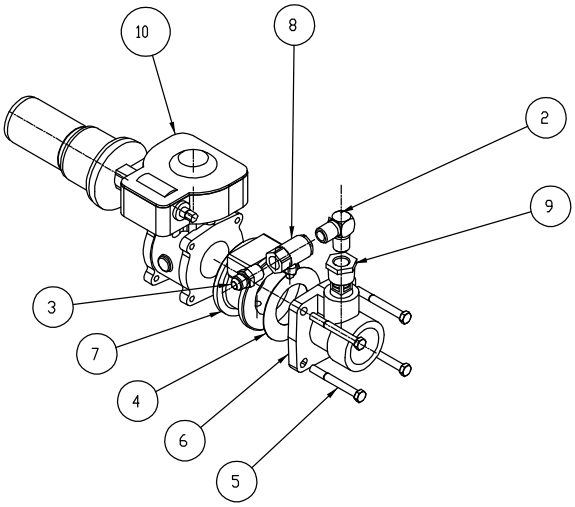
Prepared by: RJG
Approved by: MCR
Revised by: RJG

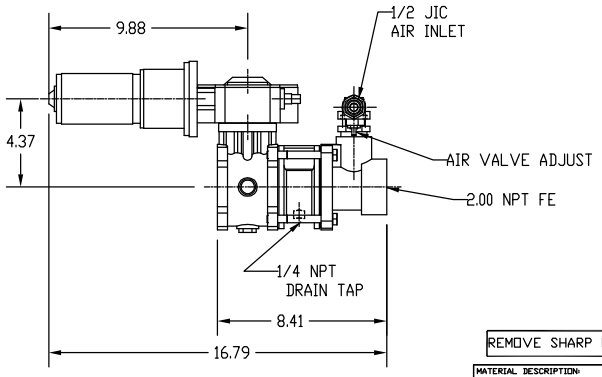
Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

NO.	DESCRIPTION	PART NO.	QTY.
2	ELBOW - PIPE, .50 NPT DBL MALE	1080736	1
3	FITTING - .50 NPTM x .50 JICM ADAPTER	3501526	1
4	GASKET	3806306	1
5	HHCS - .375-16 x 3.25, GR5	5400045	4
6	NIPPLE - FOAM INJECTION, 2.00	1925800	1
7	VALVE - 2.00 CHECK, MODIFIED	5204601	1
8	VALVE - CAFS AIR FLOW, 0.50	5207700	1
9	VALVE - CHECK, 0.50" DURABLO	5204400	1
10	VALVE - AKRON BALL, 2.00", SUB-ASSY	5202902	1

REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D





MODEL NAME: AZ02700 | MDL CREATED: 29-AUG-2004 | SHEET: 1/1 | B

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

TOLERANCE EXCEPT AS NOTED: .00 ±.03, .000 ±.010, ANGLES ±1°

W.S. Darley, MELROSE PARK, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

CAFS - 2.00 VALVE & CHECK W/ELECT ACTUATOR

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

DR'N DWS | CHKD JSS | TRCD

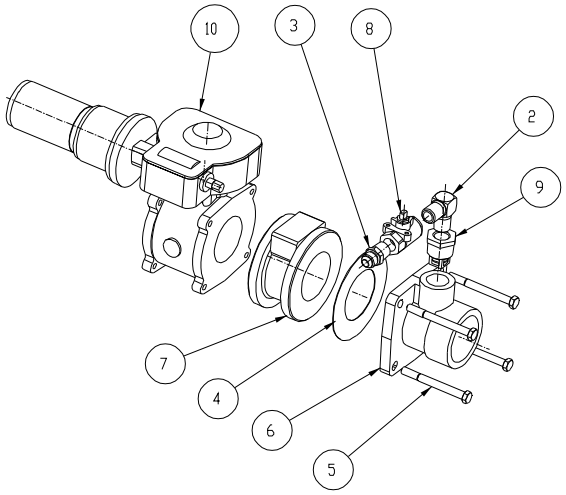
DATE 29-Aug-04 | SCALE 1/4

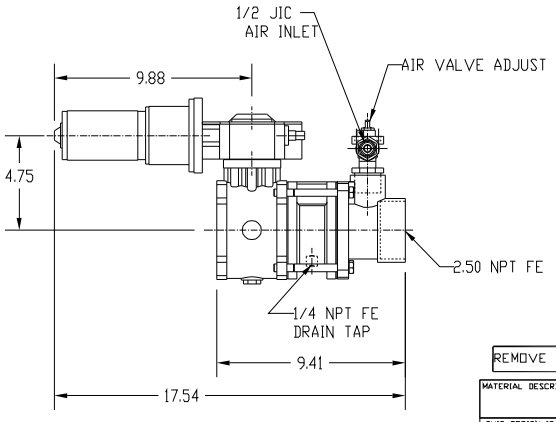
DCM0305

NO.	DESCRIPTION	PART NO.	QTY.
2	ELBOW - PIPE, .50 NPT DBL MALE	1080736	1
3	FITTING - .50 NPTM x .50 JICM ADAPTER	3501526	1
4	GASKET	3806307	1
5	HHCS - .375-16 x 3.75, GR5	5400047	4
6	NIPPLE - FOAM INJECTION, 2.50	1925801	1
7	VALVE - 2.50 CHECK, MODIFIED	5205101	1
8	VALVE - CAFS AIR FLOW, 0.50	5207700	1
9	VALVE - CHECK, 0.50" DURABLO	5204400	1
10	VALVE - AKRON BALL, 2.50, SUB-ASSY	5203003	1

REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D





MODEL NAME: AZ02800 | MDL CREATED: 29-AUG-2004 | SHEET: 1/1 | B

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

TOLERANCE EXCEPT AS NOTED: .00 ±.03, .000 ±.010, ANGLES ±1°

W.S. Darley & Co., MELROSE PARK, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

CAFS - 2.50 VALVE & CHECK W/ELECT ACTUATOR

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DR'N DWS | CHKD JSS | TRCD

DATE 29-AUG-04 | SCALE 1/4

DCM0306

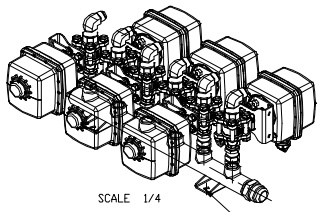
Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

NO.	DESCRIPTION	PART NO.	QTY.	
1	CAFS - 1/2 AIR DIST VALVE ASSY	AZ02402	6	VARIABLE *
2	FITTING - .75 NPTM x 1.00 JICM ADAPTER	3501528	1	
3	HOSE - 1.00 X 72 AIR LINE	3520510	1	
4	MANIFOLD - AIR DISTRIBUTION	3107401	1	
5	PLUG - PIPE .75 HEX BRASS	1080539	1	
6	PLUG - PIPE, 0.500, BRS SQ HD	1080512	1	VARIABLE *

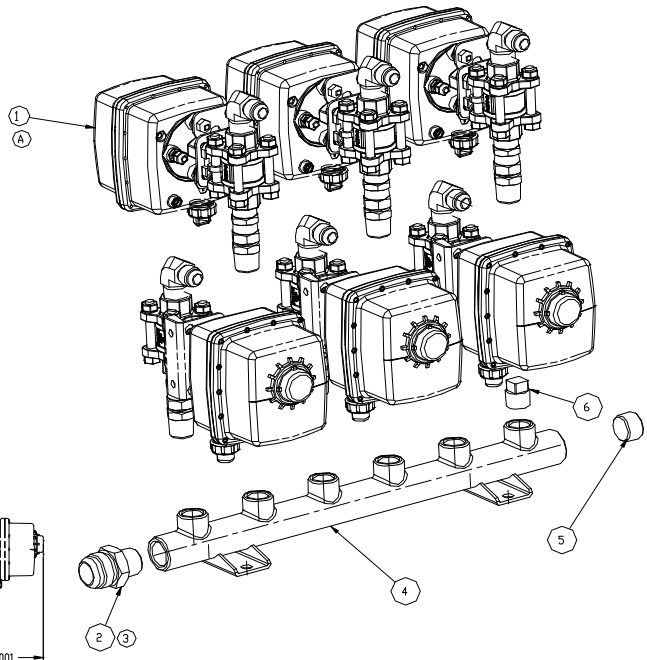
* QUATITY VARIES DEPENDING ON NUMBER OF AIR DISCHARGE VALVE ASSEMBLIES

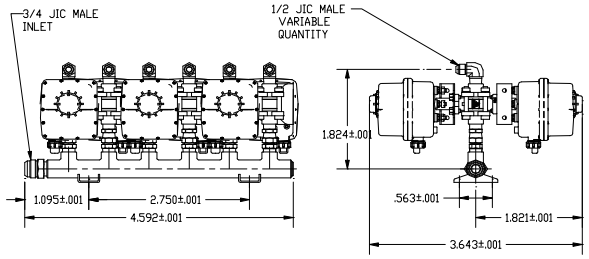
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	ROTATED ACTUATOR 90 DEGREES	9JAN2007		MWE



SCALE 1/4

[4] Ø.406 MOUNTING HOLES





SCALE 1/4

REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION | MATERIAL NO. | PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & CO. MELROSE PARK, IL - CHIPPEWA FALLS, WI

CAFS - AIR DIST MANIFOLD ASSY SLOW OPEN VALVE

DR'N DWS | CHK'D TCD | TRC'D

DATE 02-SEP-04 | SCALE 1/2

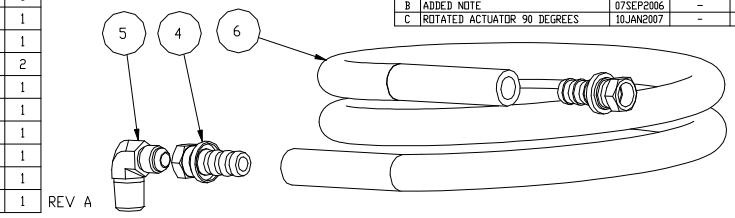
MODEL NAME	MDL CREATED	SHEET	
AZ02302	02-SEPT-2004	1/1	C

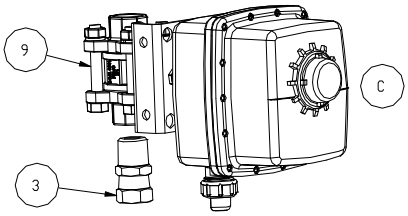
DCM1701

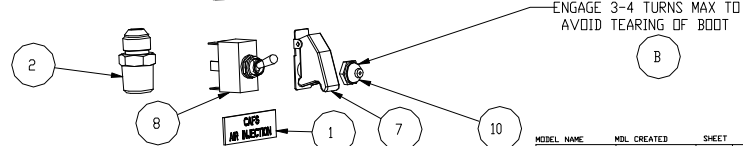
NO.	DESCRIPTION	PART NO.	QTY.
1	DECAL - CAFS AIR INJECTION	1973900	1
2	FITTING - .50 NPTM x .50 JICM ADAPTER	3501526	1
3	FITTING - BRASS ADAPTER	3502026	1
4	FITTING - BARB, .63 x .50, SWVL	3502008	2
5	FITTING - BRASS ELBOW	3502028	1
6	HOSE - .63 X 72 AIR LINE	3520501	1
7	SWITCH - TOGGLE, COVER, RED	2600088	1
8	SWITCH - TOGGLE, DPDT, ON-ON	2600125	1
9	VALVE - ACTUATED, 12V, .50NPT FE	5209400	1
10	BOOT - HALF TOGGLE	2605069	1

REV A

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	ADDED 2605069 BOOT	05APR06	2006-118	DWS
B	ADDED NOTE	07SEP2006	-	MWE
C	ROTATED ACTUATOR 90 DEGREES	10JAN2007	-	MWE







REMOVE SHARP EDGES | INCH [MILLIMETER] | THIRD ANGLE PROJECTION | OLD PART NO.

MATERIAL DESCRIPTION | MATERIAL NO. | PATTERN NO.

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°

W.S. Darley & CO. MELROSE PARK, IL - CHIPPEWA FALLS, WI

CAFS - 1/2 AIR DIST VALVE ASSY SLOW OPEN VALVE

DR'N DWS | CHK'D JSS | TRC'D

DATE 03-Sep-04 | SCALE 1/2

MODEL NAME	MDL CREATED	SHEET	
AZ02402	03-SEPT-2004	1/1	B

DCM1801

Prepared by: RJG
Approved by: MCR
Revised by: RJG

Rev. A
Date: 03/04/10
Rev Date: 01/31/12
1200625.doc

ELECTRIC CLUTCH MAINTENANCE AND REPAIR GUIDE

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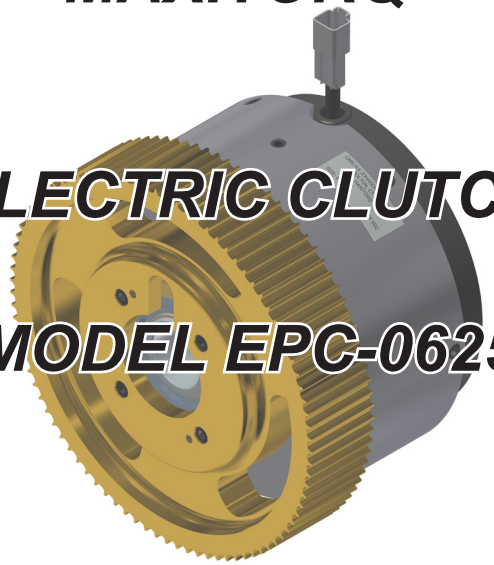
CARLYLE JOHNSON

MAXITORQ®



ELECTRIC CLUTCH

MODEL EPC-0625

MAINTENANCE and DISC AND SPRING REPLACEMENT GUIDE

The Carlyle Johnson Machine Company, LLC
291 Boston Turnpike / P O Box 9546 / Bolton, Connecticut 06043
(860) 643-1531 / Toll Free: (888) - MAXITORQ
www.cjmco.com

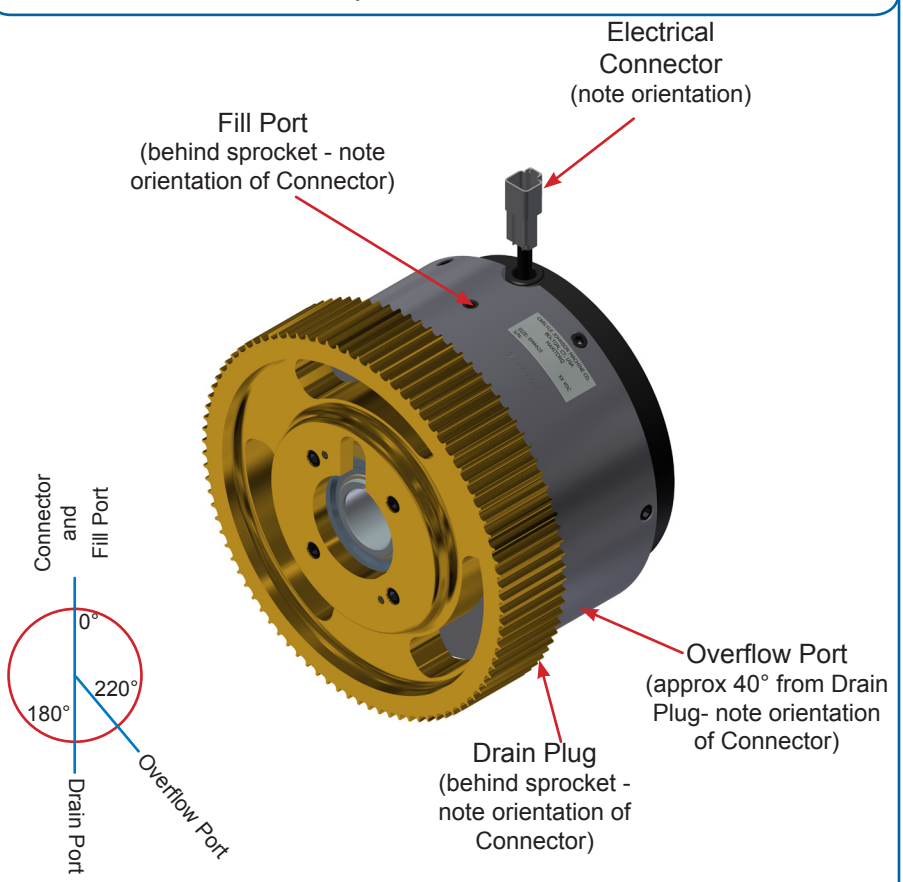
SAFETY WARNING

**ALWAYS DISCONNECT
ELECTRICAL POWER,
PLACE EQUIPMENT IN REST POSITION
(WITH NO STORED ENERGY)
AND LOCK OUT / TAG OUT MACHINERY
BEFORE PERFORMING SERVICE
OR REMOVING/REINSTALLING CLUTCH**

**WHEN ON-EQUIPMENT
ELECTRICAL READINGS ARE REQUIRED,
INSTRUMENTS MUST BE ATTACHED
PRIOR TO CONNECTING LEADS
AND INTRODUCING POWER INTO SYSTEM**

**WHEN ASSEMBLING
OR DISASSEMBLING CLUTCH,
USE OF APPROVED SAFETY GLASSES
IS MANDATORY**

CLUTCH, EXTERNAL VIEW



IMPORTANT! ADDING OIL TO UNIT

Orient clutch such that Electrical Connector is upright.

Remove Fill Port Plug and Overflow Port Plug. Fill clutch with approximately one (1) oz. Dexron® III oil (Castrol® or equivalent) through Fill Port, until overflow occurs.

Use Loctite® 567 Retaining Compound on threads, then Replace Overflow Port Plug and Fill Plug.

WARNING!
USE OF IMPROPER OIL WILL CAUSE CLUTCH FAILURE WHICH IS NOT COVERED BY WARRANTY!

CLUTCH INSTALLATION

Installing the Clutch

1. The clutch is shipped dry (without oil). The proper quantity and type of oil must be added prior to use.

2 Orient the clutch with the electrical connector in the “12 o’clock” position.

3. Remove the Fill Port Plug and Overflow Port Plug (see illustration on Page 1). Do not remove the Drain Port Plug

4. Add one (1) oz. of Dexron® III oil (Castrol® or equivalent) to the clutch, until oil escapes from the Overflow Port.

   NOTE: The use of an incorrect type of oil will cause the clutch to malfunction. Any resulting damage is not covered by warranty!

5. Use Loctite® 567 Retaining Compound on the threads of the plugs. Install the Overflow Port Plug first, then the Fill Port Plug.

6. Install the clutch before connecting the electrical connector.

Clutch Maintenance

1. The clutch requires very little maintenance in normal service. Oil level should be checked occasionally and oil added if needed - see instructions above.

2. We recommend limiting field maintenance to disc and spring replacement, following the instructions in this manual.

3. If clutch is not performing satisfactorily, Discs may be cleaned and reused. Use denatured alcohol for disc cleaning.

4. After cleaning and reassembly, if clutch still fails to perform properly, Disc and Spring replacement is necessary.

5. All other maintenance should only be performed at the factory.

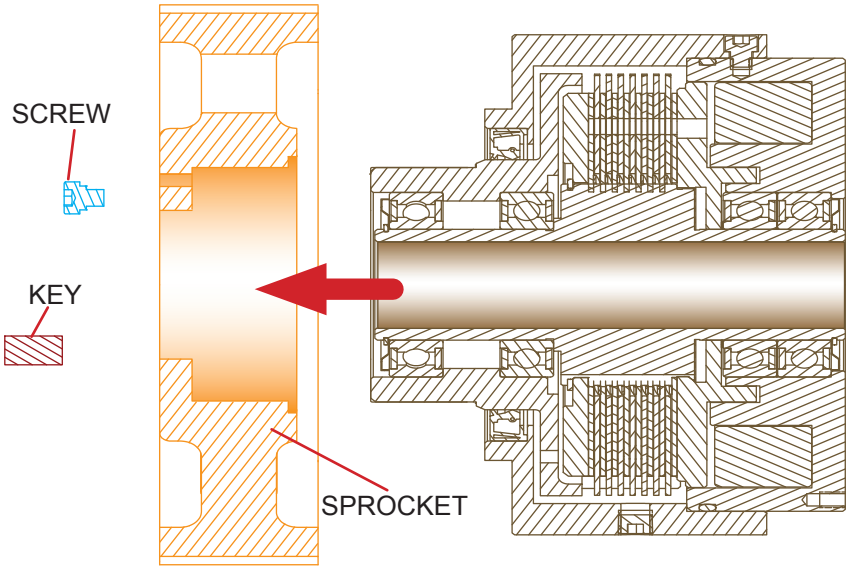
CLUTCH MAINTENANCE

Preparing for Maintenance

1. Make sure electrical leads are disconnected before servicing clutch.
2. Remove the Drain Plug and drain all oil from clutch. Place clutch on a work surface resting on its Coil Housing with the Sprocket facing UP.
3. During disassembly, Cover Screws must be removed. They have been coated with Loctite® 271 Threadlocker and may require a small heat source to loosen.
4. Ball Bearings must be removed during disassembly. They are coated with Loctite® 567 Retaining Compound on their O.D., and are slip-fit on their I.D. They must be removed carefully to prevent damage. Any distortion of these bearings will require replacement prior to reassembly.
5. The Cover contains a Rotary Lip Seal which should be replaced if removed. Obtain a replacement from the factory. Coat Seal with Dow Corning Molycote® 55 (or equivalent) before installation.
6. The Coil Housing contains an O-Ring to seal the Cover. If the Cover is removed, obtain a new O-Ring from the factory and coat with Dow Corning Molycote® 55 (or equivalent) before installation.
7. Do not disassemble Clutch beyond the level needed for Disc and Spring replacement. Bearing replacement (there are four (4) Ball Bearings, two on each end of the Clutch) will be necessary if further disassembly is attempted.
8. Proper hand tools are required to prevent damage to parts during disassembly and reassembly. Do not pry parts apart! A bearing-puller may be necessary to dislodge the Drive Cup with its captive bearings.
9. Wipe all internal parts with a clean rag before commencing reassembly.
10. The tabs on the Outer Discs must be aligned carefully to permit the Drive Cup “fingers” to engage ALL of the discs. Before completing assembly, make sure no Outer Disc tabs are distorted.
11. DO NOT use Loctite® Threadlocker or Retaining Compound on internal parts unless instructed to do so.
12. Carefully test the clutch before installation.

CLUTCH DISASSEMBLY

1



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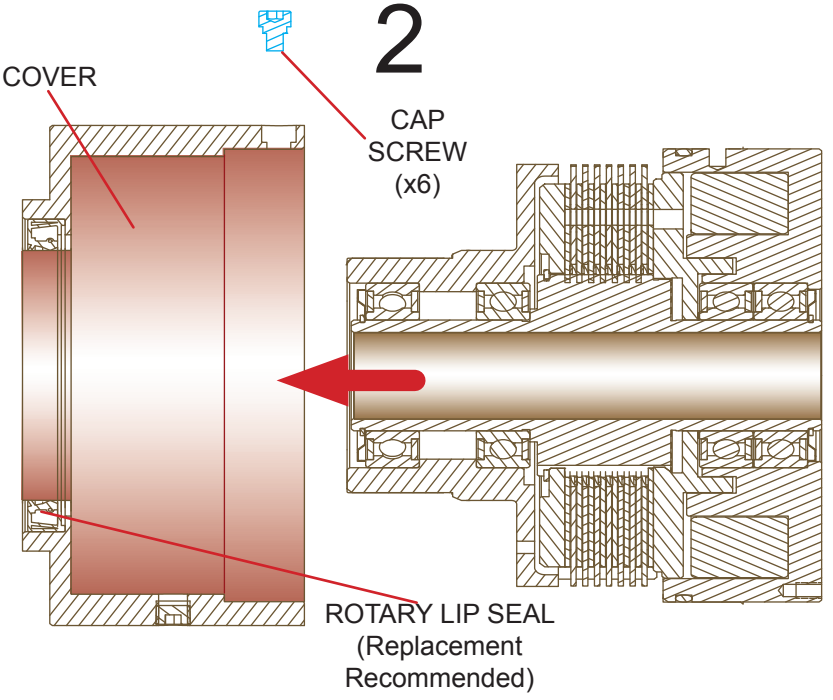
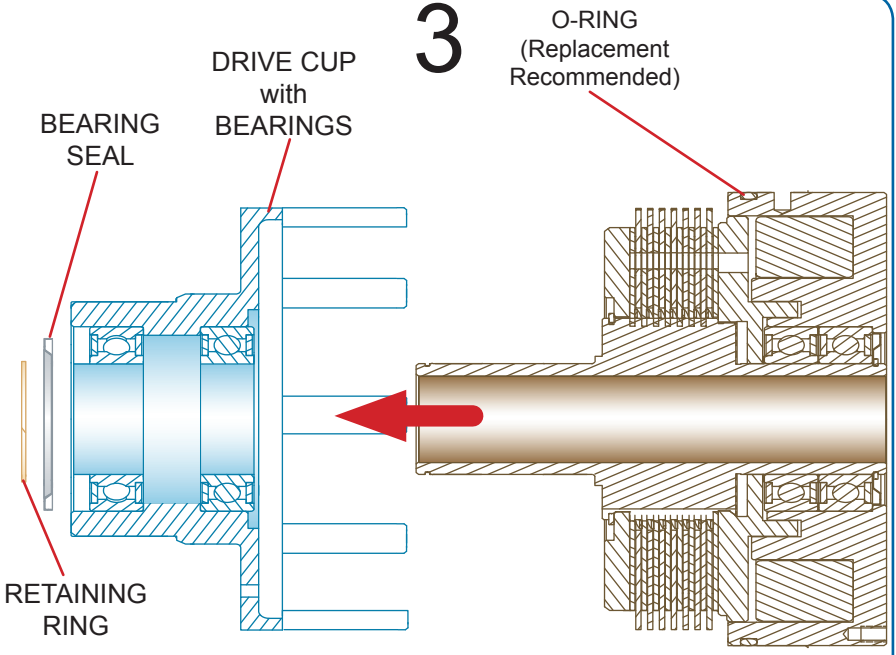


CLUTCH DISASSEMBLY

3



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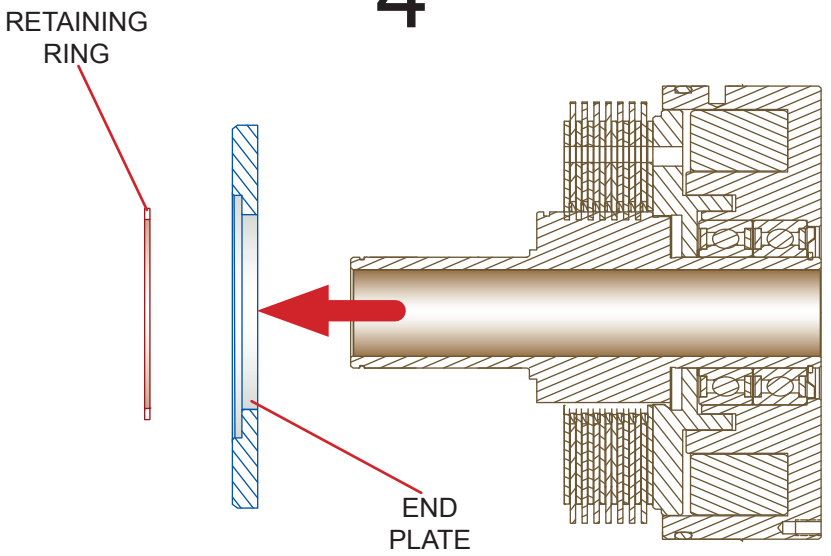
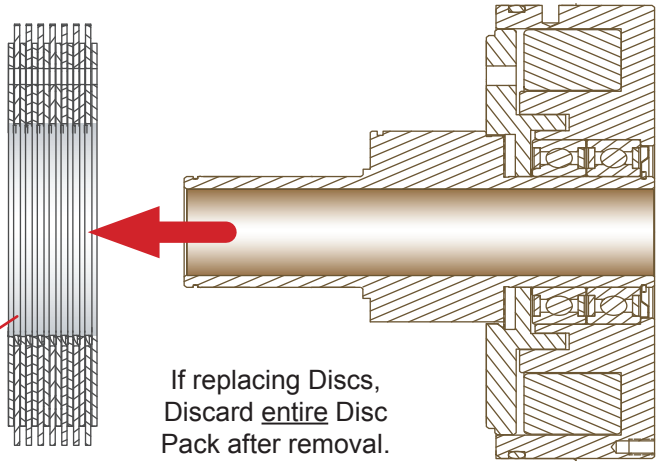


CLUTCH DISASSEMBLY

5

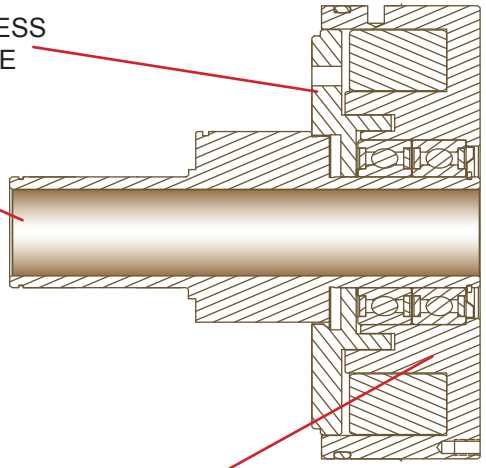
If cleaning Discs, use denatured alcohol and dry thoroughly with compressed air



DISC PACK

If replacing Discs, Discard <u>entire</u> Disc Pack after removal. Do not mix old and new discs

6



BUTTRESS PLATE

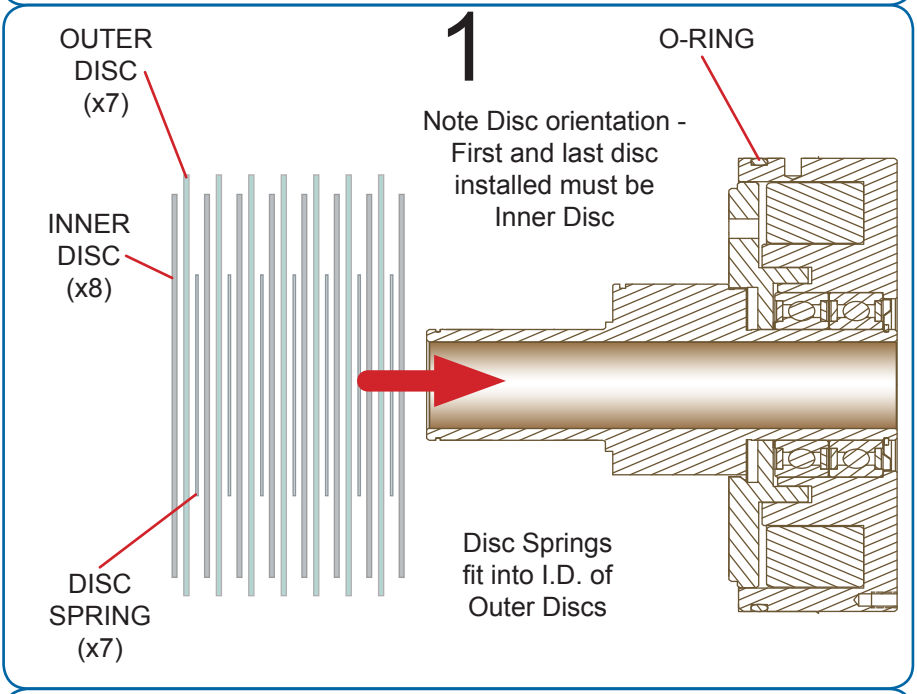
BODY

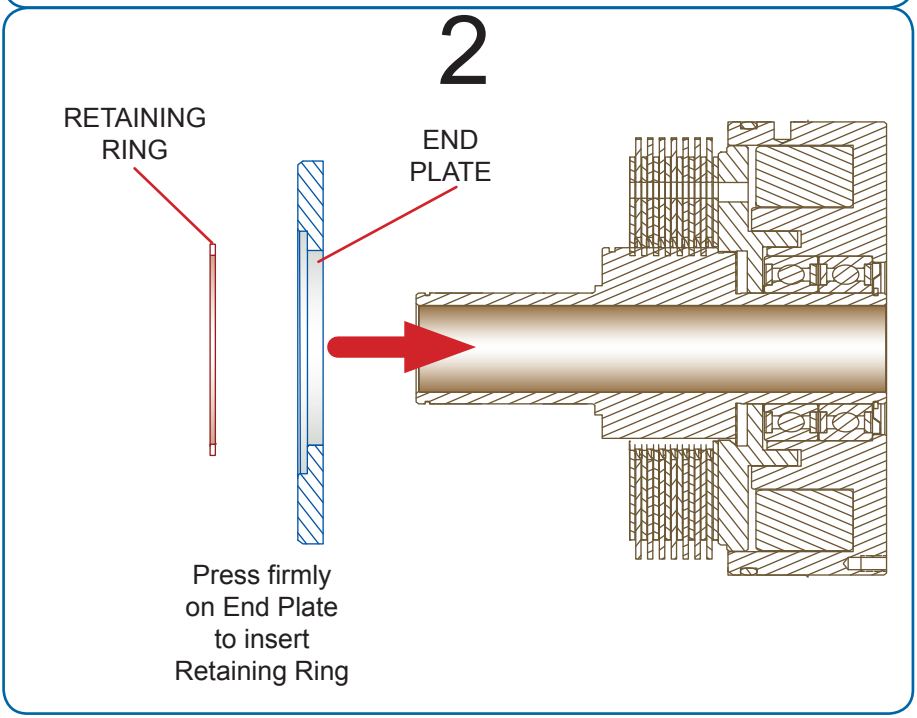
IMPORTANT!

Do not disassemble beyond this point or Bearing replacement will be necessary!

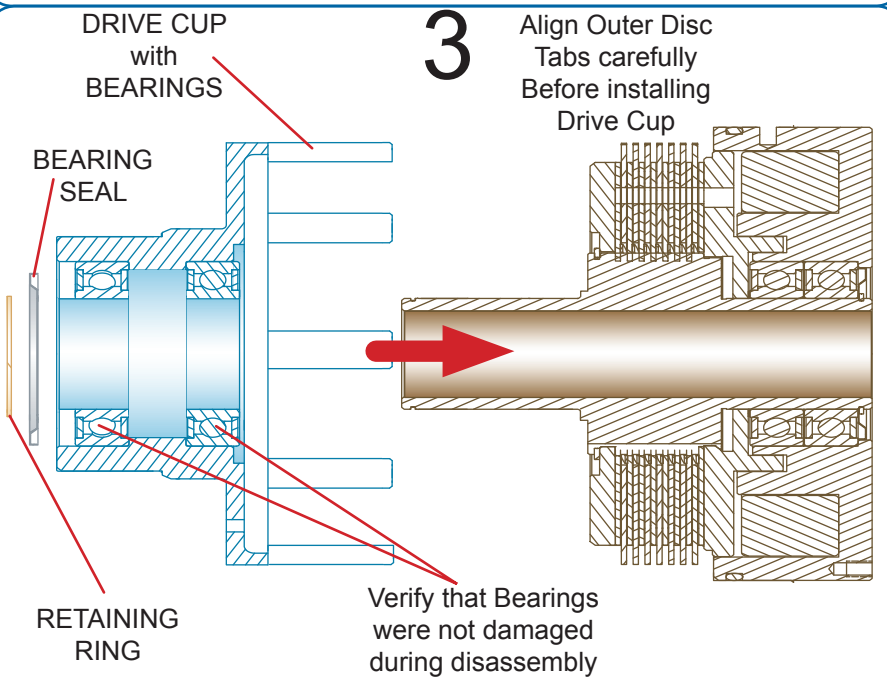
COIL and COIL HOUSING

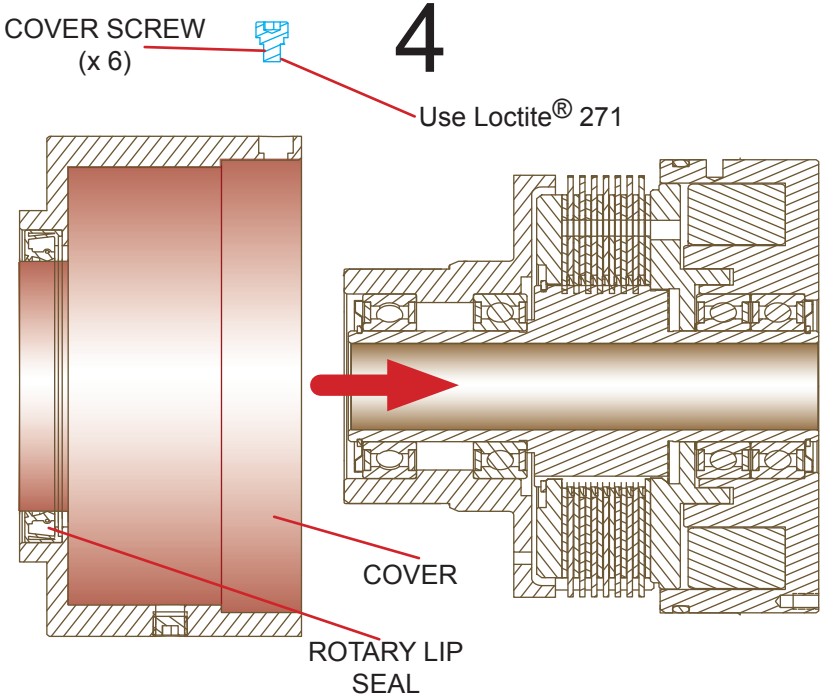
CLUTCH REASSEMBLY





CLUTCH REASSEMBLY





CLUTCH REASSEMBLY

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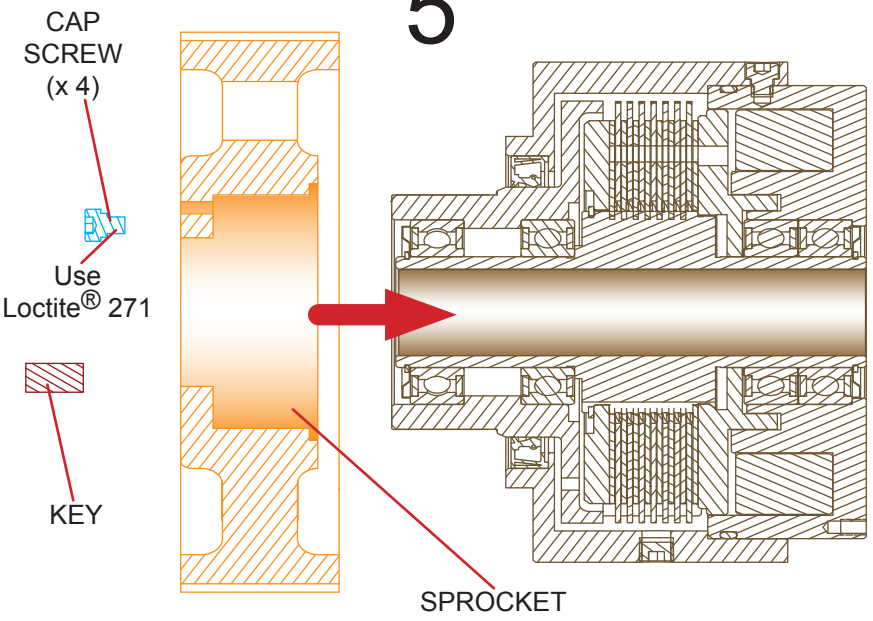

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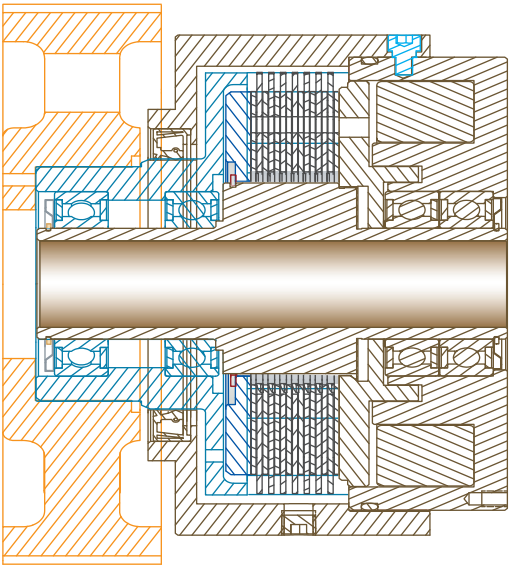

CLUTCH SPECIFICATIONS

Manufacturer Information:

The Carlyle Johnson Machine Company, LLC
291 Boston Turnpike
Bolton, Connecticut USA 06043

Federal CAGE Code - 75182

Clutch Model No. EPC062599D40012

Electrical Requirements: 12 VDC (± 10%)

Performance Specifications:

Static Torque rating - 600 lb. ft.

Operating Speed - 2,500 RPM (in oil)

Unit Weight - Approximately 52 lbs

Lubrication and Adhesives:

Lubricants

Fill clutch with 1 oz. Dexron® III (Castrol or equivalent) oil before operation. See Page 2 for instructions.

Coat O-Ring with Dow Corning Molycote® 55 (or equivalent) before installation.

Coat Rotary Lip Seal with Dow Corning Molycote® 55 (or equivalent) before installation.

Adhesives

Use Loctite® 271 Threadlocker on the external screws when installed.

Use Loctite® 567 Retaining Compound on the Drain Plug and on the Overflow Plug.

Use Loctite® 567 Retaining Compound on the O.D. (ONLY) of any Ball Bearings which are replaced.

FACTORY SERVICE

Contacting the Factory.

The Maxitorq® Multiple-Disc Electric Clutch is manufactured by:

The Carlyle Johnson Machine Company, LLC
291 Boston Turnpike • P O Box 9546
Bolton, Connecticut USA 06043-9546

Carlyle Johnson is located in the Eastern Time Zone of the United States and can be reached by telephone at the following numbers:

Main Number : 1 – (860) 643-1531
Toll-free within the USA : 1 – (888) 629-4867
FAX : 1 – (860) 646-2645

Additional manuals are available free of charge. Model and serial number are required to order.

Technical help is available between 8:00 AM and 5:00 PM local time, Mondays to Fridays, excluding holidays.

Spare Parts may be ordered by calling the above number. Please have Serial Number and Model of Clutch available for our representative.

The company can also be reached via the internet at the e-mail address

maxitorq@cjmco.com

Returning Equipment for Repairs or Maintenance

Contact the factory prior to any returns to obtain a Return Material Authorization number (RMA). Be sure to have the model number and serial number of the unit requiring service available when you call. This will speed the handling of your Maxitorq® product when it is received.

Ship the unit prepaid to the above address in Bolton, Connecticut.

If the equipment is within its warranty period and our analysis shows that the repair is due to a manufacturer's defect, we will repair or replace the clutch at no cost to you and return it prepaid to your location.

If our technicians determine that the unit needs parts which are not covered by the warranty or are outside the warranty period, you will be contacted with cost and schedule information prior to having the repairs undertaken. If you direct us to return the device without repair, an evaluation charge may apply.

We recommend that any time the clutch is disassembled for service at the factory, a complete set of wear parts (discs and springs) be installed to restore the device to like-new performance.

NOTES

NOTES

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Routine Maintenance

Preventative Maintenance

The clutch supplied on this unit is a multiple disc clutch which requires little to no maintenance in normal use. Repair by you, the customer, is not recommended or warrantied.

CAUTION Never intentionally expose the clutch to liquids of any kind, especially oil. Doing so may damage the clutch.

If damage occurs, contact W.S. DARLEY PUMP DIVISION IMMEDIATELY. The clutch may need repair or replacing.

NOTE THAT THE WATER PUMP SYSTEM ON THE HMBC FIRE PUMP WILL STILL FUNCTION EVEN IF THE CLUTCH WILL NOT ENGAGE.

Replacement of Clutch

CAUTION ***REMOVE THE BELT FROM THE CLUTCH and COMPRESSOR ASSEMBLY BEFORE ATTEMPTING TO REMOVE THE CLUTCH, REFERENCE "BELT ADJUSTMENT AND REPLACEMENT" IN SECTION 3 OF THIS MANUAL. TWO to THREE SETS OF HANDS MAY BE REQUIRED TO REMOVE THE BELT AND/OR CLUTCH PROPERLY.***

Clutch Removal

The clutch and input drive shaft it is seated on a machined shaft surface to have a slight slip fit between the clutches bore and the shafts OD. Over time, grime and debris may get trapped between the two diameters causing slight difficulty in disassembly. A pry bar may be used to loosen the fit between the drive shaft and clutch bore. Using the outside edge of the pump gearcase as a fulcrum, the clutch can be pryed by pressing on the shoulder of the clutch bore or the outside face of the sprocket (closest to the shaft).

Once the clutch is removed, contact the W.S. Darley company for instructions on where to send the clutch to be replaced or repaired and be sure to give details of what needs to be done with your clutch.

Clutch Installation

To install the clutch onto the input shaft of the pump gear case:

1. Lube the shaft and the bore thoroughly with lube oil.
2. Slide the sprocket side of the clutch onto the input shaft while carefully lining up the clutch keyway with the shaft key.
3. Install the remaining parts to the shaft as shown in drawing DHC2330.
4. Refer to "BELT ADJUSTMENT AND REPLACEMENT" IN SECTION 3 OF THIS MANUAL FOR COMPLETION OF BELT INSTALL.

CAUTION **ALL BEARINGS WILL NEED TO BE REPLACED IF REMOVED. BEARINGS SHOULD NOT BE REUSED AFTER REMOVAL BECAUSE THEIR LIFE MAY BE CONSIDERABLY SHORTENED DUE TO THE REMOVAL PROCESS.**

CAUTION **NEVER ATTEMPT TO REPLACE PARTS AND REASSEMBLE THE CLUTCH TO THE SPROCKET ON YOUR OWN. THIS SHOULD BE DONE BY THE CLUTCH or PUMP MANUFACTURER. IF DONE INDIVIDUALLY, CONCENTRICITY BETWEEN THE SPROCKET AND THE CLUTCH BODY MAY BE INCORRECT AND AS A RESULT, PREMATURE CLUTCH FAILURE.**

CAUTION **NEVER ATTEMPT TO REMOVE THE SPROCKET ON YOUR OWN. DOING SO MAY VOID THE CLUTCH WARRANTY OR DAMAGE YOUR CLUTCH WHEN IT IS STILL IN REUSABLE CONDITION.**

CAUTION **NEVER ATTEMPT TO REMOVE THE SPROCKET BY PRYING ON IT BETWEEN THE CLUTCH BODY AND THE SPROCKET. YOU WILL DAMAGE THE CLUTCH OR THE SPROCKET BY DOING THIS.**

GENERAL TROUBLESHOOTING ISSUES

1. Check fuses and electrical power. If the circuit is fused, check that the fuse is good. If fuse is being replaced, be sure the proper type fuse is installed in accordance with the equipment manufacturer's specifications. If no specifications are available, see the section on ***Fuse*** for recommended fuse application.
2. If the fuse is OK, or if no fuse is in the circuit, verify that power is reaching the clutch. To operate correctly, the clutch must receive voltage + 10% / - 0% of the nominal rated voltage of the clutch coil.
3. Check for missing or damaged parts. If the clutch has been subjected to repair, removal, and reinstallation, check to see if the clutch has been reassembled correctly. Review the parts diagram included in this manual.

MAINTENANCE/REPAIR PROCEDURES

Fuse

If the circuit is fused, check the fuse condition. If the fuse is blown, replace with the same type/rating as specified by the equipment manufacturer.

If no specifications are given, use a fuse which will tolerate an inrush current approximating 135% of the nominal rating of the clutch coil.

NOTE: Always follow the manufacturer's recommendation for fuse replacement. The fuse protects upstream equipment in the machinery, not the clutch. Use the table on Page 12 ONLY if no manufacturer's instructions are given.

Clutch Voltage

Attach a voltmeter to the clutch with the power OFF. When power is applied to the clutch, it must be +10% and -0% of the nominal voltage rating of the coil. If sufficient power is not being applied to the clutch, full engagement and full torque transmission will not take place. Repair or replace power supply to assure good clutch actuation.

Residual Magnetism

Occasionally, after installation of a new or rebuilt clutch, the clutch may build up residual magnetism after the first few cycles, and fail to disengage properly when power is removed. This condition can be easily overcome by reversing the power leads to the coil, energizing the clutch momentarily, then restoring the leads to their original polarity. The clutch should now fully engage when power is applied, and fully disengage when power is removed from the coil.

Electrical Connections

Check that all electrical connections are properly made. There is no polarity to the clutch leads - either one may be considered positive (+).

AutoCAFS II - TESTING REFERENCE GUIDE

General: This reference guide is based on the Darley Model HMBC PTO Driven, Enduro 12 TS, AutoCAFS II package with an electric compressor clutch. This compressor system has a 220 CFM rating at 125 PSI and provides for automatic air pressure balancing.

INSTRUCTIONS:

1. *PREPARE COMPRESSOR FOR RUNNING TEST:*

1.1. The test technician should have available for reference and must be familiar with this HMBC 'OPERATING, MAINTENANCE, REPAIR AND TROUBLESHOOTING INSTRUCTION' manual, part number 1200625, before operating this unit.

1.2. The first step, before testing the system, is to make sure that all equipment has been properly installed. All air compressors related components should be clean and free of obstructions before installation. Follow installation instructions and component layout diagrams and verify correct installation.

1.3. Once this has been established be sure to have the correct oil type and proper oil level in both the compressor system and the water pump gear case.

1.3.1. Air Compressor - 32 Weight (Hydraulic air compressor oil) Ex: Phillips Magnus oil ISO VG 32 RX mineral oil (refer to SECTION 3 of this manual for further specifications) Fill the oil tank reservoir to the high level mark on the sight tube. Depending on total length of hoses, more oil may need to be added after the unit begins running and oil circulates throughout the system. WARNING: Oil separator tank is pressurized after compressor shutdown until system blow down is complete. Allow 2 minutes for system pressure blow down before opening the oil fill valve.

1.3.2. Clutch – 1 oz. of CAT 8T-9569 10W CAT TO-4 Oil.

CAUTION Do not overfill the oil reservoir. If the oil level is above the maximum level, the separator elements may not be able to handle the flow of air/oil mixture being supplied. The result may be an oily air discharge mist when the airflow valve is opened.

1.4. The water pump transmission requires SAE 80W - 90 GL4/GL5 gear lube oil filled to the proper level on, just below the oil level holes on the pump gear case..

2. *ADDITIONAL TESTING EQUIPMENT*

2.1. A calibrated 250 CFM air flow meter with valve must be installed on the air compressor reservoir outlet. A calibrated, 300-PSI gauge should be installed on the air flow meter.

3. *PREPARE THE PUMP FOR RUNNING TEST*

3.1. Prime and prepare the pump for water discharge. Begin rotating the pump with the engine at idle speed. RPM should be as low as possible when the air compressor is engaged. Turn on the air compressor by pressing and holding the

"On/Off" button on the AutoCAFS Commander for two seconds. The light next to the "On/Off" button will be illuminated. The compressor will now begin to build air pressure. Air pressure is controlled by pump pressure.

3.2. Observe the following precautions:

3.2.1. RPM should be as low as possible when air compressor is engaged. ***Warning: Never engage the air compressor at over 900 RPM.***

3.2.2. Allow 1 minute between compressor stop and start for system blow down.

3.2.3. Once compressor is engaged, do not exceed engine speeds of the set engine RPM under the AutoCAFS Commander CODES 314 and 315.

3.2.4. During all tests it is important to keep cool fresh water circulating through the water pump. Water flow from the pump is used to cool the air compressor oil using a brazed plate type heat exchanger.

3.3. Check to see that there are no oil or air leaks in the air compressor system. Do not proceed until all leaks are repaired. Check oil separator tank oil level. Shutdown compressor and adjust oil level as required.

3.4. Begin by raising the water pump pressure slowly to 75 PSI. The water pump should have a discharge valve gated slightly open to circulate water. Once again, check to see that all fittings are tight and no leaks are found. A leak can cause a malfunction in air pressure adjustment and control. Commonly leaks will cause air pressure to rise higher than attempted settings.

There are seven steps to perform to test the air compressor system.

- Ensure that all AutoCAFS Commander settings are correct
- Ensure that the "Maximum Compressor RPM" portion of "SECTION 3" of this manual has been visited and the AutoCAFS Commander is properly programmed to operate with your specific Compressor Sprocket Ratio and Truck PTO Ratio.
- Perform the calculations in SECTION 3 of this manual to note at what engine speeds you can expect a compressor OVERSPD warning from the AutoCAFS Commander and when you can expect the AutoCAFS Commander to disengage the compressor system due to Excessive OVERSPEED.
- If the AutoCAFS Commander does not follow the logic SECTION 3 "Compressor Disengagement RPM and Maximum Compressor RPM". Return to the "Maximum Compressor RPM" portion of "SECTION 3" of this manual. Your Commander is not programmed correctly.
- Pressure Limiting Valve Adjustment Setting
- Control Pressure Sensitivity adjustment
- Maximum Air flow test
- Temperature test
- Blow-down test

- Speed Calibration test

4. ***Pressure Limiting Valve Adjustment Setting – Reference drawing DCM1002***

4.1. This test is designed to set the maximum air pressure limiting control to 150 PSI. The water pump pressure determines how much pressure the air compressor will produce.

4.2. The water pump pressure must be increased to at least 160 PSI.

4.3. Open the airflow valve slightly. Flow approximately 40-50 CFM.

4.4. The pressure-limiting valve, normally bracket mounted to the pump discharge head, has a threaded adjustment screw with a locking nut to hold the setting in place. First loosen the lock nut. The threaded bolt must be turned in clockwise to raise the governed pressure and counter-clockwise to lower pressure. Adjust the air pressure to a governed maximum factory setting of 150 PSI. Tighten the lock nut.

4.5. Close the airflow valve to verify that the compressor stays at 150 PSI. Re-open the valve to flow over 100 CFM then close it again. Verify that the air compressor stays at 150 PSI.

5. ***Control Pressure Sensitivity adjustment – Reference drawing DCM1002***

5.1. This test is designed to set the sensitivity of the air pressure balancing system.

5.2. It is important to properly adjust the needle valve which is bracket mounted to the pump discharge head. The needle valve's function is to dampen the control pressure bleed off line, reducing modulator sensitivity. As a result, the inlet valve will respond slower to pressure change thus reducing modulator pulsation. If it is set too far in or closed (clockwise rotation) no pressure modulation will take place. If it is open too far (counter-clockwise rotation) pressure fluctuations will go unnoticed and pressure spikes are then unavoidable. For example: When a CAFS discharge is closed at the nozzle, pressure may build until the pressure relief valve releases at 200 PSI. Should the needle valve need adjustment, use the following as a guide. Start by closing the valve (4) completely. Then open it approximately 3 turns. Operate the unit at around 125 PSI; begin by flowing about one third the capacity of the air compressor. At this flow rate, the air inlet modulator valve will open to bring in air and then close as air pressure builds. The goal is to set the needle valve at a position where pressure fluctuations are minimized. If the air pressure gauge is fluctuating more than 20 PSI above or below the water pressure, then the needle valve should be adjusted out or counter-clockwise. As the pressures come closer to balancing, less flow meter fluctuation should also be noticed. Note: Some pressure modulation is normal and required for the system to auto-balance while delivering CAFS. Expect pressure variation to range from 5-20 PSI. Pressure fluctuations should be pulsing at the beat of at least one per second but no more than 20 in a ten second period.

6. ***Air Flow Test***

The Air Flow test is performed to verify that the system can flow at least 220 CFM of air at 125 PSI.

6.1. Note: the water pump will commonly need be flowing at least 500 – 1000 GPM to keep both the air compressor and the water pump both operating at 125 PSI.

6.2. To test the airflow capability of the unit start by running the pump at approximately 140 PSI. The desired goal is to try to find the lowest RPM required flowing 220 CFM and at least ~440 GPM or higher all while both the air compressor and the water pump are at 125 PSI. Commonly water flow is required to be higher than 450 GPM due to the necessary reduction of the pressure of the pump. Open at least two of the pumps 2-1/2" discharges until the water pump pressure is 125 PSI. Begin to flow air by opening airflow valve until the air pressure begins to drop below 125 PSI. Slowly close air discharge valve raising air pressure back to 125. This will be the maximum airflow of the unit at this RPM. If the airflow is not at least 220 CFM, higher rpm may be needed to attain this rating.

6.3. Record air and water flow and pressure along with input rpm and power requirement on the pump test sheet.

7. ***Operating Temperature test***

The operating temperature test can be performed during the maximum airflow test.

7.1. To test the operating temperature of this system you will need to operate the air compressor at over 150 CFM at 70-75 degrees F ambient temperature for at least 10 minutes, to check that the thermostatic valve in the oil filter assembly is working properly. The lubricating/cooling oil in the oil reservoir, if 170 degrees F or less, travels through the oil filter before going to the air compressor. If the oil temperature is higher than 170 degrees F a thermostatic valve in the oil filter mounting block will redirect the flow of oil through the heat exchanger before entering the opposite side of oil filter housing and then onto the air compressor.

7.2. The oil temperature should not exceed 170 degrees F by more than 20 degrees or it may indicate a limited flow, or high temperature water flow through the heat exchanger. There is a high temperature overheat warning message for both the air compressor and the clutch on the AutoCAFS Commander.

7.3. Observe and Record compressor temperature on test sheet.

7.4. Using infrared temperature sensor, measure clutch temperature. Normal temperature range is 110-125°F. The upper limit is 135°F.

7.5. Using infrared sensor measure outboard pump bearing cap. Normal temperature range is 180-200°F. The upper limit is 210°F.

7.6. Observe fan to confirm airflow direction is from rear screen opening forward over clutch and belt.

7.7. If compressor temperature rises above normal operating temperature to 212°F, the Compressor COMP HOT warning will flash on the Commander display. If temperature warning is indicated, shut down the compressor as soon as practical by depressing the "On/Off" button for 2 seconds. The compressor can be switched off (DISENGAGED) at any time or input speed. Check for adequate water flow through heat exchanger. Check for adequate oil level in separator tank. See trouble-shooting guide for further options.

⚠WARNING ***If compressor temperature continues to rise to 240℉, the compressor will be automatically disengaged.***

8. *System Blow-Down*

8.1. After compressor shutdown, system pressure is bled off to guard against overloading drive components at startup. If the receiver assembly is not depressurized on shut down, oil will flood the compressor filling the area above the screws. Oil trapped above the screws will then cause a hydraulic lockup when compressor rotation rapidly accelerates during startup. A hydraulic lockup of this type can induce extreme loads on the power train. Refer to Instruction manual for detailed explanation of blow down process.

8.2. After compressor clutch disengagement, observe test gage mounted on the separator tank below the safety relief valve. Record time it takes for system pressure to bleed down to 0 psi. System should blow down in 1 minute or less.

8.3. Confirm that the clutch exhibits minimal drag when disengaged. With the pump idling and the clutch disengaged, observe that the compressor belt is not moving.

9. *Speed Protection*

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9.1. Speed control is included in the compressor engagement circuit. The AutoCAFS Commander has been calibrated by the apparatus manufacturer to allow compressor engagement only at engine speeds below 900 rpm and allows for a maximum compressor operating speed. RPM signal for the speed control needs to be wired to the data bus. Refer to Section 4 of this manual for further details on the AutoCAFS Commander Control module.

9.2. To verify complete system; switch off compressor ENGAGED switch, raise engine RPM above 900 RPM, switch compressor on; the clutch connector should not be energized. Reduce engine throttle to below 900 RPM; clutch connector should be energized. Raise RPM to above high limit and power to connector should be de-energize. Reduce RPM and power should remain off until RPM is below the low limit set point and blow down is achieved. Adjust if required using the AutoCAFS Commander programming procedure as a guide.

9.3. Shut down pump and engine.

⚠CAUTION ***Avoid immediate restart of compressor after shutdown. Allow a 1-minute minimum time period between compressor shutdown and restart for system blow–down.***

10. If the unit being tested has performed as stated and conforms to the test requirements then the system is ready for delivery.

11. After shutdown, thoroughly drain water from compressor heat exchanger and feed lines.

12. Visually inspect belt for adjustment and tracking. Belt adjustment can be checked by pushing a 1/8-diameter rod through the cover perforations on the middle of the belt span with. As a guide, a 22-pound force in the middle of the belt span should deflect the belt approximately 3/16 inch.

13. Confirm that all control tubes are bundled and wire tied in a neat and orderly fashion.

Detailed Specifications

When preparing specifications for a new Compressed Air Foam equipped apparatus, use the following technical specifications to assure that your apparatus will be equipped with the most advanced CAFS system available; Darley AutoCAFS II.

SINGLE STAGE FIRE PUMP - CAFS COMPATIBLE

The pump shall be a Darley HMBC single stage fire pump, capable of a water flow rating from 250 to 500 GPM.

Power to drive the pump shall be provided by the same engine used to propel the apparatus. The pump shall be mounted in a location permitting ideal or acceptable driveline angles from a PTO.

The pump casing shall be a fine grain cast iron or bronze alloy, vertically split, with a minimum 30,000 PSI tensile strength and bronze fitted.

The pump shall contain a cored heating jacket feature that, if selected, can be connected into the vehicle antifreeze system to protect the pump from freezing in cold climates.

The impeller shall be a high strength bronze alloy of mixed flow design, accurately balanced and splined to the pump shaft for a precision fit and durability. The impeller shall feature a single suction inlet design with a single volute cutwater.

The seal rings shall be renewable, double labyrinth, wrap around bronze type.

The pump shaft shall be precision ground stainless steel. The shaft shall be splined to receive broached impeller hubs, for greater resistance to wear, torsional vibration, and torque imposed by the engine.

The bearings provided shall be heavy duty, deep groove, radial type ball bearings. They shall be oversized for extended life. The bearings shall be protected at all openings from road dirt and water splash with oil seals and water slingers.

The transmission case shall be a heavy-duty cast iron casting with adequate oil reserve capacity for low operating temperatures. The transmission case shall contain a magnetic drain plug for draining the gear case oil. The transmission case shall have an oil level/fill location for checking and/or filling the oil of the gear case through its opening.

The pump driveshaft shall be precision ground, heat-treated alloy steel. Gears shall be a helical design, and shall be precision cut for quiet operation and extended life. The gears shall be cut from high strength alloy steel, carburized, heat-treated and ground. The pump and apparatus manufacturer's Engineering Department shall select the gear ratio of the pump.

Due to the advantages of the above gear and drive feature, chain drive and designs requiring additional lubrication are not acceptable.

A discharge manifold, as supplied as part of the pump by the pump manufacturer in certain versions of the pump, shall include a discharge check valve assembly to allow priming of the pump from draft with discharges open and caps off. No exception.

Due to the importance of the above discharge manifold and check valve assembly, intended to be included with the overall pump design, there shall be no exception allowed to this requirement.

Discharge outlets shall have extensions with flange openings to allow ease of service. Two ports shall be provided on a pump panel for testing of vacuum and pressure readings. A weather resistant Performance Data Plate shall be installed on a pump panel.

The pump priming system, discharge and suction valves, relief valves, pump, and master drain shall be as detailed elsewhere in these specifications.

One manual covering the fire pump, pump transmission and selected options of the fire pump shall be provided with the apparatus.

CAFS COMPATIBLE

The pump transmission shall be designed to accommodate an integrated, air compressor mounting bracket. This bracket shall be installed to properly align a rotary screw air compressor with an external sprocket driven off of the input shaft of the pump transmission.

The air compressor shall be driven using a Gates “Poly Chain GT” belt drive system.

The air compressor drive sprocket shall be supplied with an electric, wet, sealed type, multi plate, industrial clutch providing engagement at idle and disengagement at any rpm. The AutoCAFS shall be supplied with the “Commander” control and instrumentation system. The AutoCAFS Commander display shall include a digital air pressure, oil temperature, and RPM display. A mode button can be used to display air flow (if so equipped), and total air compressor system hours. The system also provides electronic protection to prohibit air compressor engagement if engine rpm is higher than recommended and also features blow down protection.

AutoCAFS - COMPRESSED AIR FOAM SYSTEM

Description: This fire apparatus shall be equipped with a high-energy, automatic compressed air foam system (AutoCAFS).

Ratings: The fire pump and air compressor shall be sized to provide at least 220 CFM (cubic feet per minute) of compressed air while simultaneously flowing at least 440 GPM (gallons per minute) of water flow. The pressure of the system shall be set at 125 PSI for the duration of this test as outlined in the NFPA document 1906. This rating is consistent with the NFPA recommendation that the water pump shall discharge two gallons of water for every one CFM of compressed air discharge. Fire pumps with UL ratings in excess of 1000 GPM commonly flow near capacity while simultaneously operating the air compressor at full output.

Components: The air compressor shall be a high quality, industrial rated, modulating, continuous duty, and of rotary screw design. The air compressor shall be mechanically driven by the main pump and shall be so designed as to provide optimum performance at 70% of rated engine RPM. Air compressor drive train shall provide a means to engage and disengage the air compressor as required.

The air compressor system shall include a pressurized oil lubrication system, oil reservoir with receiver/separator element, oil filter, inlet air filter, and modulating air inlet control. The air compressor shall be provided with a pressure control system to automatically balance air pressure to water pressure. The air compressor inlet valve shall open and close to provide the airflow desired while maintaining the air system pressure to water pump pressure to within 5 PSI differential. This balancing system is essential for safe operation of a compressed air foam system.

The air compressor lubrication system shall require cooling water to be supplied from the fire pump through a brazed plate type heat exchanger to cool the air compressor oil. The water flow to this oil cooler shall be supplied using a flushed strainer system to ensure a consistent flow of cooling water. The oil temperature shall be thermostatically controlled to remain at a consistent operating temperature within a range from 170 °F to 180 °F.

Panel Mounted Controls: The air compressor system shall have mounted on the operators control panel an AutoCAFS Commander control that displays all pertinent CAFS information including Air compressor pressure, CAFS oil temperature and system RPM. The Commander also provides the necessary temperature warning and shut down, RPM protection, and blow-down related safety systems.

Gauges and controls shall be positioned and clearly marked so as to provide simple and easy operation.

Each of the components of this Automatic Compressed Air Foam System - (air compressor, drive system, foam proportioner, control and instrumentation system) shall be sized, driven, and installed to produce a well operating and reliable CAFS unit.

The compressed air foam system (AutoCAFS) shall be completely installed and tested by the fire pump manufacturing facility before delivery. No exceptions.

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