Operator's Manual Table of Contents For Darley Midship Type EM Fire Pump

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

This manual is for DARLEY FIRE PUMP:

Model: **EM** Pump Serial Number: _____

Description of Pump Type

The **Type EM** pump is a high speed, two stage, centrifugal pump, designed to operate with its two impellers in series as a two stage pump, or in parallel with the characteristics of a conventional single stage pump.

The pump is operated in series at restricted capacities for higher pressures, or lower engine speeds. Parallel operation is employed for maximum capacities at lower pressures.

If a two stage pump operating in parallel is switched to series and the capacity reduced by one half, and the engine speed kept the same, then the output pressure will be approximately doubled.

OPERATION AND MAINTENANCE OF TYPE EM FIRE PUMP

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

Lubrication

Keep the gear case filled with oil to the level of the oil level plug, which is marked on the pump gear case.

Check the oil level every 25 hours or every 3 month, and change it every 50 hours or 6 months.

Use 80W/90 gear lube oil - not grease - in the pump transmission.

CAUTION: Do not overfill.

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

Operation of Pump

The pump gear shift consists of a sliding clutch gear splined to the transmission shaft which can be moved forward to engage the pump clutch gear or to the rear to engage the rear drive shaft connected to the truck drive axle. A neutral position is half way between.

The sliding clutch gear is moved either by direct mechanical linkage from a shift lever, or air powered cylinder controlled by a selector switch. The shift lever must be moved all the way and locked into either ROAD position to drive the truck, or PUMP position to power the pump.

The truck clutch must always be disengaged to stop the rotation of the truck transmission output shaft before shifting into either ROAD or PUMP gear to prevent clashing and damaging the gear teeth. With the manual shift lever, a butt tooth position of gears may be encountered occasionally preventing engagement. If this occurs, move pump shift lever to neutral (half way) position, engage truck clutch momentarily, then disengage the truck clutch and try to shift the pump again.

The pump is always operated with the truck transmission in direct (high) gear, such as 4^{th} on a 4-speed, or 5^{th} on a 5-speed manual transmission, and D or 2.5 on an automatic transmission.

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

Series Parallel Control Valve

A single control lever transfers operation of the pump from SERIES to PARALLEL. When this lever is in position marked “CAPACITY”, the pump is in parallel, and should be operated in this position for maximum flow at normal pressures. The position marked “PRESSURE”, sets the pump for series operation, which gives maximum pressure at reduced capacity (or flow). The lever must be moved all the way into each position. When moving from “CAPACITY” to “PRESSURE”, water flow must be stopped to permit suction check valves to close. Move the control valve lever frequently to maintain freedom of travel.

WARNING: Do not use this pump for hose testing.

Pump Division
1051 Palmer St.
Chippewa Falls, WI 54729
715-726-2650

Technical Bulletin on Midship Mounted Fire Pump Drivelines

1202519

FEB, 25 2016

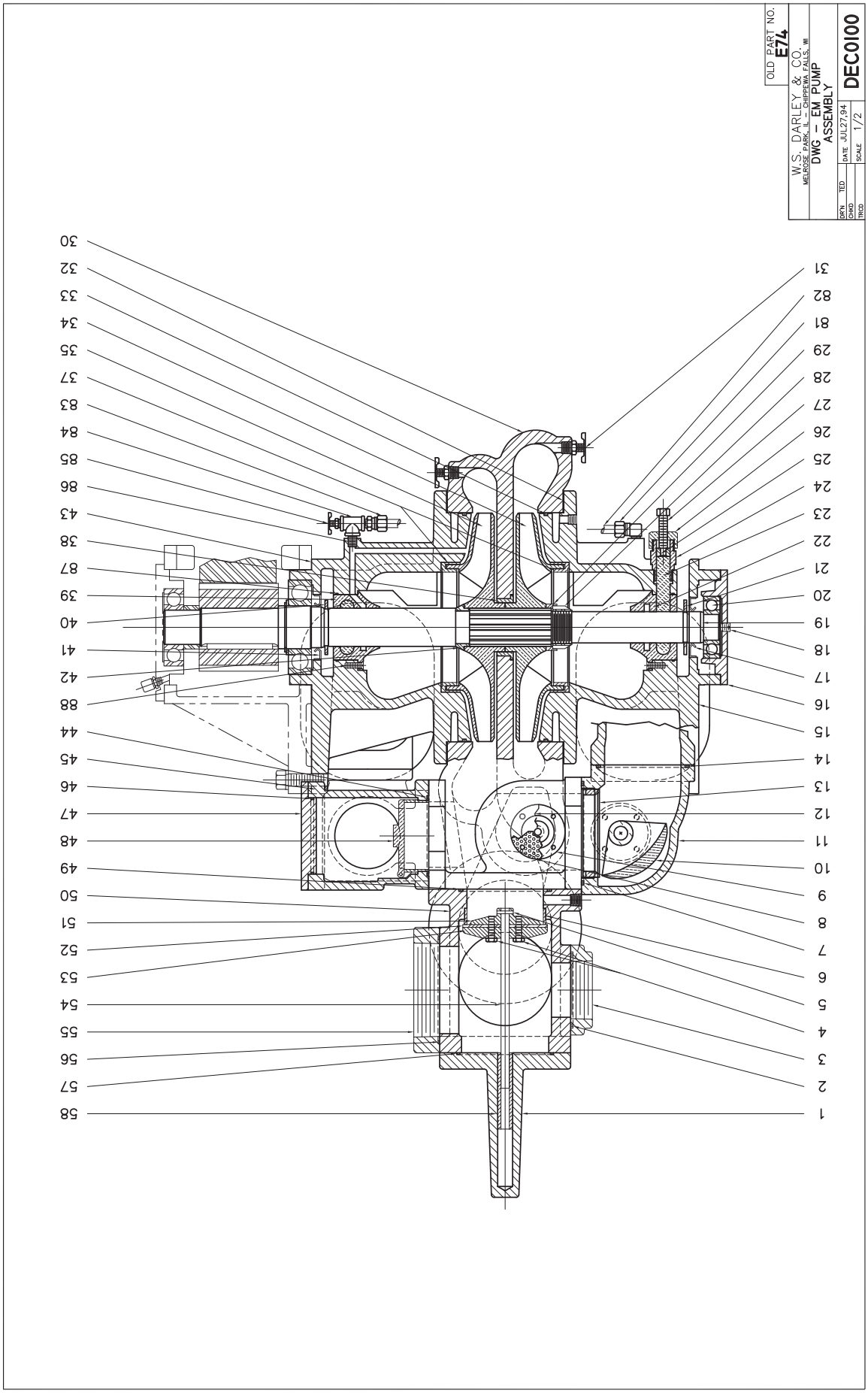
The driveline torque rating is 19,230 lb-ft (26,072 Nm) – exceeding this torque rating can result in a driveline failure.

Great care must be taken in the layout of pump drivelines. Interference and driveline vibration must be considered. An experienced installer with knowledge of driveline considerations, proper layout and recommended guidelines should be utilized as well as proper CAD systems for driveline layouts. Installation of the driveline should not occur until a proper analysis is performed by either a qualified driveline specialist or W.S. Darley. W.S. Darley utilizes, can distribute and can train qualified individuals to use the Allison Multiple Joint Driveline Analysis program.

W.S. Darley requires that midship driven pumps have at most 500 radians per second^2 torsional vibration, at most 1000 radians per second^2 inertial drive torsional vibration and at most 1000 radians per second^2 inertial coast torsional vibration, as calculated by the Allison Multiple Joint Driveline Analysis program, for a completed driveline installation. A completed driveline installation includes the entire multi-driveshaft assembly from the power source on apparatus transmission output flange to the input flange of the rear axle.

Failure to design and analyze a proper driveline layout could result in severe injury and damage to equipment, including but not limited to: the water pump, the water pump transmission, drive tubes, hanger bearings, u-joint crosses, gears, the rear differential, and the main truck transmission.

Questions can also be directed to our Customer Service Department at 800-634-7812 or 715-726-2650.


OLD PART NO.
E74
W.S. DARLEY & CO.
MELROSE PARK, IL - CHIPPEWA FALLS, WI
DWG - EM PUMP
ASSEMBLY
DEC0100
DRN TED
CHKD
TRCD
DATE JUL27,94
SCALE 1/2
1
2
3
4
5
6
7
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11
12
13
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15
16
17
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19
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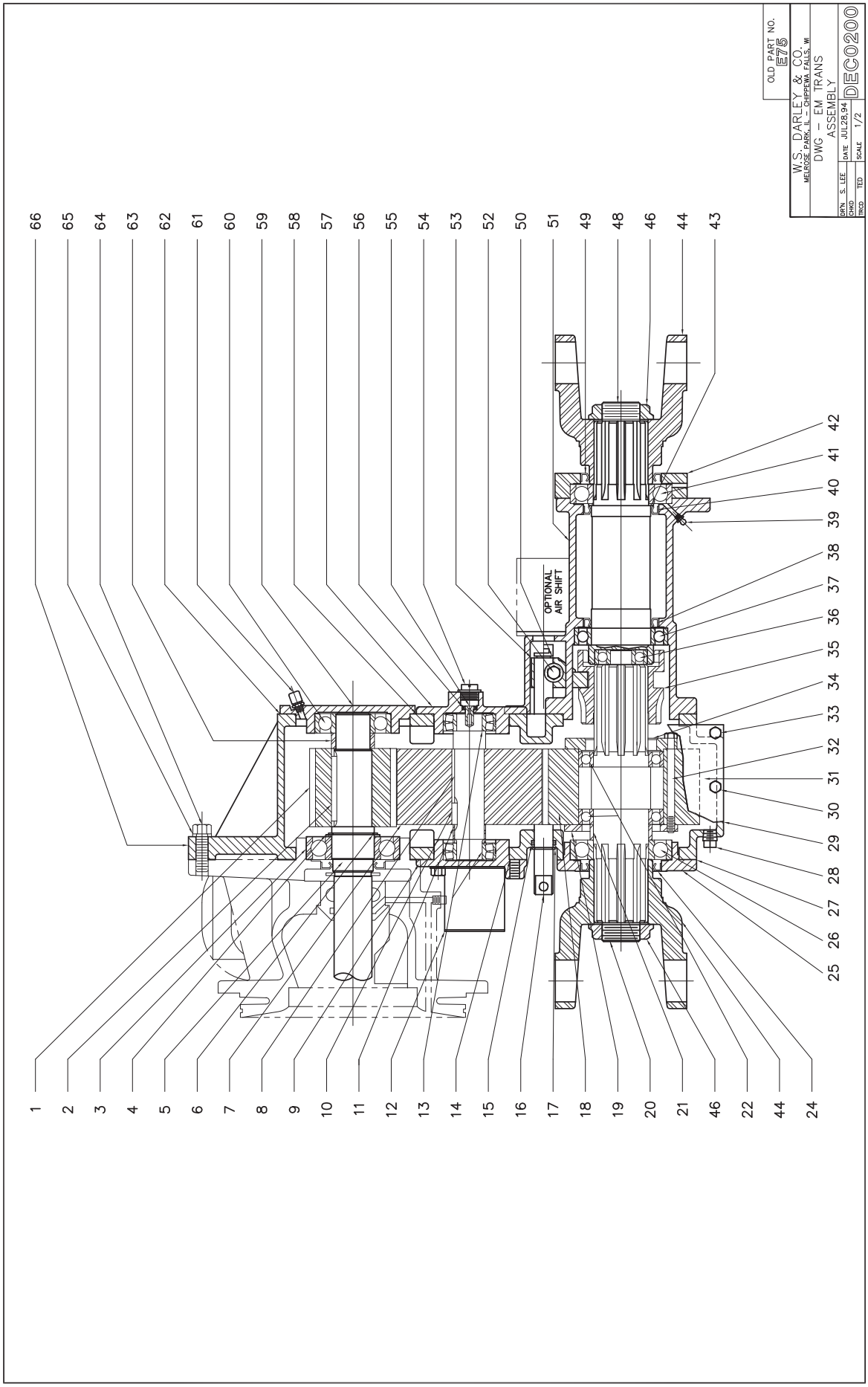
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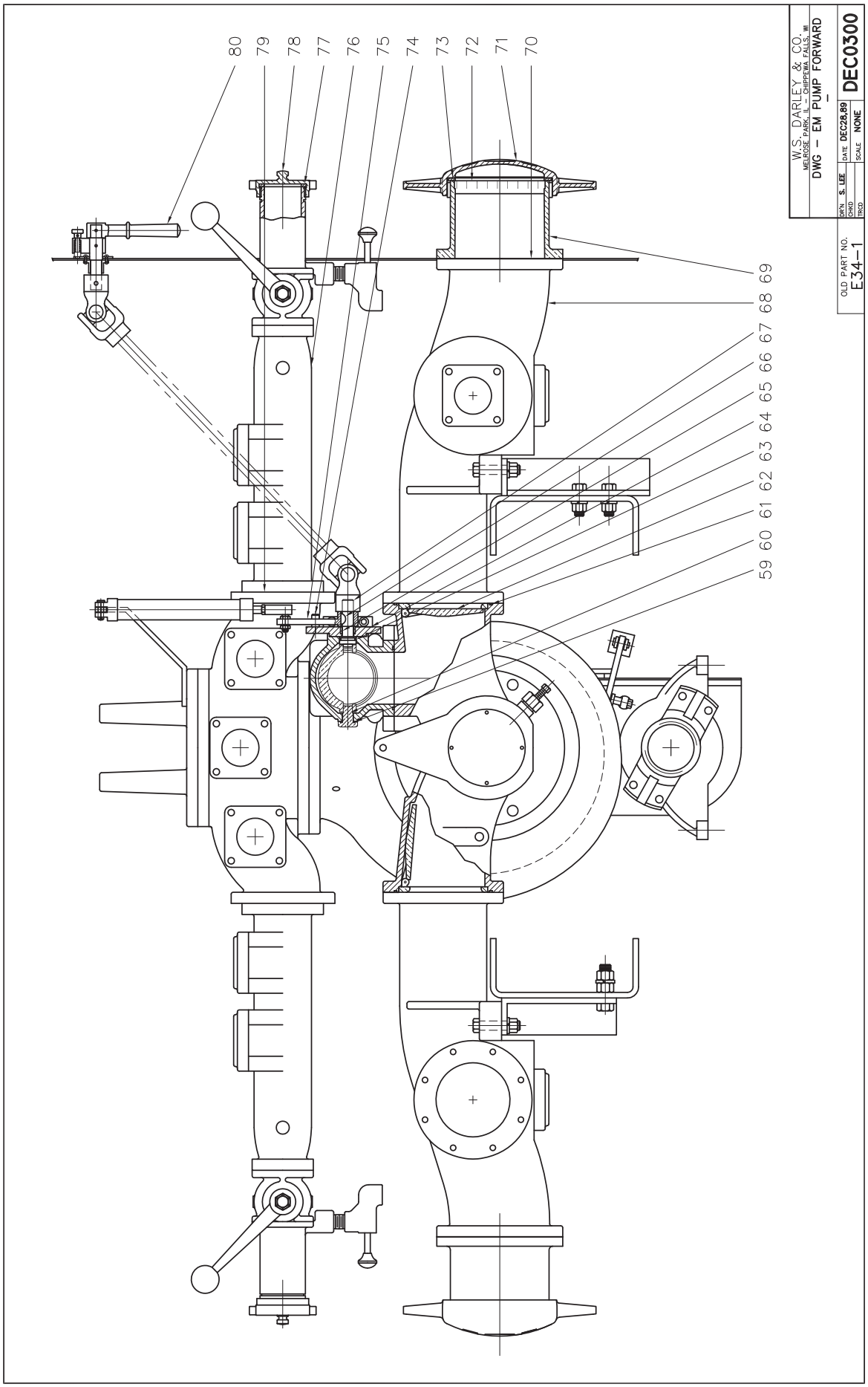
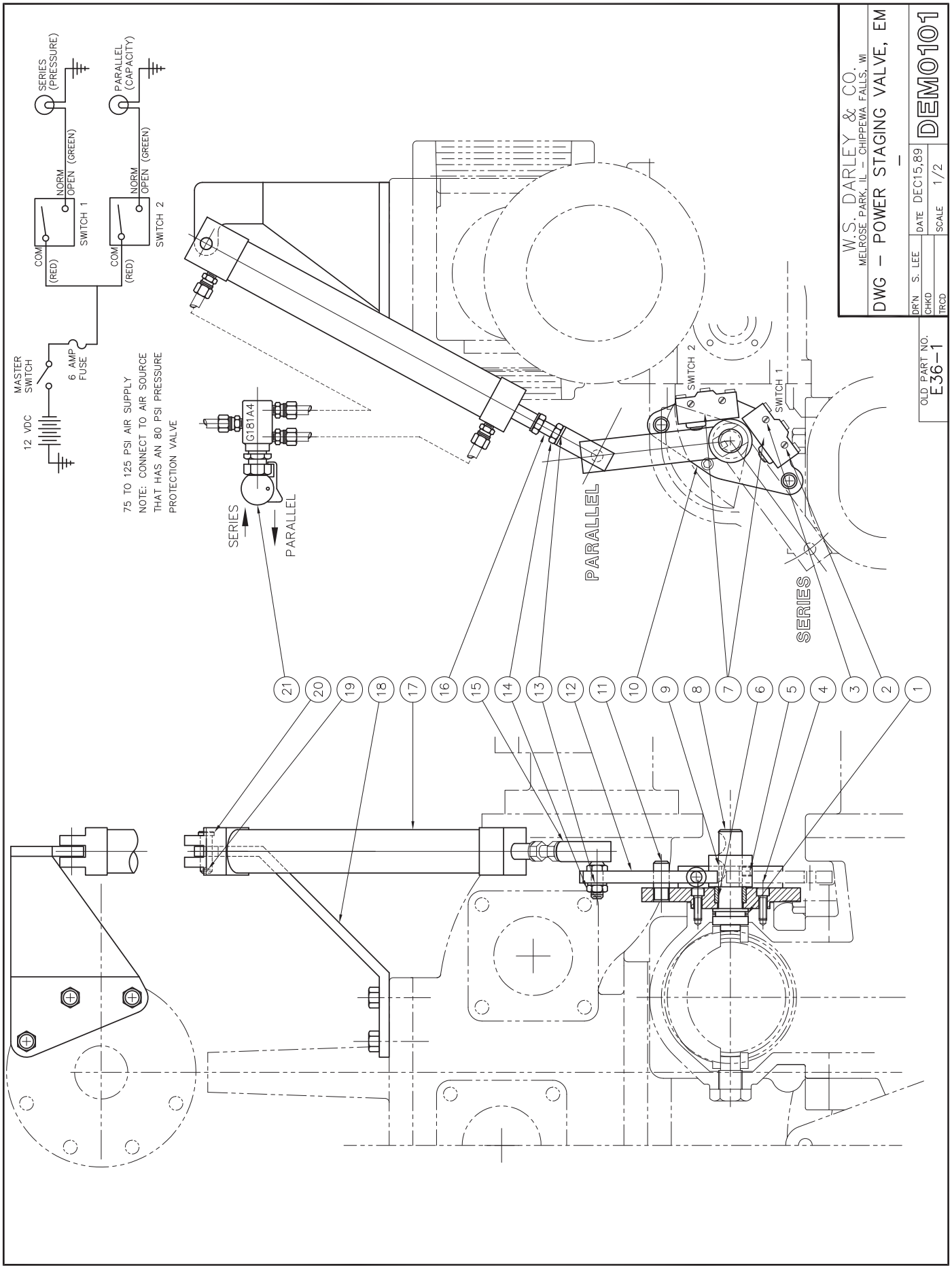
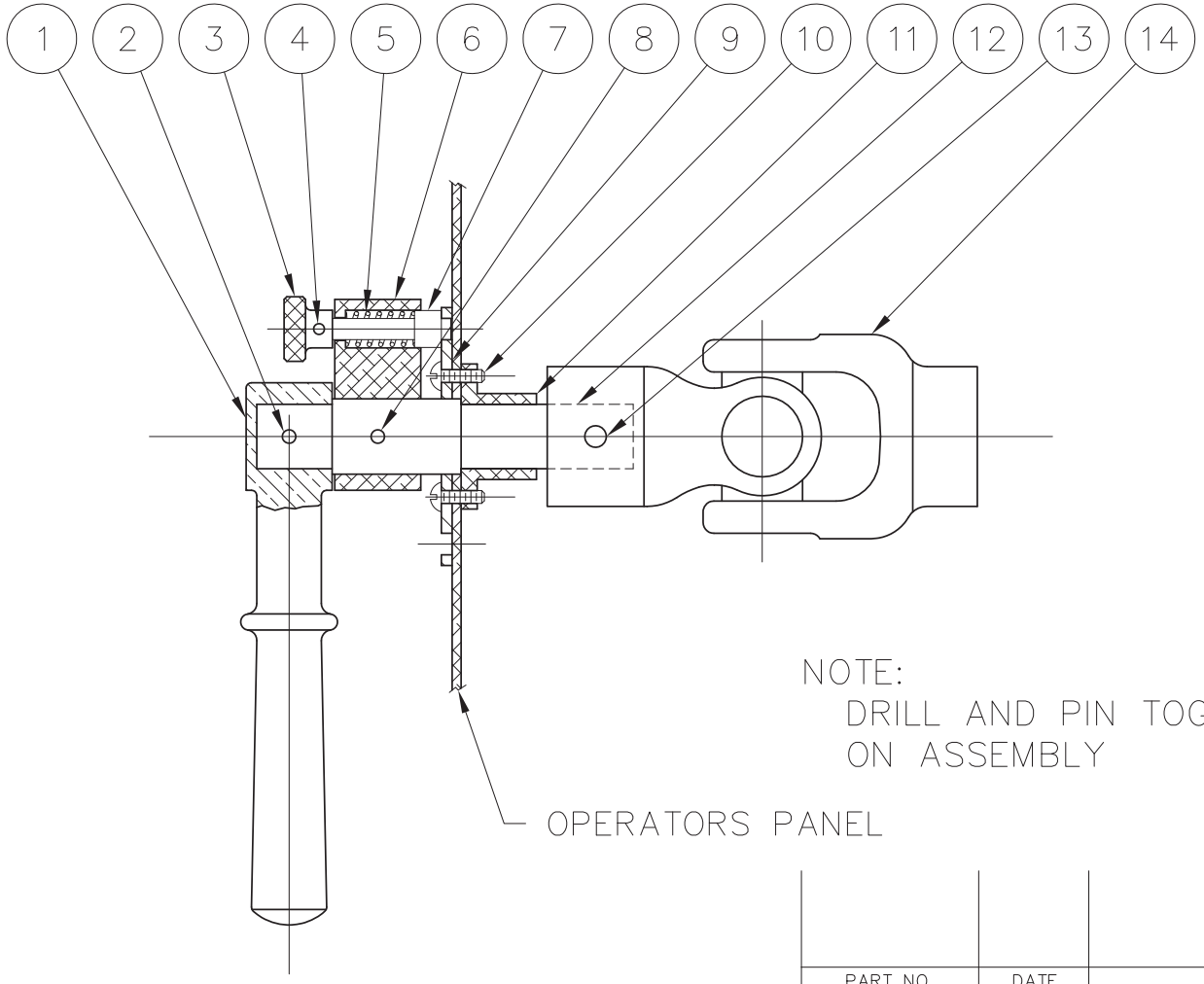
E75
W.S. DARLEY & CO.
MELROSE PARK, IL - CHIPPEWA FALLS, WI
DWG - EM TRANS
ASSEMBLY
DEC0200
DRN S. LEE
CHKD
TRCD TED
DATE JUL 28,94
SCALE 1/2
OPTIONAL AIR SHIFT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 46 22 44 24
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 50 51 49 48 46 44 43


80 79 78 77 76 75 74 73 72 71 70
69 68 67 66 65 64 63 62 61 60 59
W.S. DARLEY & CO.
MELROSE PARK, ILLINOIS
DWG – EM PUMP FORWARD
DRN S. LEE
CHKD
TRCD
DATE DEC28,89
SCALE NONE
DEC0300
OLD PART NO.
E34–1


W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI
DWG – POWER STAGING VALVE, EM –
DEM0101
DR'N S. LEE
CHK'D
TRC'D
DATE DEC15,89
SCALE 1/2
OLD PART NO. E36–1
SERIES (PRESSURE)
PARALLEL (CAPACITY)
NORM OPEN (GREEN)
SWITCH 1
SWITCH 2
COM (RED)
MASTER SWITCH
6 AMP FUSE
12 VDC
75 TO 125 PSI AIR SUPPLY
NOTE: CONNECT TO AIR SOURCE THAT HAS AN 80 PSI PRESSURE PROTECTION VALVE
G181A4
SERIES
PARALLEL
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1



PART NO.	DATE	CHANGE

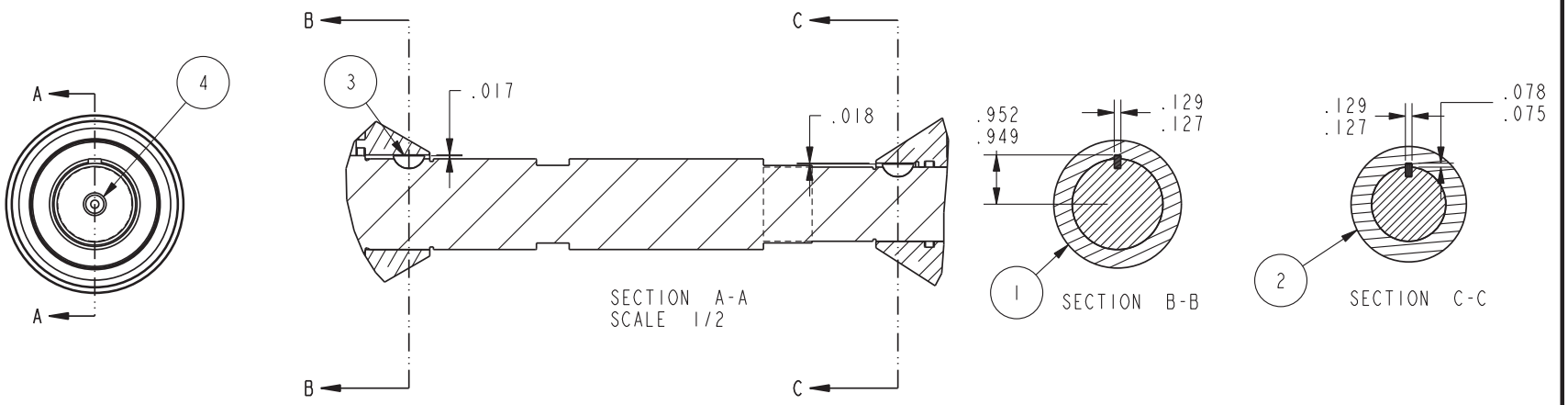
	OLD PART NO. G2304	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI	
MATERIAL: ASSEMBLY NO. AA00218 (G52A4)	MATERIAL NO. –	PATTERN NO.	DWG – LEVER, STAGING CONTROL –	
		DR'N S. LEE	DATE MAY31,89	DGC1100
		CHKD		
		TRCD	SCALE 1/2	

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NO.	DESCRIPTION	PART NO.	QTY.
1	HSG - MECH SEAL, EM, BACK, IN	1844000	1
2	HSG - MECH SEAL, EM, BACK, OUT	1844001	1
3	KEY - WOODRUFF, 405	3602202	2
4	SHAFT - PUMP, EM, MECH SEAL	5001207	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL NAME	MDL CREATED	SHEET	
DEL0100	14MAY99	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.
MELROSE PARK, IL - CHIPPEWA FALLS, WI

DWG - EM PUMP, MECH SEAL LAYOUT

DR'N WMW

CHKD - - -

TRCD

DATE 14-Feb-00

SCALE 1/8

DEL0101

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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.

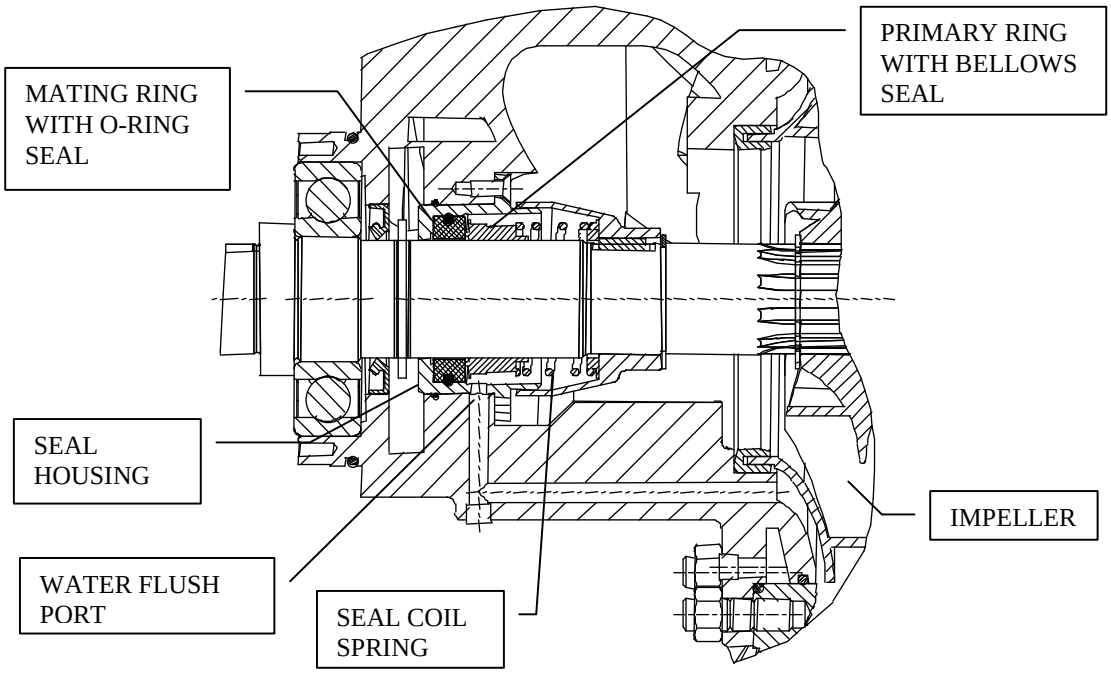
Mechanical Seal Basics

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.**

DARLEY

INSTALLATION OF MECHANICAL FACE SEAL WITH O'RING

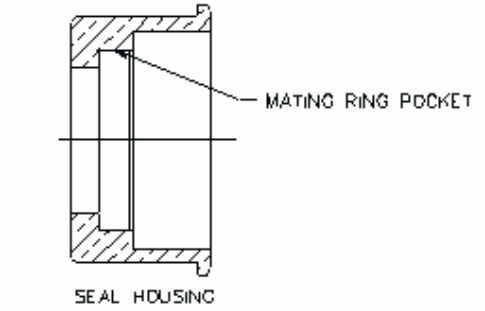
SPECIAL HANDLING

Study the engineering layout before installing the seal. This shaft seal is a precision product and should be handled and treated with care. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area where the assembly will take place. Clean hands prior to assembly.

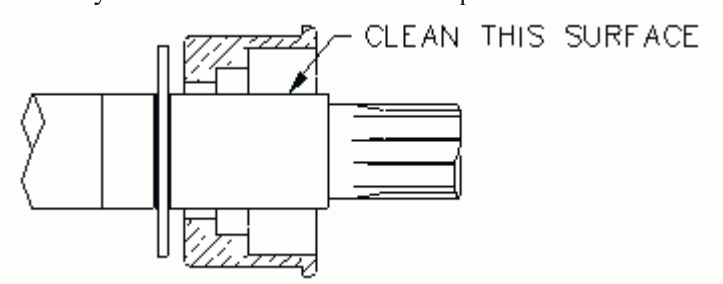
INSTRUCTION STEPS:

Instructions for Installing a Mechanical Shaft Seal

1. Inspect mating ring pocket in seal housing ensuring it is clean, free of chips, and nick free, to provide a proper sealing surface. Isopropyl alcohol may be used to clean the surfaces if required.

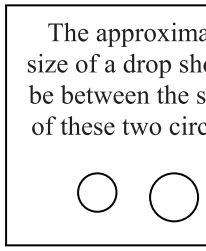


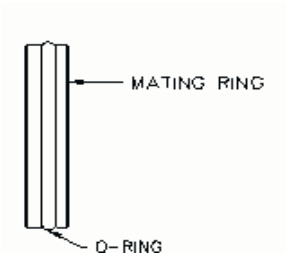
2. Inspect the pump shaft surface under the bellows, ensuring it is clean and nick free to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

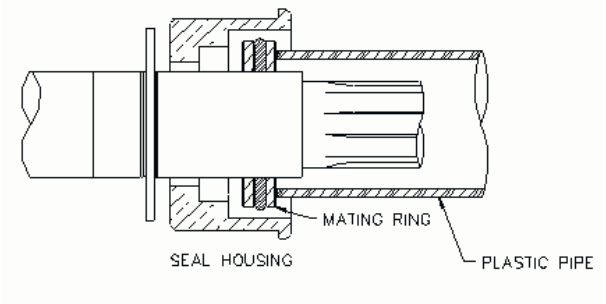


3. Lightly lubricate the o-ring on the mating ring with a single drop of P-80 water soluble rubber lubricant (do not over lubricate) and push it into the cavity using the recommended installation tool or other suitable plastic tube free of contaminants, firmly seating the mating ring square.
   Note: The polished face of the mating ring must face out – away from the pump's gear case. Try to not touch the polished sealing face with your fingers; the oils from your fingerprint can cause the seal to leak. Remove any P-80 from the sealing face after installation.

The approximate size of a drop should be between the sizes of these two circles.





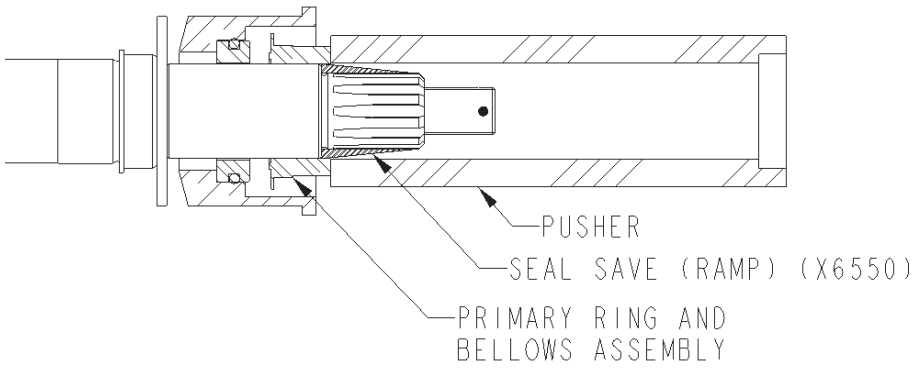


4. Clean the mating ring surface with isopropyl alcohol to remove any fingerprints and any other contaminants left on mating ring.

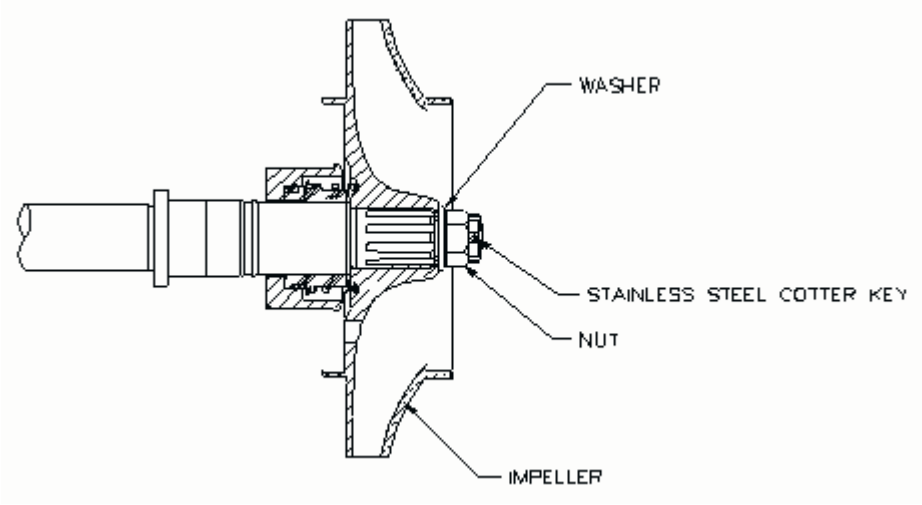
Note: Steps 5 – 9 need to all be completed with in 15 minutes or less.

5. Apply a small drop of P-80 rubber lubricant or water-soluble lubricant (not soapy water) to the inside diameter of the bellows assembly allowing it to be pushed easily into position.
6. Clean the polished sealing face of the primary ring with a clean lint free rag with isopropyl alcohol to remove all fingerprints and other contaminants.
7. Slide a seal save, similar to X6550, over the shaft splines to ensure that the seal is not damaged during installation. Place the primary ring and lubricated bellows assembly (without the spring) on the shaft, using a proper pusher - push the assembly into position so that the seal surfaces are in contact. Remove the seal save from the shaft.

The approximate size of a drop should be between the sizes of these two circles.



8. Put the spring in place, seated tight against the spring retainer on the primary ring.
   Note: Some springs may be slightly tapered, so one end fits the seal better than the other. The end of the spring that best fits the seal should go towards the seal to ensure even spring pressure all the way around.
9. Slide impeller onto impeller shaft, engage the spring into the groove of the impeller hub and install impeller washer, impeller nut, and stainless steel cotter key.



*** Reference pump configuration for individual mechanical seal instructions.*
*** Reference pump assembly drawings and pump assembly tips for further assembly.*

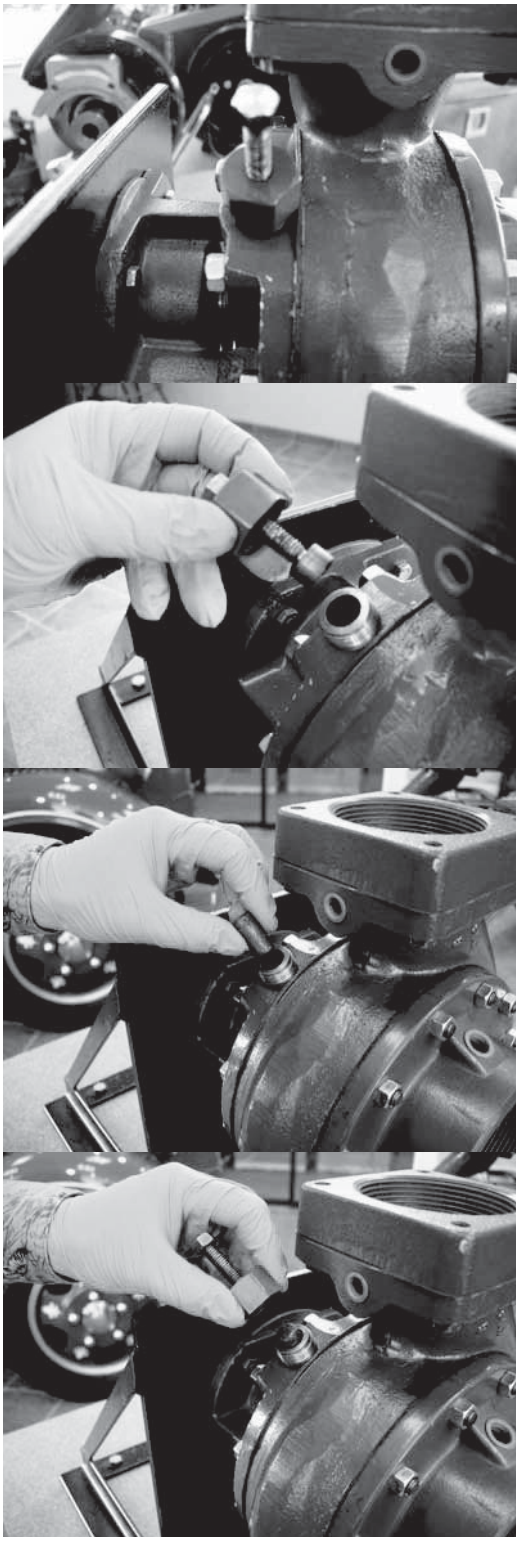
Note: If the seal leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out excess lubricant and other contaminants.

Once a mechanical seal has been installed, it is recommended that it not be reused.

If further information is needed, call **DARLEY** in
Chippewa Falls, WI. at 800-634-7812 or 715-726-2650

W. S. DARLEY & CO.

DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT



⚠ Prop 65 Warning: This product contains lead, a chemical known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

⚠ Caution: Do not attempt to use anything but Darley injection packing. Using the wrong packing material in your pump may cause catastrophic failure of the pump shaft sealing components.

Only use W.S. Darley & Co.'s plastallic injection packing material. It is made of a special composition of shredded fibers, and a special bonding and lubricating compound.

It is important that the stuffing box is completely filled solid with packing and compressed firm during adjustment to prevent formation of voids and excessive leakage.

To pack the stuffing box when empty and assembled in the pump, remove the packing screw and nut assembly, and insert pellet form packing into the packing plunger guide. Replace the packing screw assembly and use a hand speed wrench to force the pellets into the gland. DO NOT USE A POWER TOOL! Repeat pellet additions while turning the impeller shaft by hand until resistance to turning is felt when the stuffing box is almost full. Continue turning packing screw by hand using a standard 6" long 9/16" end wrench until 4 lb. of force is felt at the end of the wrench. This is equivalent to 2 ft-lb or 24 in-lb torque. Continue turning until a few flakes of packing are extruded out the opening between the impeller shaft and the stuffing box hole. The gland is now ready for pressure testing or pumping.

After priming the pump with water, start the pump and raise the discharge pressure to 50 psi. Tighten the packing screw using a 6" long 9/16" end wrench until 4 lb. force is felt at the end of the wrench (24 in-lb torque). Continue operating the pump at 50 psi for 5 minutes to dissipate packing pressure against the shaft and permit cooling water to flow between the shaft and stuffing box hole. Make sure that water actually does come through before operating pump at any higher pressure. The normal drip rate may vary between 5 and 60 drops per minute.

Operate the pump for 10 minutes at the highest normal operating pressure flowing sufficient water to prevent overheating. Do not run the pump blocked tight. Lower discharge pressure to 50 psi and repeat the packing screw tightening procedure outlined above.

The pump may now be operated for any time period required within its rated capacity. However, the drip rate should be monitored more frequently during the first few hours, and adjusted if necessary to achieve a stable flow rate. Several more adjustments may be required.

For a list of approximate quantity of packing pellets required by model (completely repacked), see below:

Model	Approximate # Packing Pellets
A	
2BE	
EM	
H	
JM	
KD	
KS	
LD	
LS	
P	
U2	
U4	

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

SUMMARY OF THINGS TO REMEMBER

1. Always shift pump clutches with engine clutch disengaged.
2. Do not clash clutch gears when shifting.
3. Close booster valves, drain valves, cooling line and third stage discharge valve before attempting to prime the pump.
4. Always keep primer shut-off valve closed, except while priming.
5. Re-open and close primer valve to re-prime or eliminate trapped air from suction line.
6. Always drive a midship mounted split-shaft pump with truck transmission in the gear recommended by the chassis manufacturer.
7. Never run the pump without water in it except momentarily while priming.
8. Accelerate and retard speed of engine gradually.
9. Watch the engine temperature, and start the cooling water at the first signs of overheating.
10. Keep good gaskets in suction hoses, and handle carefully to avoid damage to coupling threads.
11. Air leakage into suction lines is the most frequent source of trouble when pumping from a suction lift (draft).
12. Always use a suction strainer when pumping from draft, and a hydrant strainer when pumping from a hydrant.
13. Foreign matter in impellers is a result of failure to use adequate strainers and is a common source of trouble.
14. Drain pump immediately after each run. This is especially critical in freezing conditions.
15. Do not run the pump long with discharge completely shut off.
16. Do not close a “Shutoff” nozzle when pumping with motor throttle wide open, unless relief valve or pressure regulator is set for the correct pressure.
17. Keep the pump gear case filled with oil to the level of the oil level plug/dipstick.
18. Check oil level in the pump transmission after every 25 hours of operation or 3 months, and changed it after every 50 hours of operation or 6 months.
19. In such equipped transmissions, once the oil is drained, remove the strainer screen oil sump fitting and thoroughly cleanse in a parts washer or with isopropyl alcohol, ensuring any debris is washed away.
20. If pump is equipped with a Darley plastallic (injection) packing shaft seal, check the drip rate frequently, and adjust according to the packing adjustment instruction, as required. The drip rate may vary between 5 and 60 drops per minute.
21. Work all suction and discharge valves often to ensure free and easy operation.

PUMP SHIFTING PROCEDURE

For trucks equipped with manual transmissions, the following shifting procedure should be followed for pump operation:

1. Set parking brake.
2. Disengage truck clutch to stop shaft rotation.
3. Move pump shift lever to PUMP position.
4. Move truck transmission shift lever to neutral position.
5. Engage truck clutch.
6. Prime the pump (see priming instructions).
7. Disengage the truck clutch.
8. Move truck transmission shift lever to direct drive position and lock in place with safety latch.
9. Engage truck clutch to begin pumping.

If the power pump shift is provided, the procedure is identical except green indicator light (if provided) will come on at step #3 to show pump gear has been engaged.

To return to road operation:

1. Disengage truck clutch to stop shaft rotation.
2. Move truck transmission shift lever to neutral position.
3. Move pump shift lever to ROAD position.

When the truck is equipped with an automatic transmission, a danger exists that if the operator forgets to move the pump shift lever to PUMP position, and at the same time place transmission selector lever in high gear before leaving cab, the engine will continue to run due to converter slip. Upon advancing the vernier throttle at the pump operators panel, the engine could overcome the parking brake and accidentally move the truck. To prevent this possibility, the following shifting procedure should be followed for pump operation:

1. Set parking brake.
2. Place automatic transmission shift selector in neutral.
3. Move pump shift lever to PUMP position. “Pump Engaged” light in cab should now come on.
4. Prime the pump (see Priming Instructions).
5. Move automatic transmission shift selector to direct drive position (See Automatic Transmission Instructions).
6. Lock automatic transmission shift selector in direct drive position with safety latch provided.
7. Check that the parking brake is fully engaged.
8. Depress foot accelerator and observe that speedometer registers MPH. If pump is not engaged, speedometer will not indicate MPH.
9. Listen for pump shift and sound of pump gears turning.
10. At pump operators position, observe that the green indicator light above vernier throttle control is on. **Do not** operate throttle unless light is on.
11. Observe discharge pressure gage on panel while advancing vernier throttle, to ensure that it is indicating pressure. If Pump is not engaged, no pressure will show.
12. Remember, the vernier throttle has a quick release emergency center button. Push it all the way in immediately, should the truck move.

To return to ROAD OPERATION:

1. Place the truck transmission selector lever in reverse position to stop forward rotation of transmission shaft.
2. Move transmission selector to neutral, and at the same time, move the pump shift lever from PUMP to the ROAD position.

OPERATION OF PUMP SHIFT WITH AUTOMATIC TRANSMISSION

The pump gear shift consists of a sliding clutch gear splined to the transmission shaft which can be moved forward to engage the pump clutch gear, or to the rear to engage the rear drive shaft connected to the truck drive axle.

The sliding clutch gear is moved either by direct mechanical linkage from a notched quadrant shift lever, or by an air power cylinder controlled by a selector valve. The shift lever or selector valve must be moved all the way and locked for either ROAD position to drive truck or PUMP position to pump.

MANUAL PUMP GEAR SHIFT PROCEDURE

With trucking parking brake set, the truck transmission shift selector must be in neutral position to stop rotation of truck transmission output shaft before shifting into either ROAD or PUMP gear to prevent clashing and damage to gear teeth. With a manual pump gear shift control, a butt tooth position of gears may be encountered preventing engagement and "Pump Engaged" light from coming on. If this occurs, move transmission shift selector momentarily into any forward gear position with engine idling, then return to neutral. Wait approximately 5 seconds until shaft stops turning. Moving the pump shift lever to PUMP position again should complete the pump shift and turn on the "Pump Engaged" light. Repeat this procedure if a butt tooth condition is again encountered. Pump priming should be completed before shift to PUMP position.

AIR POWER PUMP GEAR SHIFT PROCEDURE

With the air power pump gear shift control a butt tooth condition may also occur preventing engagement and "Pump Engaged" light from coming on. This can be easily overcome by momentarily placing truck transmission in any forward gear position with engine idling after the pump shift valve is placed in the PUMP position. Shaft rotation will complete the shift and turn on green "Pump Engaged" light. Transmission shift should be returned to neutral position after "Pump Engaged" light comes on for the pump priming period.

The above procedure insures that the pump shift is completed and the "Pump Engaged" light comes on. An alternate procedure in case of a butt tooth condition is simply to wait until the transmission is placed into pump drive gear position, when shaft rotation will immediately permit pump gears to mesh into full engagement.

The pump is usually operated with truck transmission in direct (high) gear such as D or 2-5. Overdrive may be required with very low speed engines.

When the truck is equipped with an automatic transmission, a danger exists that should the operator forget to move the pump shift valve to PUMP position, and at the same time place transmission selector in high gear before leaving cab, the engine will continue to run due to converter slip. If the operator advances the vernier throttle at the pump operators panel, the engine could overcome the parking brake and cause the truck to move. To prevent this possibility, the following shifting procedure should be followed for PUMP position:

1. Read and fully understand pump Operators Manual before proceeding.

2. Set parking brake and idle engine.

3. Place automatic transmission shift selector in neutral.

4. Move pump shift lever or valve to PUMP position. "Pump Engaged" green light in cab should now come on. If not, momentarily place truck transmission shift selector in a forward gear to complete pump shift, then return to neutral position. Green light will now be on.

5. Prime pump.

6. Move automatic transmission shift selector to direct drive position. “OK to Pump” green light in cab should now be on.

7. Lock automatic transmission shift selector in direct drive.

8. Listen for sound of pump gears turning. Speedometer will show MPH unless connected to the wheel.

9. At pump operators position, observe the green indicator warning light near vernier throttle control. WARNING: DO NOT OPEN THROTTLE UNLESS LIGHT IS ON.

10. Advance throttle to provide a minimum of 900 rpm idle speed. Observe discharge pressure gage on panel while advancing vernier throttle to make sure it is indicating pressure. If pump is not engaged or the pump is not primed, no pressure will show.

The vernier throttle has a quick release emergency red center button. Push it all the way in to return the engine to idle if necessary in an emergency situation

To return to ROAD operation:

1. Throttle engine back to idle.

2. Place the truck transmission selector lever in neutral position. Wait approximately 5 seconds until drive shaft stops rotating.

3. Move pump shift lever or valve from PUMP to ROAD position. “Pump Engaged” green indicator light should be off. A butt tooth condition may require momentary engagement of transmission to complete the shift.

OPERATION OF PUMP SHIFT WITH MANUAL TRANSMISSION

The pump gear shift consists of a sliding clutch gear, splined to the transmission shaft which can be moved forward to engage the pump clutch gear, or to the rear to engage the rear drive shaft connected to the truck drive axle. A neutral position is half way between.

The sliding clutch gear is moved either by direct mechanical linkage from a notched quadrant shift lever, or by a vacuum or air power cylinder controlled by a selector switch. The shift lever must be moved all the way and locked for either ROAD position to drive truck or PUMP position to power pump.

The truck clutch must always be disengaged to stop rotation of truck transmission output shaft before shifting into either ROAD or PUMP gear to prevent clashing and damage to gear teeth. With the manual shift lever, a butt tooth position of gears may be encountered occasionally preventing engagement. If this occurs, move pump shift lever to neutral (half way) position, engage truck clutch momentarily, then disengage truck clutch and try pump shift again.

The pump is always operated with truck transmission in direct (high) gear, such as 4th on a 4 speed or 5th on 5 speed transmission.

The following shifting procedure should be followed for PUMP operation:

1. Set parking brake.
2. Disengage truck clutch.
3. Move pump shift lever (valve) to PUMP position. “PUMP ENGAGED” green light in cab should now come on.
4. Move truck transmission shift lever to neutral position.
5. Engage truck clutch.
6. Prime pump (See Priming Instructions).
7. Disengage truck clutch.
8. Move truck transmission shift lever to direct drive position and lock in place with safety latch provided.
9. Slowly engage truck clutch to begin pumping.

TO RETURN TO ROAD OPERATION

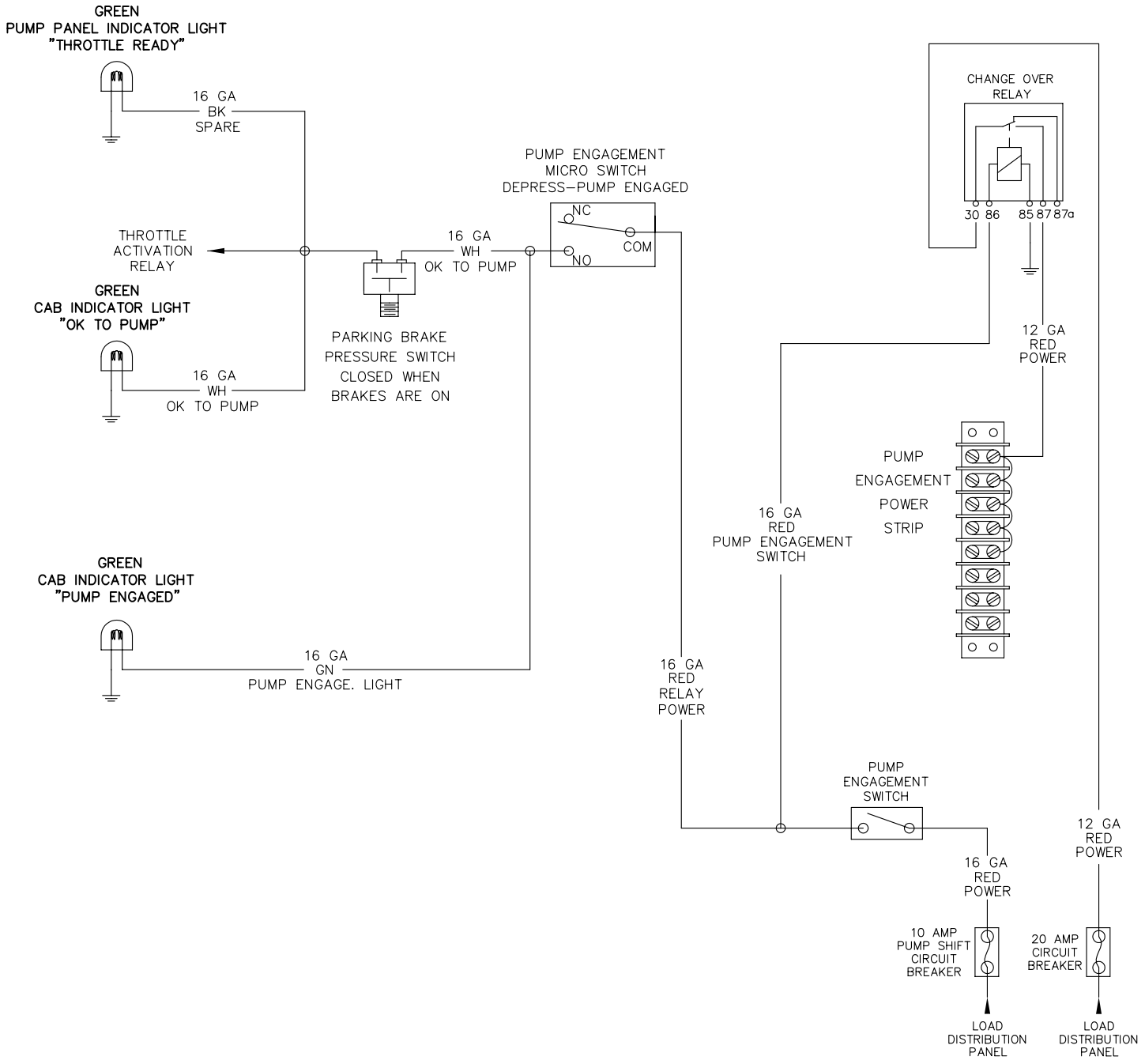
1. Disengage truck clutch to stop shaft rotation. Allow 10 seconds for shaft to stop rotating.
2. Move truck transmission shift lever to neutral position.
3. Move pump shift lever (valve) to ROAD position.

CAUTION

Follow the procedures step by step as indicated.

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

REVISIONS			
SYM.	DATE	BY	REVISION



ELECTRICAL SCHEMATIC
MANUAL TRANSMISSION
PUMP ENGAGEMENT

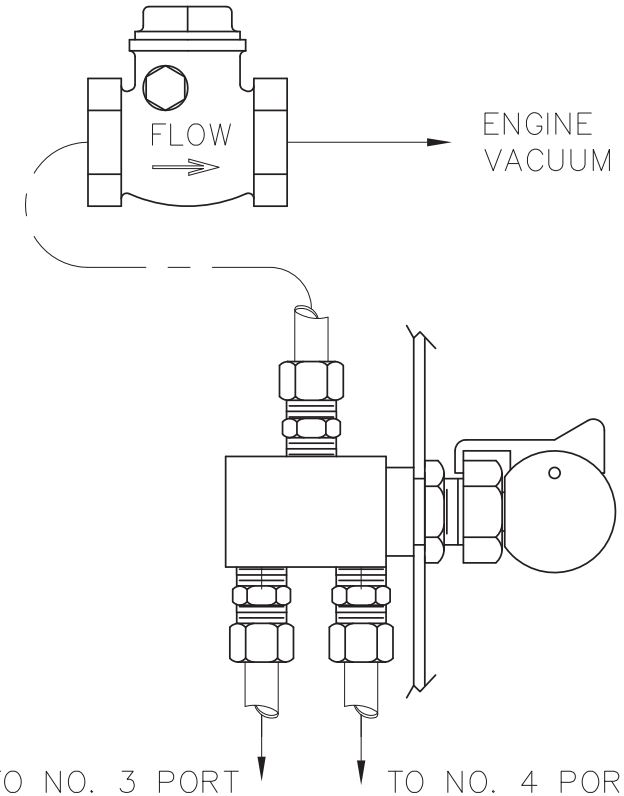
W.S. Darley & Co.
APPARATUS DIVISION
920 KURTH ROAD
CHIPPEWA FALLS, WISCONSIN 54729
1-715-726-2645

DWG BY JSS	SCALE NONE	REV
DATE 7-23-02	JOB NO.	DWG. NO. DGS1202

Prepared By: EAP
Revised By: EAP
Approved By: TED

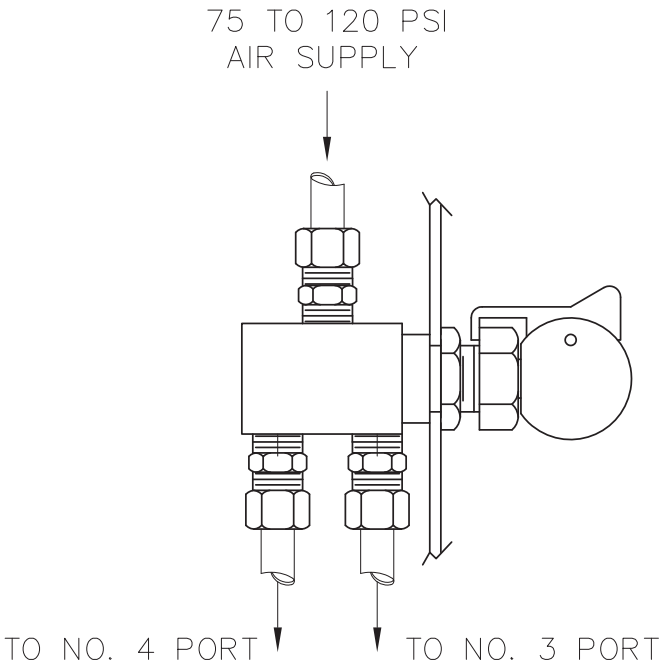
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

CHECK VALVE



VACUUM SHIFT
PIPING DIAGRAM
3" DIA. CYLINDER

NOTE: CONNECT TO AIR SOURCE
THAT HAS AN 80 PSI PRESSURE
PROTECTION VALVE



AIR PRESSURE SHIFT
PIPING DIAGRAM
1-1/8 DIA. CYLINDER

INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

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

DWG – POWER SHIFT VALVE
–

DR'N TED
CHKD
TRCD

DATE MAR10,97
SCALE NTS

DGS0500

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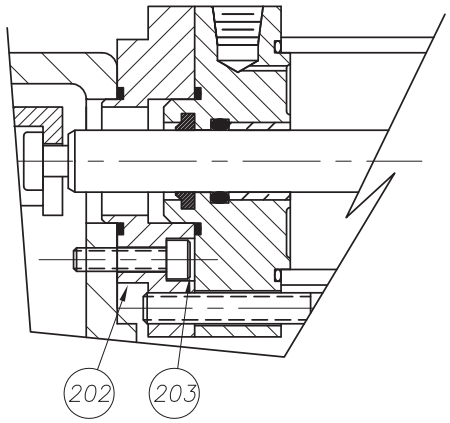
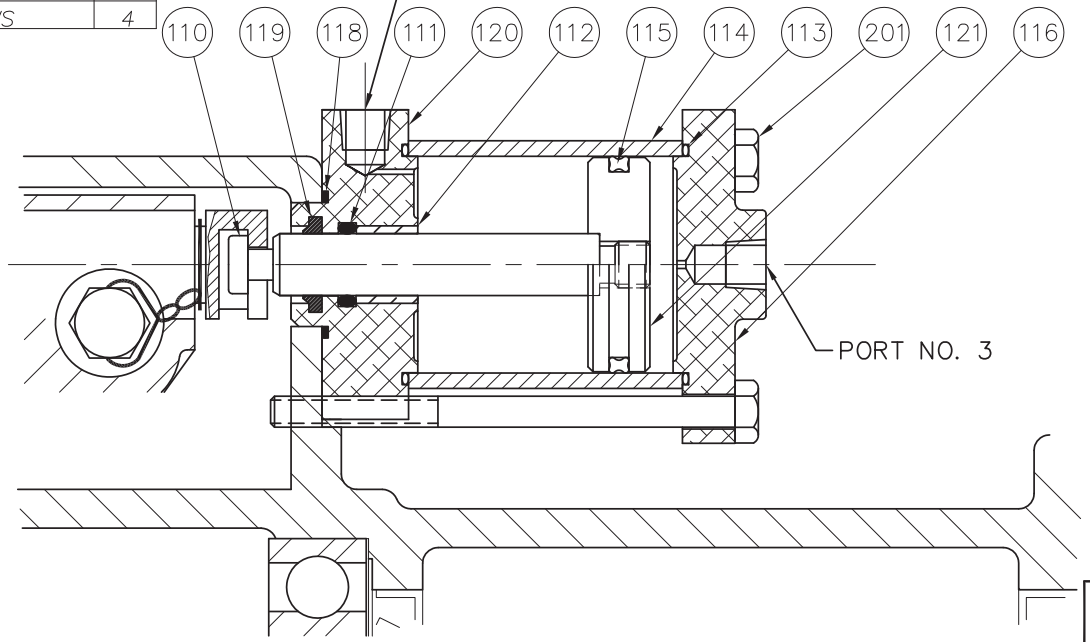
ALL DIMENSIONS IN INCHES UNLESS NOTED

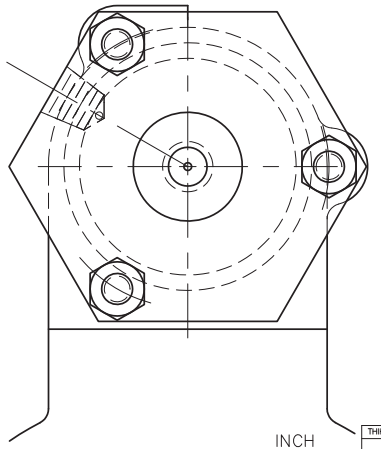
DO NOT SCALE PRINT

Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

PARTS LIST		
REP. NO.	DESCRIPTION	QTY.
110	PISTON ROD	1
111	ORING – ROD	1
112	OILITE SLEEVE BEARING	1
113	O'RING	2
114	CYLINDER	1
115	QUAD RING SEAL	1
116	CYLINDER END	1
118	O'RING	1
119	WIPER RING	1
120	CYLINDER HEAD	1
121	PISTON	1
201	CYLINDER SCREWS	3
202	*ADAPTER*	*1*
203	*ADAPTER SCREWS*	*4*







REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REFERENCE SPEC AY00201 (G427A1)
& AY00202 (G427A2)

OLD PART NO.
G2514

INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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

DWG – 1.75" AIR CYLINDER

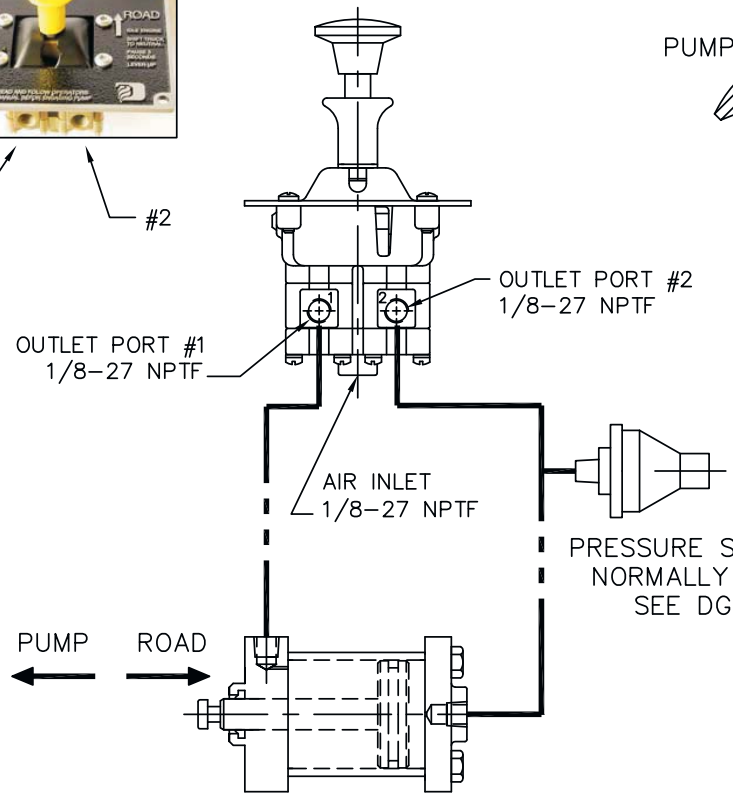
DR'N DWS
CHKD
TRCD

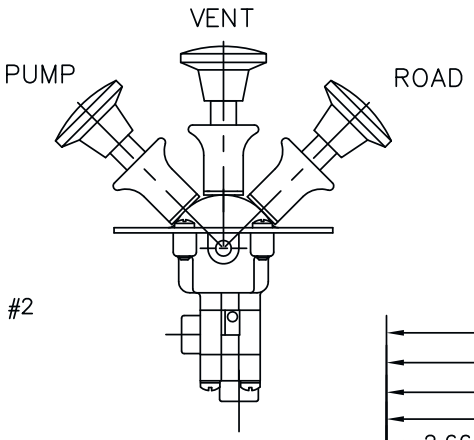
DATE JUN02,93
SCALE 1/1

DGC0701

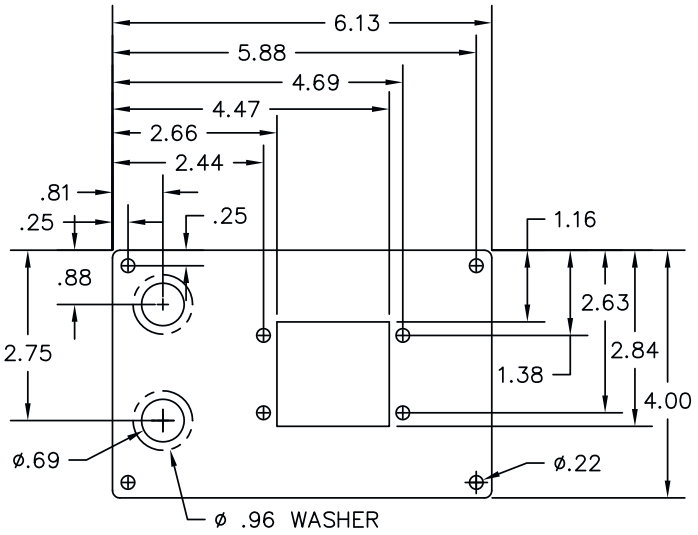
Prepared By: EAP
Revised By: EAP
Approved By: TED

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	UPDATED PHOTO	02AUG2006	CHG NO.	AAN





HANDLE POSITION	PORTS PRESSURIZED	
	No. 1	No. 2
PUMP		X
VENT		
ROAD	X	



PANEL HOLE LAYOUT

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

NOTES:

CONNECT AIR INLET TO 80 TO 125 PSI CHASSIS AIR SUPPLY SOURCE PROTECTED BY AN 80 PSI BRAKE PRESSURE PROTECTION VALVE

FOR MANUAL SHIFT BAR MOVEMENT, POSITION LEVER IN MIDDLE DETENT – VENT

MATERIAL DESCRIPTION:		MATERIAL NO. –	OLD PART 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 / CHKD TED / TRCD	DATE 03DEC,03 / SCALE 1/1

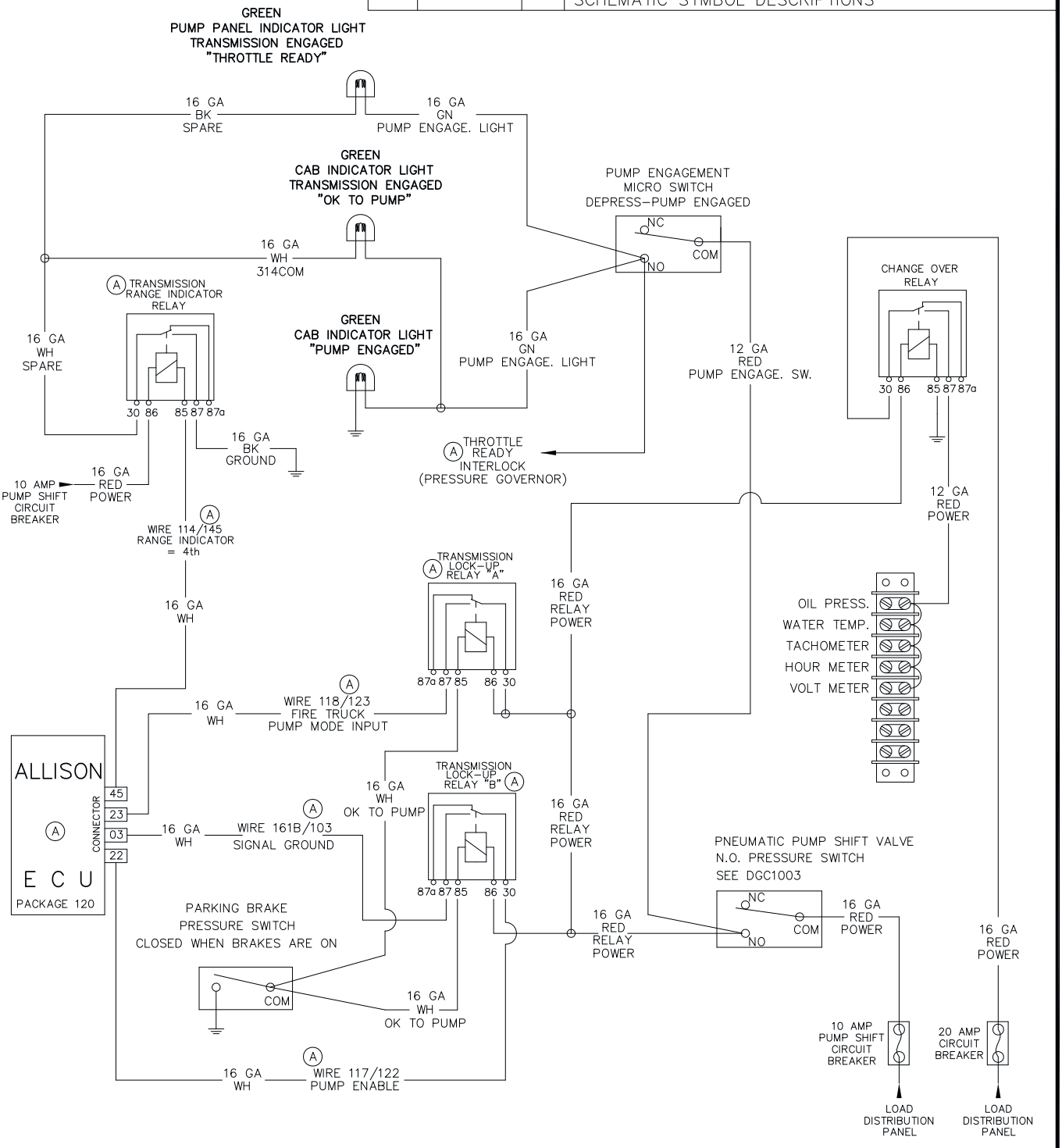
W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

DWG – 4–WAY VALVE ASSY LVR CNTRL, STANDARD

DGC1004

Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

REVISIONS			
LTR.	DATE	BY	REVISION
A	06/05/08	RJG	2008–166 ADDED NEWEST WIRE DESIGNATION #'s: 145; 123; 103 & 122; ADDED ALLISON ECU CONNECTOR #'s: 45, 23, 03 & 22; UPDATED SCHEMATIC SYMBOL DESCRIPTIONS



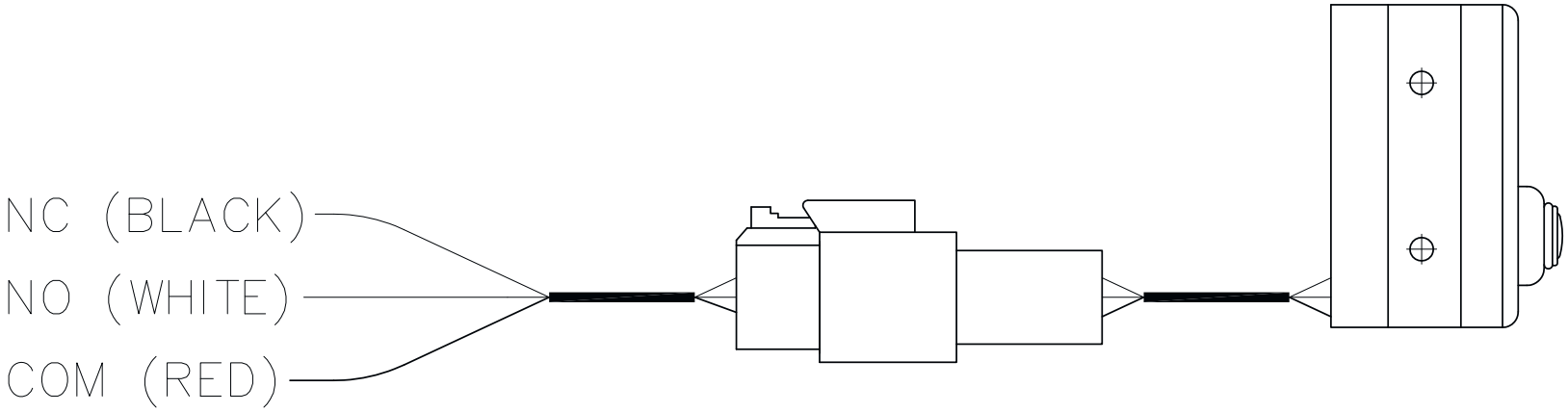
ELECTRICAL SCHEMATIC ALLISON WORLD TRANS. PUMP ENGAGEMENT

DWG – MIDSHIP TRANS, LVR CNTRL
WIRING SCHEMATIC, GEN DWG

DWG BY SCHULTZ	SCALE SIZE A, 1:2	REV A
DATE DWS 12-03-03	JOB NO.	DWG. NO. DGS1203

Prepared By: EAP
Revised By: EAP
Approved By: TED

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

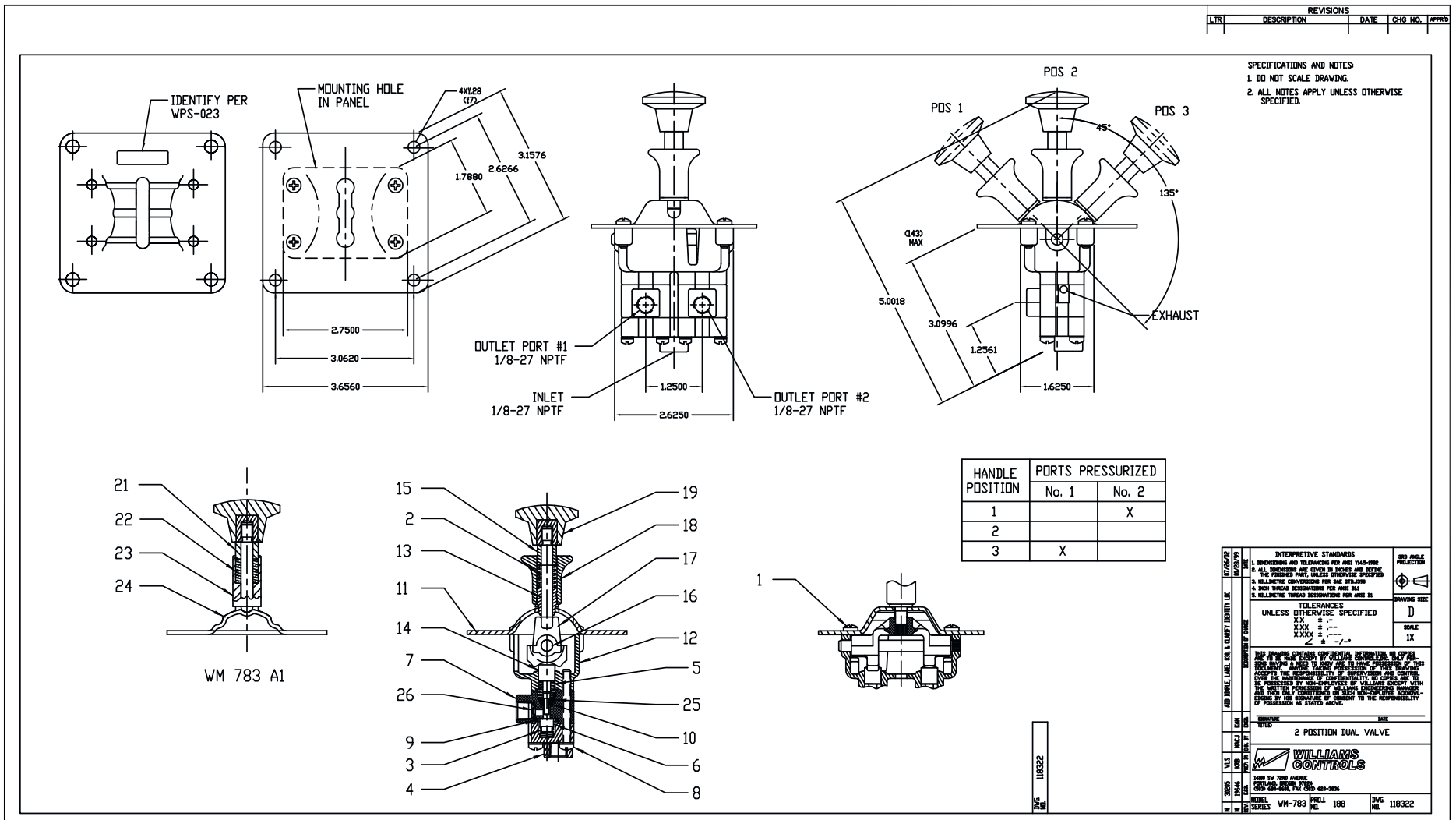


REMOVE SHARP EDGES

INCH
[MILLIMETER]

THIRD ANGLE PROJECTION

MATERIAL DESCRIPTION: —	MATERIAL NO. —	OLD PART NO. —	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
		PATTERN NO. —	DR'N JSS CHKD CKE TRCD	DWG – MICROSWITCH, WIRE DESIGNATION
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 7/2/02 SCALE 1/1	DGSI602



DRAWING ABOVE FURNISHED BY WILLIAMS CONTROL
REP NUMBERS DO NOT CORRESPOND TO ANY DARLEY BOM

OPERATION OF OPTIONAL HIGH PRESSURE STAGE

The sliding gear clutch which drives the optional high pressure stage is operated by a shift lever marked “FOG” for pumping position, and “OUT” for disengaged position. The shift lever must be locked in one or the other of these positions before the pump can be started.

The high pressure stage clutch must not be shifted while the main pump is running.

When the main pump is in operation, it must always be stopped (engine clutch disengaged) for shifting of the high pressure stage clutch either in or out.

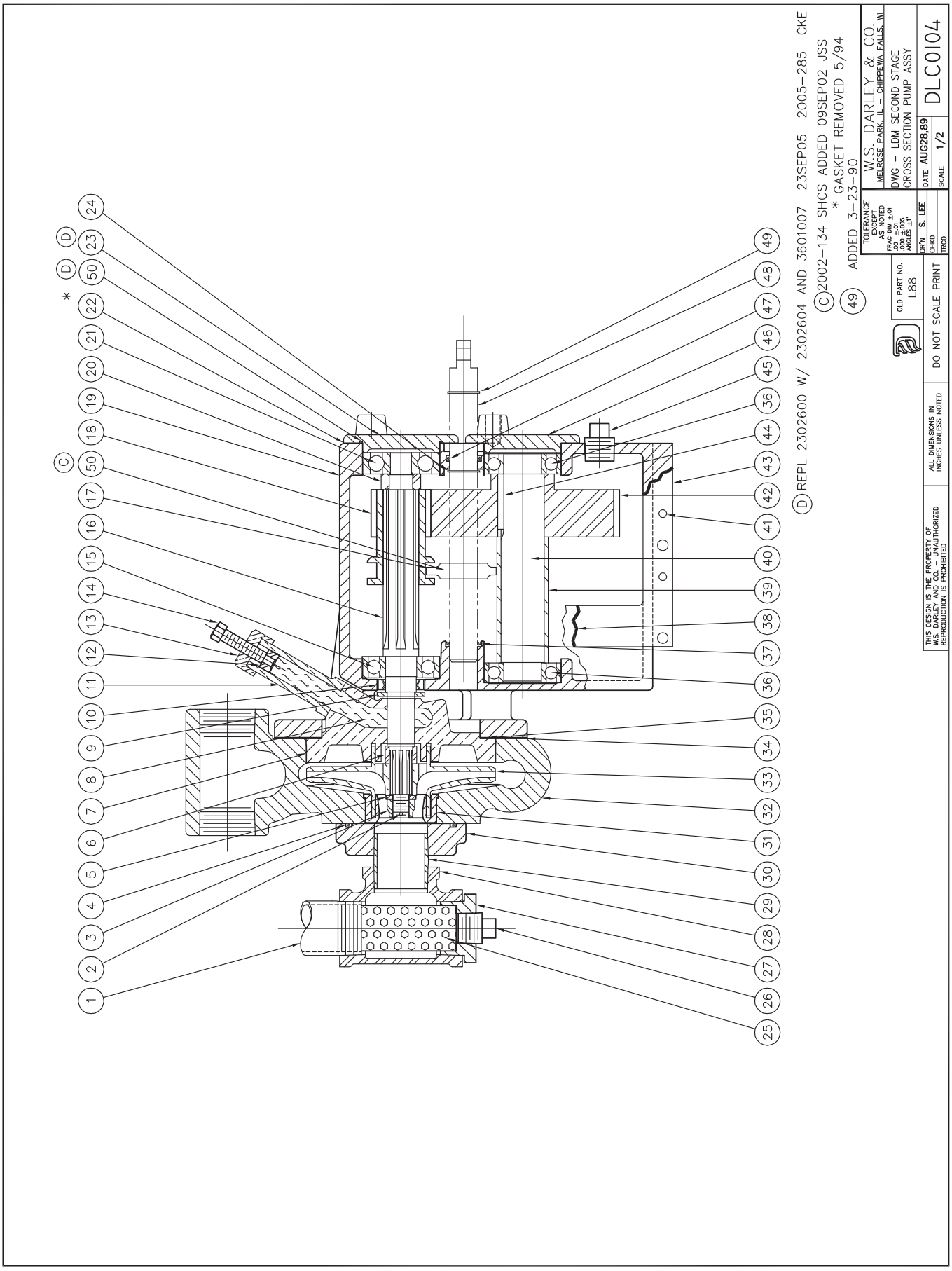
The high pressure stage is always primed by pressure from the main pump.

The high pressure stage has a small by-pass line with a valve to the booster tank. Open the by-pass valve when running with the high pressure stage discharge lines completely shut off.

HIGH PRESSURE BOOSTER PUMP
DRAWING DLC0104

Rep. No.	Name of Part	Qty	Rep. No.	Name of Part	Qty
1	Inlet Pipe	1	26	Pipe Plug	1
2	Cotter Pin	1	27	Stainer Fitting	1
3	Impeller Pin	1	28	Inlet Tee	1
4	Flange O-ring	1	29	Close Nipple	1
5	Impeller Washer	1	30	Inlet Flange	1
6	Impeller Spacer	1	31	Seal Ring	1
7	Stuffing Box Head	1	32	Pump Casing	1
8	Pump Packing	10	33	Impeller	1
9	Water Slinger	1	34	Pump Casing Gasket	1
10	Impeller Shaft Oil Seal	1	35	Stuffing Box Gasket	1
11	Packing Cylinder	1	36	Idler Shaft Bearing	2
12	Gland Stud Piston	1	37	Shift Bar Oil Seal	1
13	Gland Nut	1	38	Gearcase Gasket	2
14	Packing Screw	1	39	Idler Shaft Spacer	1
15	Impeller Shaft Bearing	1	40	Idler Shaft	1
16	Impeller Shaft	1	41	Alignment Pin	2
17	Shift Collar	1	42	Idler Gear	1
18	Pump Drive Pinion	1	43	Gearcase Spacer	1
19	Gear Case	1	44	Idler Gear Key	1
20	Pinion Spacer	1	45	Oil Level & Fill plug	1
21	Impeller Shaft Bearing	1	46	Bearing Cap	1
22	Bearing Cap Gasket	2	47	Shift Bar O-ring	1
23	Bearing Cap	1	48	Shift Bar	1
24	Retaining Ring	2	49	Retaining Ring	2
25	Strainer Sleeve	1			

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


(D) REPL 2302600 W/ 2302604 AND 3601007 23SEP05 2005-285 CKE
(C) 2002-134 SHCS ADDED 09SEP02 JSS
* GASKET REMOVED 5/94
(49) ADDED 3-23-90
W.S. DARLEY & CO.
MELROSE PARK, IL - CHIPPEWA FALLS, WI
DWG - LDM SECOND STAGE
CROSS SECTION PUMP ASSY
DLC0104
OLD PART NO. L88
DRN S. LEE
DATE AUG28,89
SCALE 1/2
CHKD
TRCD
TOLERANCE EXCEPT AS NOTED
FRAC DIM ±.01
.00 ±.005
.000 ±.0005
ANGLES ±1°
ALL DIMENSIONS IN INCHES UNLESS NOTED
DO NOT SCALE PRINT
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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.

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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
250 GPM Fire Pump							
1	250	(1), 1”	72	143	150	(1), 50'	20’ of 3”
2	175	(1), 7/8”	62	194	200		
3	125	(1), 3/4”	56	244	250		
4	250	(1), 1”	72	158	165		
350 GPM Fire Pump							
1	350	(1), 1-1/4”	58	144	150	(1), 50'	20’ of 4”
2	245	(1), 1”	69	195	200		
3	175	(1), 7/8”	62	245	250		
4	350	(1), 1-1/4”	58	159	165		
500 GPM Fire Pump							
1	500	(1), 1-1/2"	57	143	150	(1), 50'	20' of 4"
2	350	(1), 1-1/4"	58	194	200		
3	250	(1), 1"	72	245	250		
4	500	(1), 1-1/2"	57	158	165		
750 GPM Fire Pump							
1	750	(1), 1-3/4" or (2), 1-1/4"	68 66	142	150	(2), 50' or (2), 100' Siamesed	20' of 4-1/2"
2	525	(1), 1-1/2"	62	193	200		
3	375	(1), 1-1/4"	66	244	250		
4	750	(1), 1-3/4" or (2), 1-1/4"	68 66	157	165		
1000 GPM Fire Pump							
1	1000	(1), 2" or (2), 1-1/2"	71 57	142	150	(2), 50' or (3), 100' Siamesed	20' of 5"
2	700	(1), 1-3/4" or (2), 1-1/4"	60 58	193	200		
3	500	(1), 1-1/2"	57	244	250		
4	1000	(1), 2" or (2), 1-1/2"	71 57	157	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.

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
1250 GPM Fire Pump							
1	1250	(1), 2-1/4" or (2), 1-1/2"	69 88	143	150	(3), 50'	20' of 6"
2	875	(1), 2" or (2), 1-3/8"	55 61	194	200	or	
3	625	(1), 1-1/2"	88	245	250	(3), 100'	
4	1250	2-1/4" or (2), 1-1/2"	69 88	158	165	and (1), 50' Siamesed	
1500 GPM Fire 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

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
1750 GPM Fire 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 Fire 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		
2250 GPM Fire Pump							
1	2250	(2), 2-1/4”	56	144	150	(2 Groups) (3), 100’ Siamesed	20’ of 8”
2	1575	(2), 1-3/4”	76	196	200		
3	1125	(2), 1-1/2”	72	246	250		
4	2250	(2), 2-1/4”	56	153	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.

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
2500 GPM Fire Pump							
1	2500	(2), 2-1/4"	69	144	150	(2 Groups) (3), 100' Siamesed	20' of 8"
2	1750	(2), 2"	55	195	200		
3	1250	(2), 1-1/2"	88	246	250		
4	2500	(2), 2-1/4"	69	159	165		
3000 GPM Fire Pump							
1	3000	(2), 2-1/2"	65	146	150	(2 Groups) (3), 100' Siamesed	(2) 20' of 8"
2	2100	(2), 2"	78	196	200		
3	1500	(2), 1-3/4"	68	247	250		
4	3000	(2), 2-1/2"	65	161	165		
3000 GPM Industrial Fire Pump							
1	3000	(2), 2-1/2"	65	96	100	(2 Groups) (3), 100' Siamesed	(2) 20' of 8"
2	2100	(2), 2"	78	146	150		
3	1500	(2), 1-3/4"	68	197	200		
3500 GPM Industrial Fire Pump							
1	3500	(2), 2-1/2" and (1), 2-1/4"	45 44	95	100	(2 Groups) (3), 100' Siamesed & (2)-50' Siamesed	(2) 20' of 8"
2	2450	(2), 2-1/4"	67	146	150		
3	1750	(2), 2"	55	197	200		

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	2 1/2
	GALLONS PER MINUTE DELIVERED															
5	4	9	16	26	37	50	66	84	103	125	149	175	203	266	337	415
6	4	10	18	28	41	55	72	92	113	137	163	192	223	292	369	455
7	4	11	19	30	44	59	78	99	122	148	176	207	241	315	399	491
8	5	11	21	32	47	64	84	106	131	158	188	222	257	336	427	525
9	5	12	22	34	50	67	89	112	139	168	200	235	273	357	452	557
10	6	13	23	36	53	71	93	118	146	177	211	248	288	376	477	587
12	6	15	25	40	58	78	102	130	160	194	231	271	315	412	522	643
14	7	15	27	43	63	84	110	140	173	210	249	293	340	445	564	695
16	7	16	29	46	67	90	118	150	185	224	267	313	364	475	603	743
18	7	17	31	49	71	95	125	159	196	237	283	332	386	504	640	788
20	8	18	33	51	75	101	132	167	206	250	298	350	407	532	674	830
22	8	19	34	54	79	105	139	175	216	263	313	367	427	557	707	871
24	8	20	36	56	82	110	145	183	226	275	327	384	446	582	739	909
26	9	21	37	59	85	115	151	191	235	286	340	400	464	606	769	947
28	9	21	39	61	89	119	157	198	244	297	353	415	481	629	799	982
30	10	22	40	63	92	123	162	205	253	307	365	429	498	651	826	1017
32	10	23	41	65	95	127	167	212	261	317	377	443	514	673	854	1050
34	11	23	43	67	98	131	172	218	269	327	389	457	530	693	880	1082
36	11	24	44	69	100	135	177	224	277	336	400	470	546	713	905	1114
38	11	25	45	71	103	138	182	231	285	345	411	483	561	733	930	1144
40	11	26	46	73	106	142	187	237	292	354	422	496	575	752	954	1174
42	11	26	47	74	109	146	192	243	299	363	432	508	589	770	978	1203
44	12	27	49	76	111	149	196	248	306	372	442	520	603	788	1000	1231
46	12	28	50	78	114	152	200	254	313	380	452	531	617	806	1021	1259
48	12	28	51	80	116	156	205	259	320	388	462	543	630	824	1043	1286
50	13	29	52	81	118	159	209	265	326	396	472	554	643	841	1065	1313
52	13	29	53	83	121	162	213	270	333	404	481	565	656	857	1087	1339
54	13	30	54	84	123	165	217	275	339	412	490	576	668	873	1108	1364
56	13	30	56	86	125	168	221	280	345	419	499	586	680	889	1129	1389
58	13	31	56	87	128	171	225	285	351	426	508	596	692	905	1149	1414
60	14	31	57	89	130	174	229	290	357	434	517	607	704	920	1168	1437
62	14	32	58	90	132	177	233	295	363	441	525	617	716	936	1187	1462
64	14	32	59	92	134	180	237	299	369	448	533	627	727	951	1206	1485
66	14	33	60	93	136	182	240	304	375	455	542	636	738	965	1224	1508
68	14	33	60	95	138	185	244	308	381	462	550	646	750	980	1242	1531
70	15	34	61	96	140	188	247	313	386	469	558	655	761	994	1260	1553
72	15	34	62	97	142	191	251	318	391	475	566	665	771	1008	1278	1575
74	15	35	63	99	144	193	254	322	397	482	574	674	782	1023	1296	1597
76	15	35	64	100	146	196	258	326	402	488	582	683	792	1036	1313	1618
78	15	36	65	101	148	198	261	330	407	494	589	692	803	1050	1330	1639

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	2 1/2
	GALLONS PER MINUTE DELIVERED															
80	16	36	66	103	150	201	264	335	413	500	596	700	813	1063	1347	1660
82	16	37	66	104	152	204	268	339	418	507	604	709	823	1076	1364	1681
84	16	37	67	105	154	206	271	343	423	513	611	718	833	1089	1380	1701
86	16	37	68	107	155	208	274	347	428	519	618	726	843	1102	1396	1721
88	16	38	69	108	157	211	277	351	433	525	626	735	853	1115	1412	1741
90	17	39	70	109	159	213	280	355	438	531	633	743	862	1128	1429	1761
92	17	39	70	110	161	215	283	359	443	537	640	751	872	1140	1445	1780
94	17	39	71	111	162	218	286	363	447	543	647	759	881	1152	1460	1800
96	17	40	72	113	164	220	289	367	452	549	654	767	890	1164	1476	1819
98	17	40	73	114	166	223	292	370	456	554	660	775	900	1176	1491	1838
100	18	41	73	115	168	225	295	374	461	560	667	783	909	1189	1506	1856
105	18	42	75	118	172	230	303	383	473	574	683	803	932	1218	1542	1902
110	19	43	77	121	176	236	310	392	484	588	699	822	954	1247	1579	1947
115	19	43	79	123	180	241	317	401	495	600	715	840	975	1275	1615	1991
120	19	44	80	126	183	246	324	410	505	613	730	858	996	1303	1649	2033
125	20	45	82	129	187	251	331	418	516	626	745	876	1016	1329	1683	2075
130	20	46	84	131	191	256	337	427	526	638	760	893	1036	1356	1717	2116
135	21	47	85	134	195	262	343	435	536	650	775	910	1056	1382	1750	2157
140	21	48	87	136	198	266	350	443	546	662	789	927	1076	1407	1780	2196
145	21	49	88	139	202	271	356	450	556	674	803	944	1095	1432	1812	2235
150	22	50	90	141	205	275	362	458	565	686	817	960	1114	1456	1843	2273

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

2.308ft head = 1.0 psi
1ft head = .433psi

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	4-Mar	1	1 1/2	2 1/2	3	3 1/2	4	4 1/2	5	6	8
Thr'ds per inch	8	8	9	7.5	6	6	4	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	8-4 NH
Max. O.D. Male	1.375	1.375	1.99	3.0686	3.6239	4.2439	5.0109	5.7609	6.26	7.025	9.05

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.

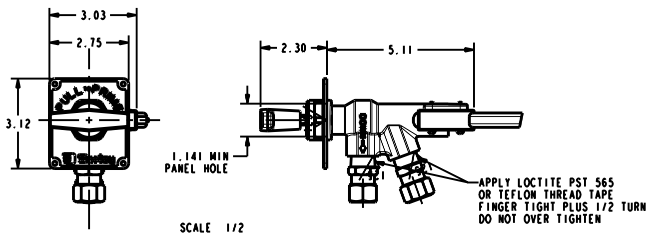
ELECTRIC PRIMING PUMPS WITHOUT FLUID RESERVOIR

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.

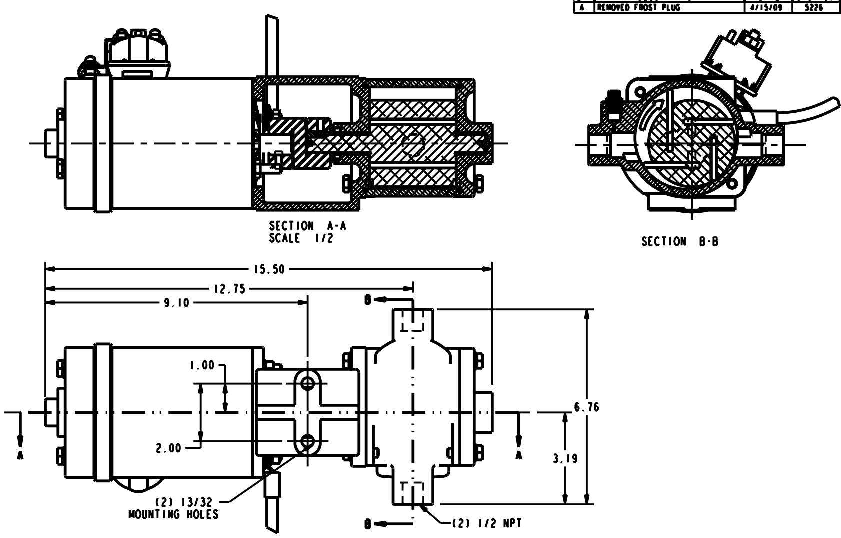
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 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

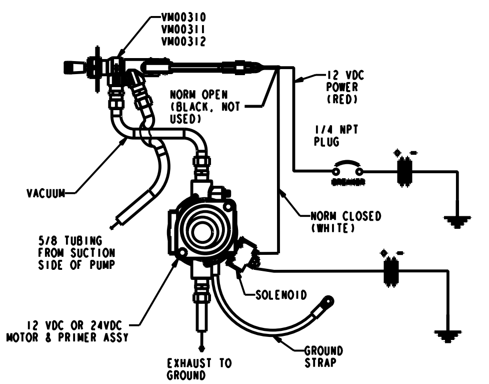


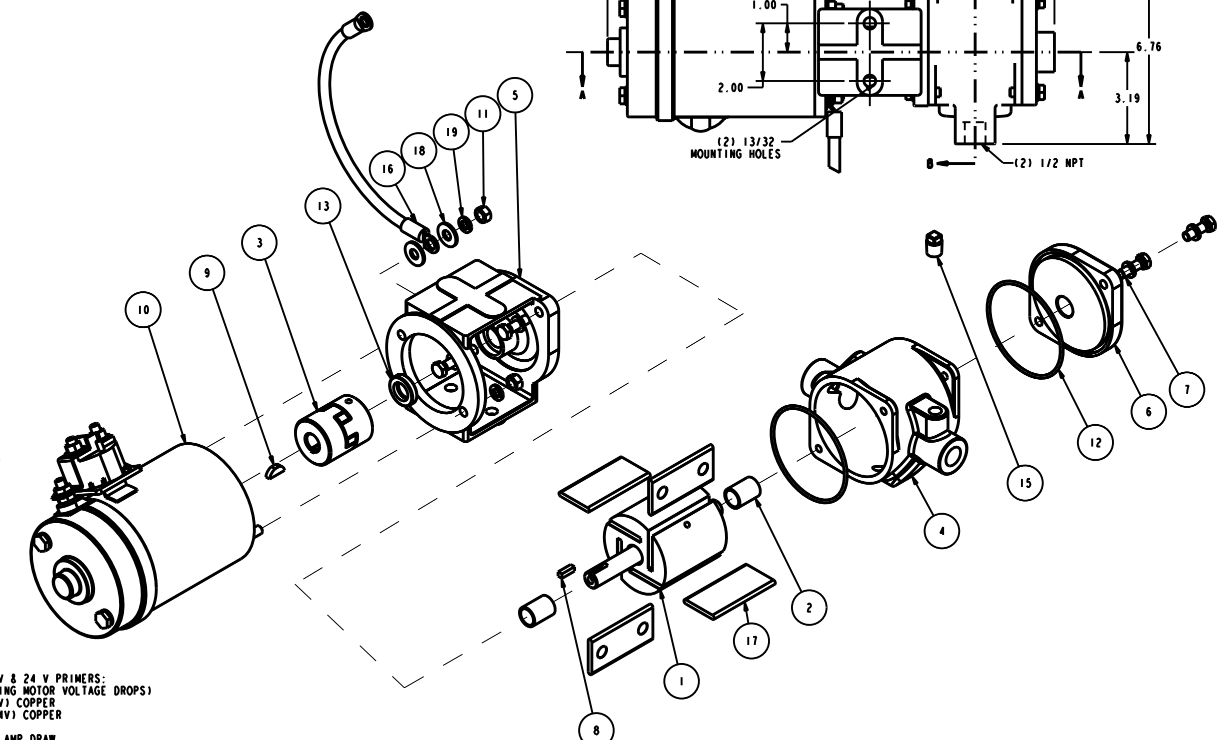
SCALE 1/2

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.

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







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)

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 .00 ±.03 .000 ±.010 ANGLES ±1°

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

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

MODEL NAME DVC0207 | MDL CREATED 04/18/08 | SHEET 1/1 | D

DATE 18-Apr-08 | SCALE 1/2

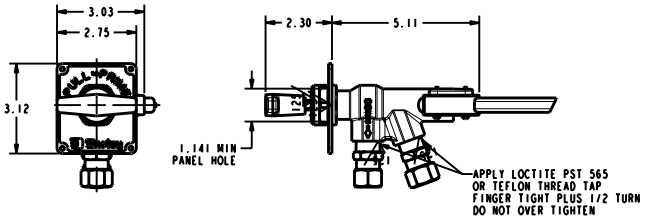
DVC0207

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

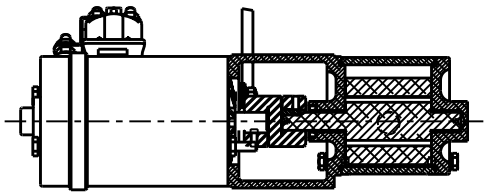
NAME:AAN OBJECT:DVC0209 DATE:29-Apr-09 10:21:45

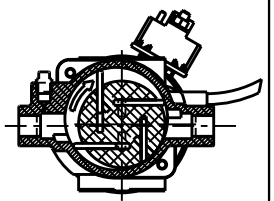
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - 844093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 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

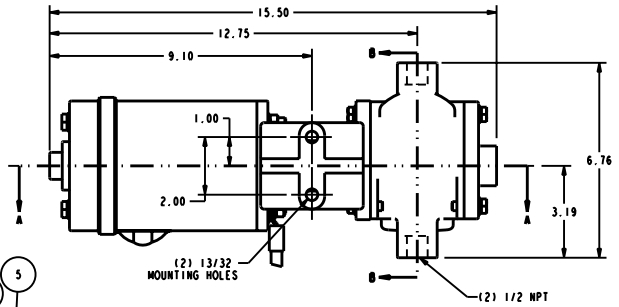
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

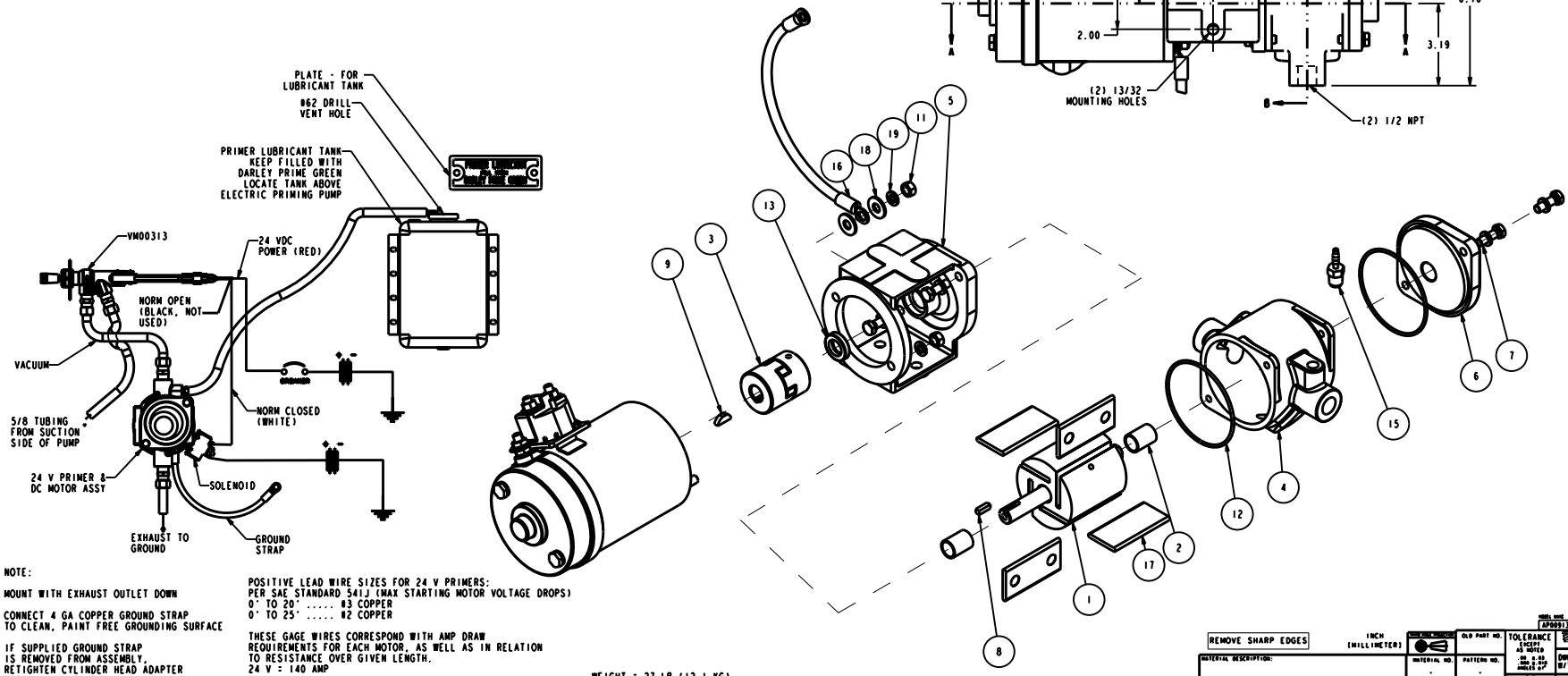


NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DRAWING DVC0203
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.









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)

MATERIAL DESCRIPTION:

MATERIAL NO. -

PATTERN NO. -

OLD PART NO.

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

DO NOT SCALE PRINT

ALL DIMENSIONS IN INCHES UNLESS NOTED

MODEL NAME AP00913.CHIBA | NO. CREATED 24-SEP-2004 | SHEET 1/1 | D

W.S. Darley & Co.
ITASCA, IL. CHICAGO'S FINEST, SINCE 1915

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

DATE 18-Apr-08

SCALE 1/2

DVC0209

W.S. DARLEY & CO.

OPERATING INSTRUCTIONS - ELECTRIC PRIMING PUMP

PUSH BUTTON ELECTRIC ACTUATED VALVE

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

The Primer is activated by a push button, 0.8 second cycle time, electric-actuated valve. This valve has three wires: ground (black), +12 or +24 VDC constant power (red), and +12 or +24 VDC energizing power (white). The valve has two internal micro-switches that cut the power to the valve when it is either fully closed or fully open. The push button is a simple SPST switch, that bypasses the red (constant power) wire with the white wire and energizes the valve to the open position when it is pushed; and cuts power to the white wire and resumes power to the red wire, closing the valve when it is released. When the button is pushed, the circuit for the primer motor is also completed, priming will begin instantaneously, and likewise when the button is released, the primer motor will shut off instantaneously.

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”.

Push the primer/valve activation button, located on your control panel, and hold until water discharges from primer pump exhaust port.

If water does not discharge from primer exhaust within about 30 seconds (45 seconds with 2-20’ lengths) stop primer pump, check for air leaks and make sure primer pump is receiving lubricant from its reservoir.

NOTE: Do not run the primer for more than one minute; it will burn up the motor, if prime is not reached within one minute, repeat the steps above.

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.

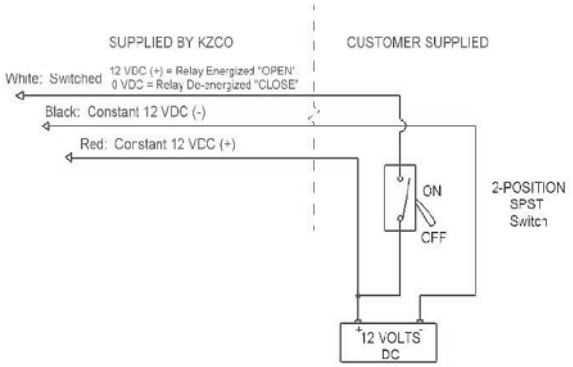
ELECTRIC PRIMING PUMPS WITHOUT FLUID RESERVOIR

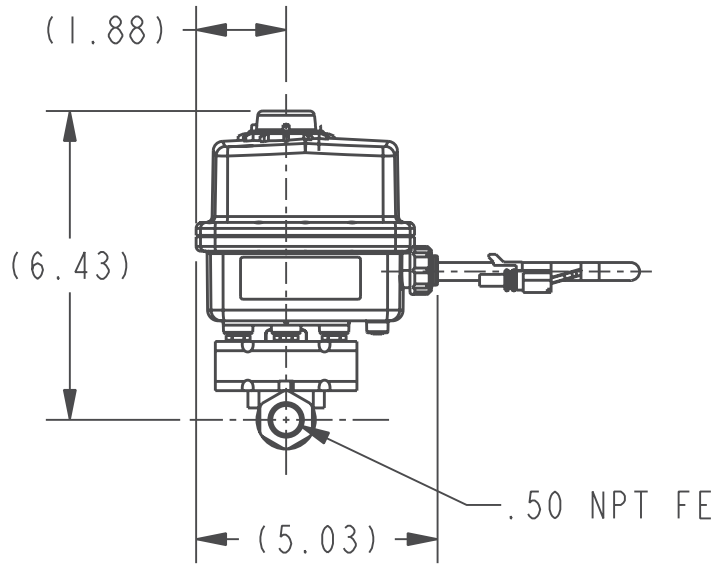
The fluidless electric-motor rotary-vane primer pump creates a high vacuum by using a special material for the vanes and an initial factory applied lubricant film. This film must be present in order for the primer to operate properly and to provide maximum life for the primer components.

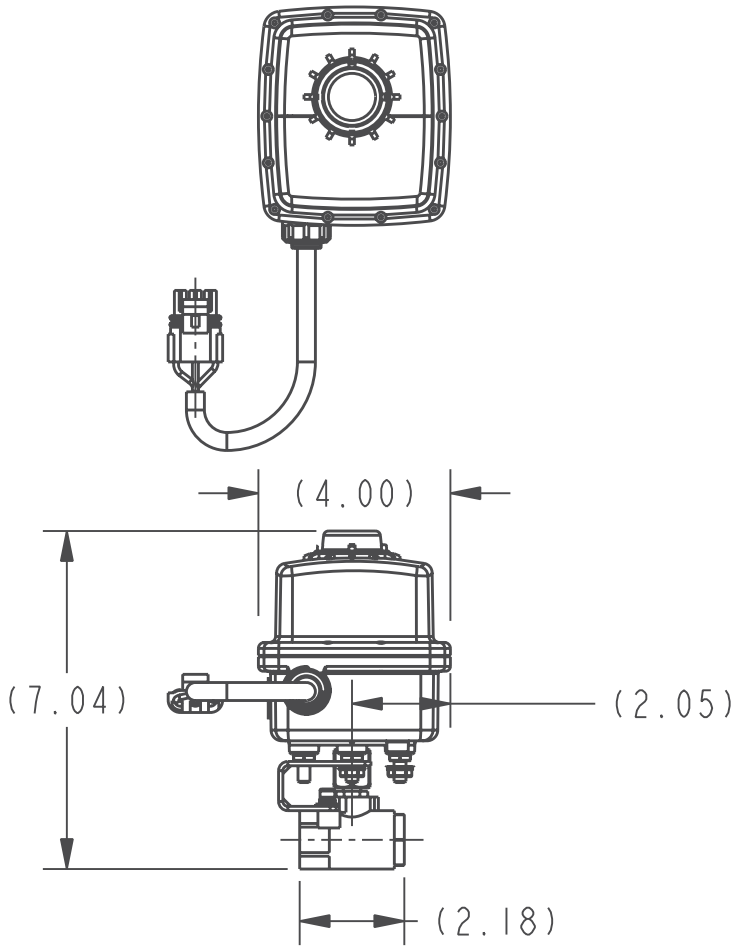
This film will not wash away completely if the pump is used to pump water. If the priming pump is disassembled for any reason, all internal surfaces of the housing and end caps must be coated completely with Dow Corning #111 Silicone valve lubricant prior to operating the primer. If after several years, a degradation of performance is noticed, performance may be restored by re-applying the film in this manner.

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

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.

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

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

MATERIAL DESCRIPTION:
KZCO 84D23-10D20-P01

MATERIAL NO. -

PATTERN NO. -

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

DR'N RJG
CHKD DWS
TRCD

DATE 13-Nov-08

SCALE 1/4

5209401

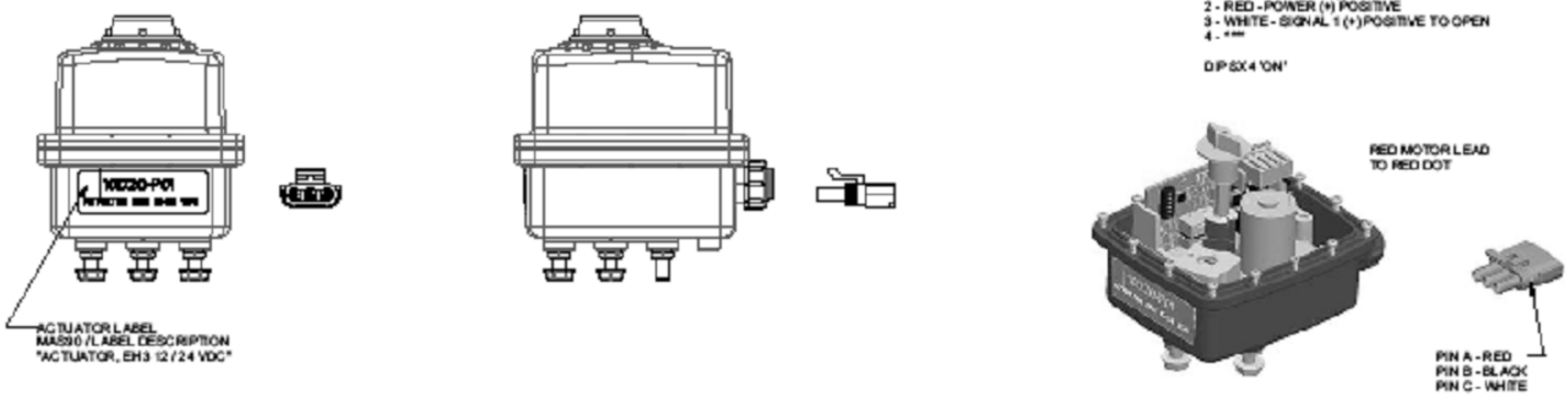
ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

REVISION	REVISED BY	REVISION DATE	REVISED BY
-.2+		7/15/2008 9:41:57 AM	bgotschall

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'



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 = CC392
ACTUATOR RANGE = 0.00-0.00
DESIGN VOLTAGE = E
DIP SX = 3
LABEL = KZCO
OPTIONS = 0
PLUG TYPE = P
TEST PLUG =

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL
21	1	EH-502	LABEL, EH ACTUATOR, 2.5" X 1", THERMAL TRANSFER, WHITE	NO_MATERIAL
20	1	800018	HARNESS, 89A,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 EH2/3 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_6N33L_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 LID, #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	

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.

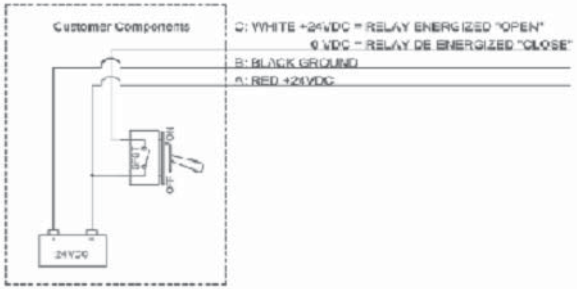
TITLE ACTUATOR, EH3, SOLID STATE
REF.
PART NO. 10020-P01 REVISION -2+
DRAWING NO. 10020-P01 SHEET 1 OF 1

Prepared By: RJG
Approved By: DWS

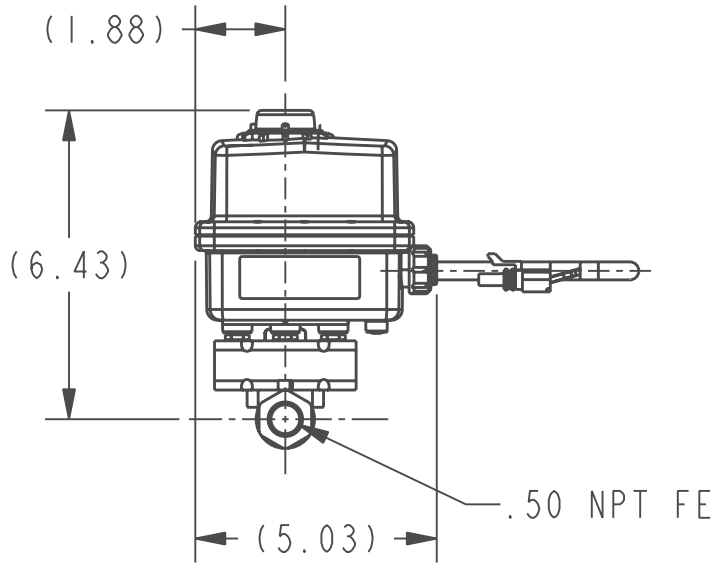
5

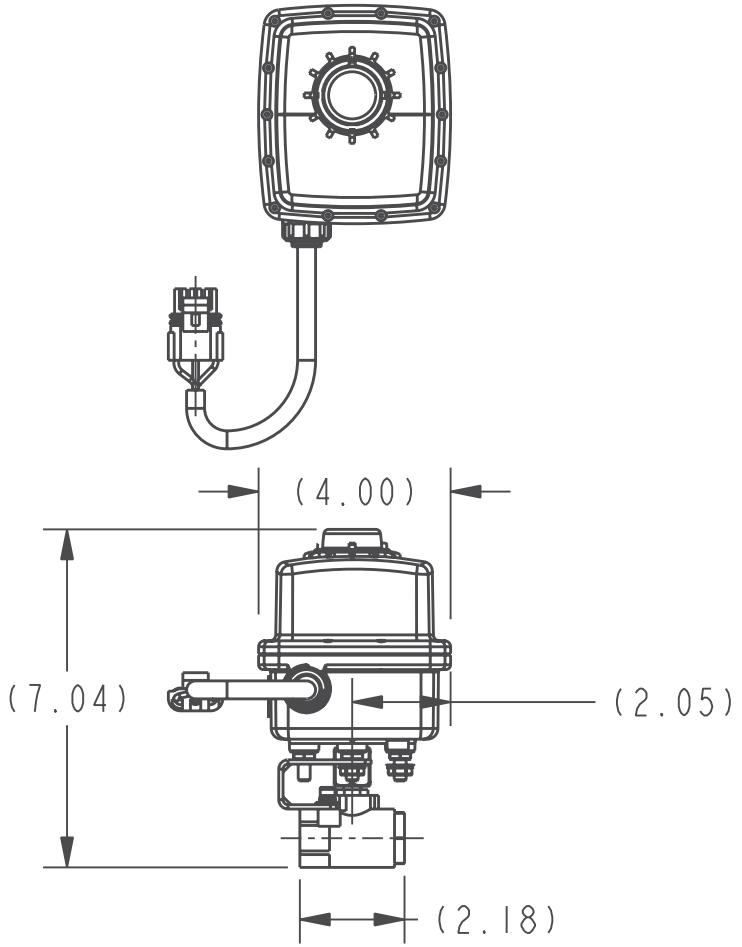
Rev. 0
Date: 12/02/08
1200617.doc

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

MATERIAL DESCRIPTION:
KZCO 84D23-60AD-M

MATERIAL NO.
-

PATTERN NO.
-

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

DR'N	RJG
CHKD	DWS
TRCD	

DATE 13-Nov-08

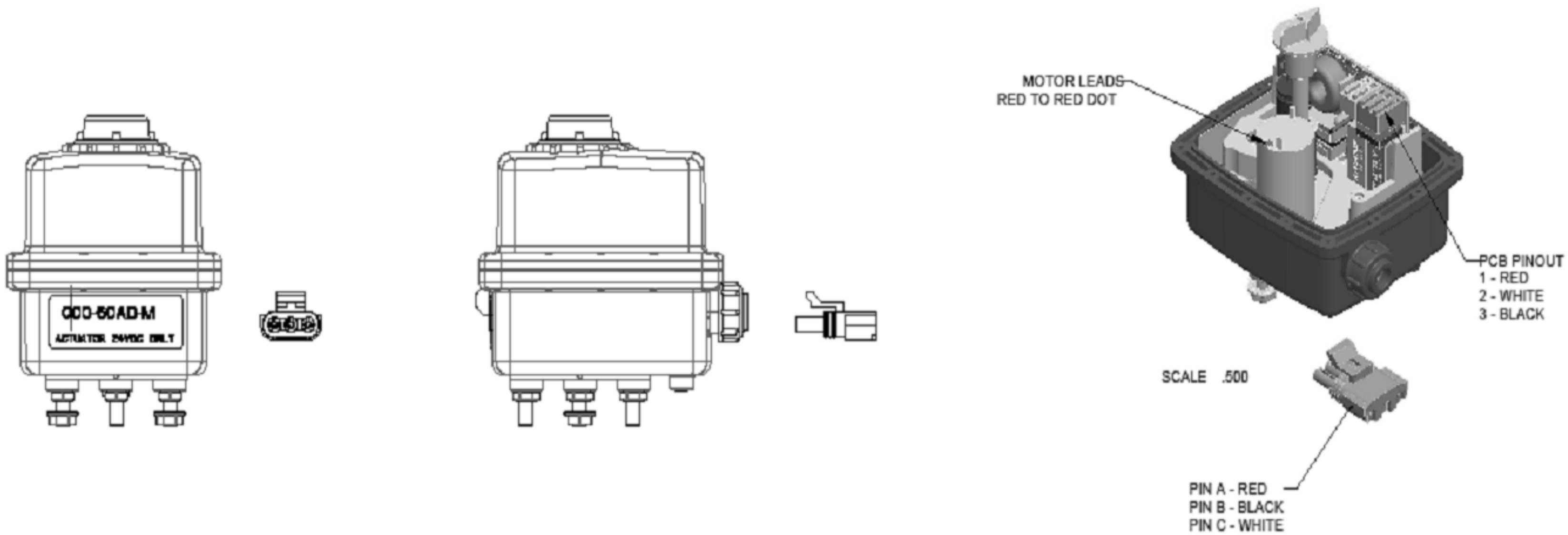
SCALE 1/4

5209402

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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



MAS90 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: .562 LBM
SURF AREA: 163.793 SQ IN
VOLUME: 12.043 CU IN

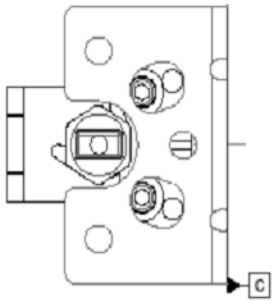
DATE: 2007-04-16
DESIGNED: L. ERDKAMP
DRAWN: W. FEDDE
APPROVED: A. KOTTAS
SCALE: .500 SIZE: B
MATERIAL:

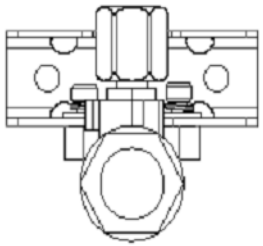
KZCO inc.
23860 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2767
FAX: +1.402.944.2402

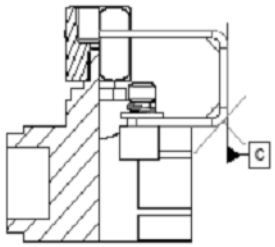
TITLE: ACTUATOR, EH3, .8S @24VDC
REF:
PART NO: 000-60AD-M REVIVER: *** .1
DRAWING NO: 000-60AD-M SHEET: 1 OF 1

CREATED BY: wfedde CREATED ON: 3/28/2008 1:49:38 PM REV: *** VER: -- REL: -- LOCATION: Root Folder/EngineeringParts BRANCH: --

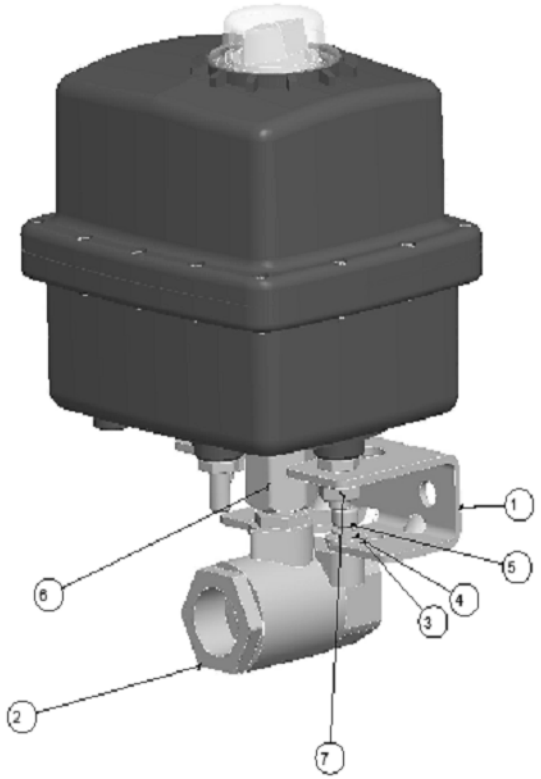
REVISER	REVISION ECO	REVISION/VERSION DATE	REVISION/VERSION BY
-.6+		8/12/2008 9:18:50 AM	bgotschall







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-146	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	EH3-64D	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: .001/.010
SURFACE FINISH: 125µIN
DENSITY: .259 LBM/CU IN
MASS: 3.134 LBM
SURF AREA: 142.873 SQ IN
VOLUME: 12.142 CU IN

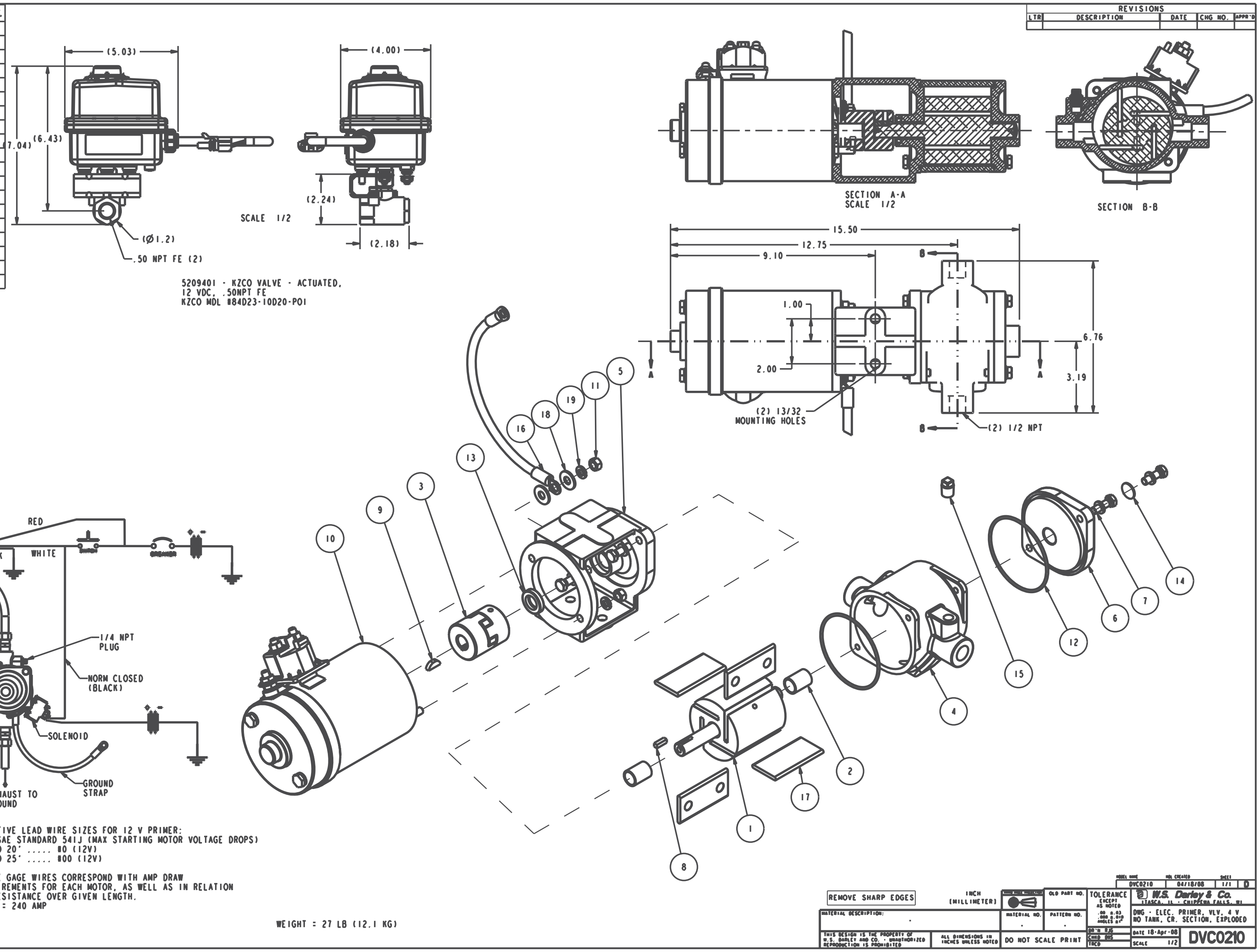
DATE: 2007-08-08
DESIGNED: L. ERDKAMP
DRAWN: C. HOWARD
APPROVED: L.ERDKAMP
SCALE: .750
SIZE: B
MATERIAL: AS NOTED

KZCO inc.
23880 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

CREATED BY: bgotschall CREATED ON: 8/12/2008 9:18:50 AM REV: - VER: 6+ REL: Revision LOCATION: Root Folder\Engineering\Parts BRANCH: main

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
14	PLUG - 0.75", FREEZE	4402500	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



NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

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

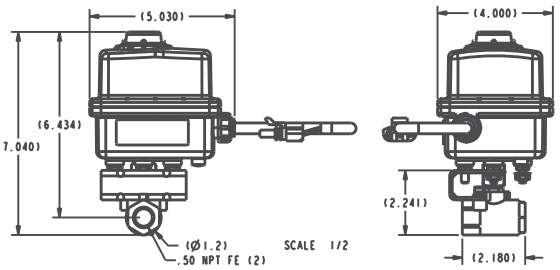
IF SUPPLIED GROUND STRAP IS REMOVED FROM ASSEMBLY, RETIGHTEN CYLINDER HEAD ADAPTER RETAINING NUTS EQUALLY TO 90 IN.LB.

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)

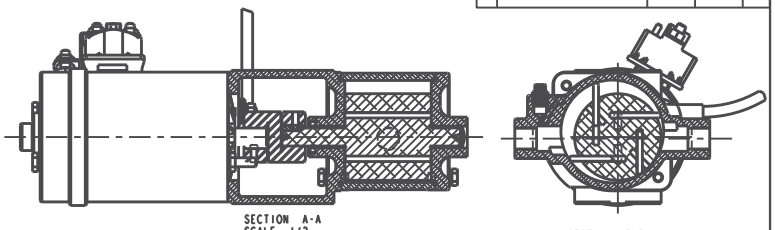
THESE GAGE WIRES CORRESPOND WITH AMP DRAW REQUIREMENTS FOR EACH MOTOR, AS WELL AS IN RELATION TO RESISTANCE OVER GIVEN LENGTH.
12 V = 240 AMP

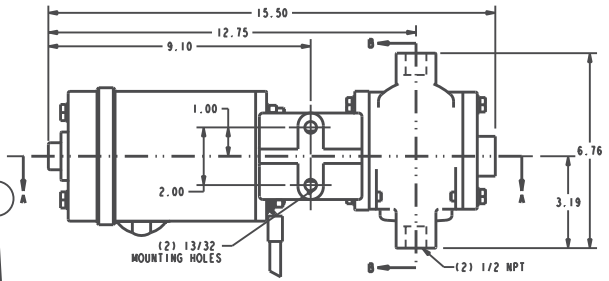
WEIGHT = 27 LB (12.1 KG)

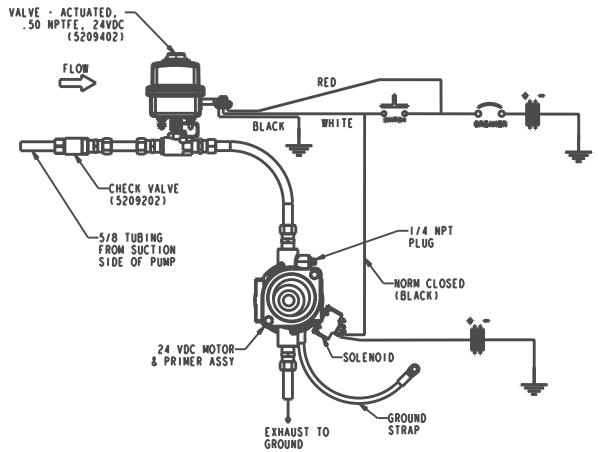
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - #44093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19 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
14	PLUG - 0.75", FREEZE	4402500	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

REMOVE SHARP EDGES

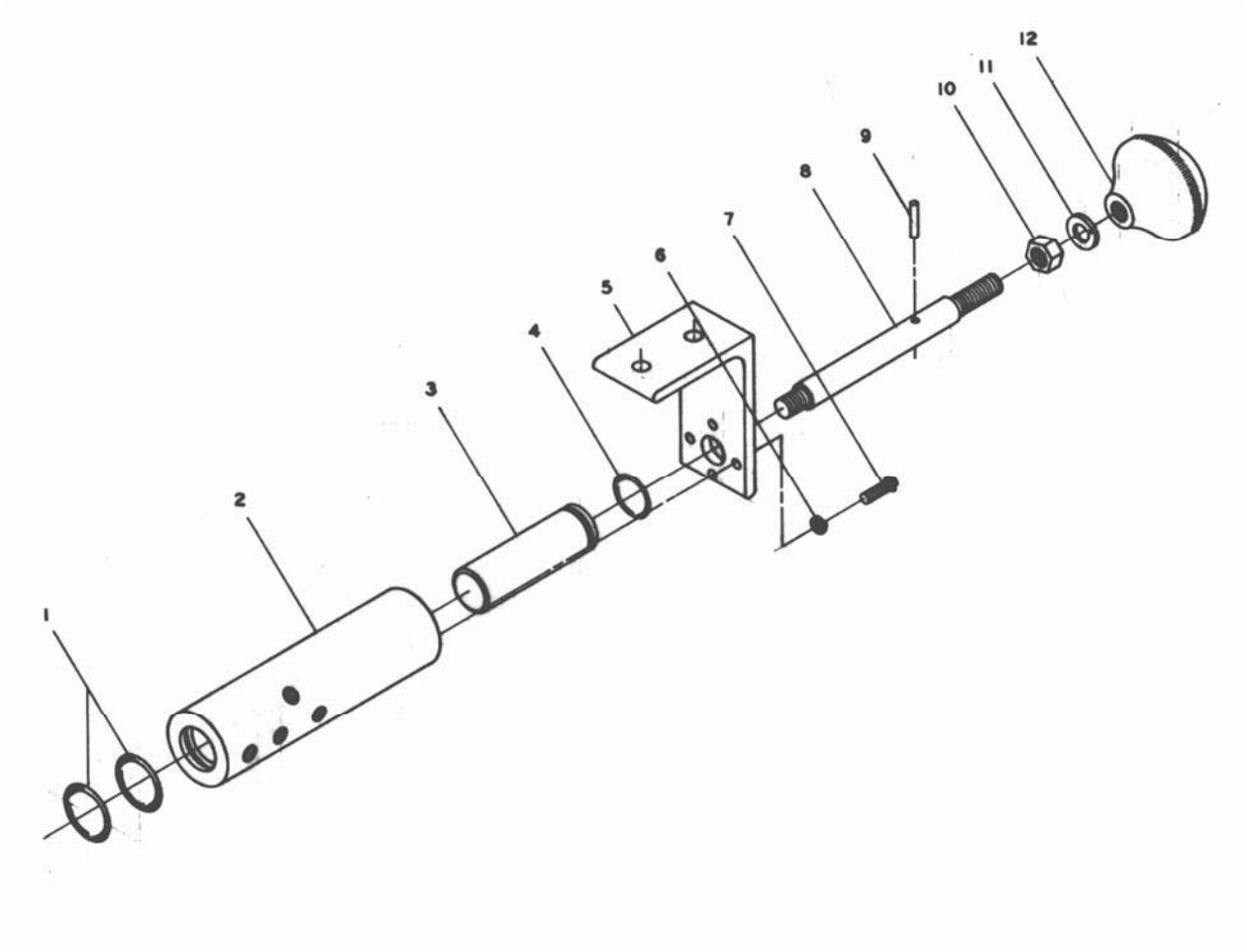
INCH (MILLIMETER)

DO NOT SCALE PRINT

W.S. Darley & Co.

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

DVC0211



PARTS LIST FOR MULTIPLE DRAIN VALVE

DRAWING NO. DGC0112

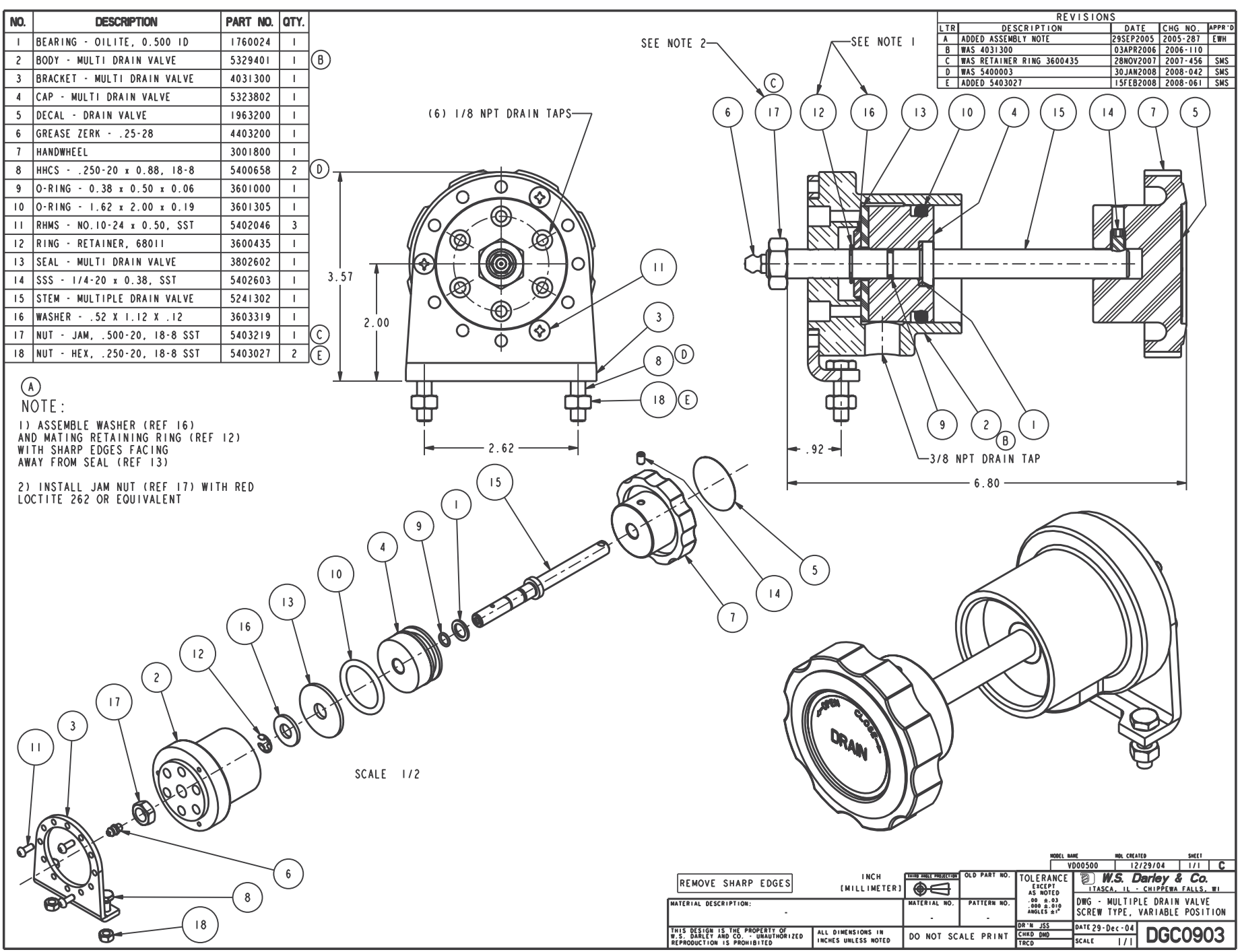
Rep. No.	Name of Part	Qty	Rep. No.	Name of Part	Qty
1	O-ring – Body	2	7	Round Head Cap Screw	4
2	Drain Valve Body	1	8	Drain Valve Stem	1
3	Drain Valve Plug	1	9	Pin	1
4	O-ring – Plug	1	10	Hex Nut	1
5	Drain Valve Mounting Bracket	1	11	Lock Washer	1
6	Lock Washer	4	12	Knob	1

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



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°

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

ALL DIMENSIONS IN INCHES UNLESS NOTED

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

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

DWG - MULTIPLE DRAIN VALVE
SCREW TYPE, VARIABLE POSITION

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 *stainless steel ball* 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.

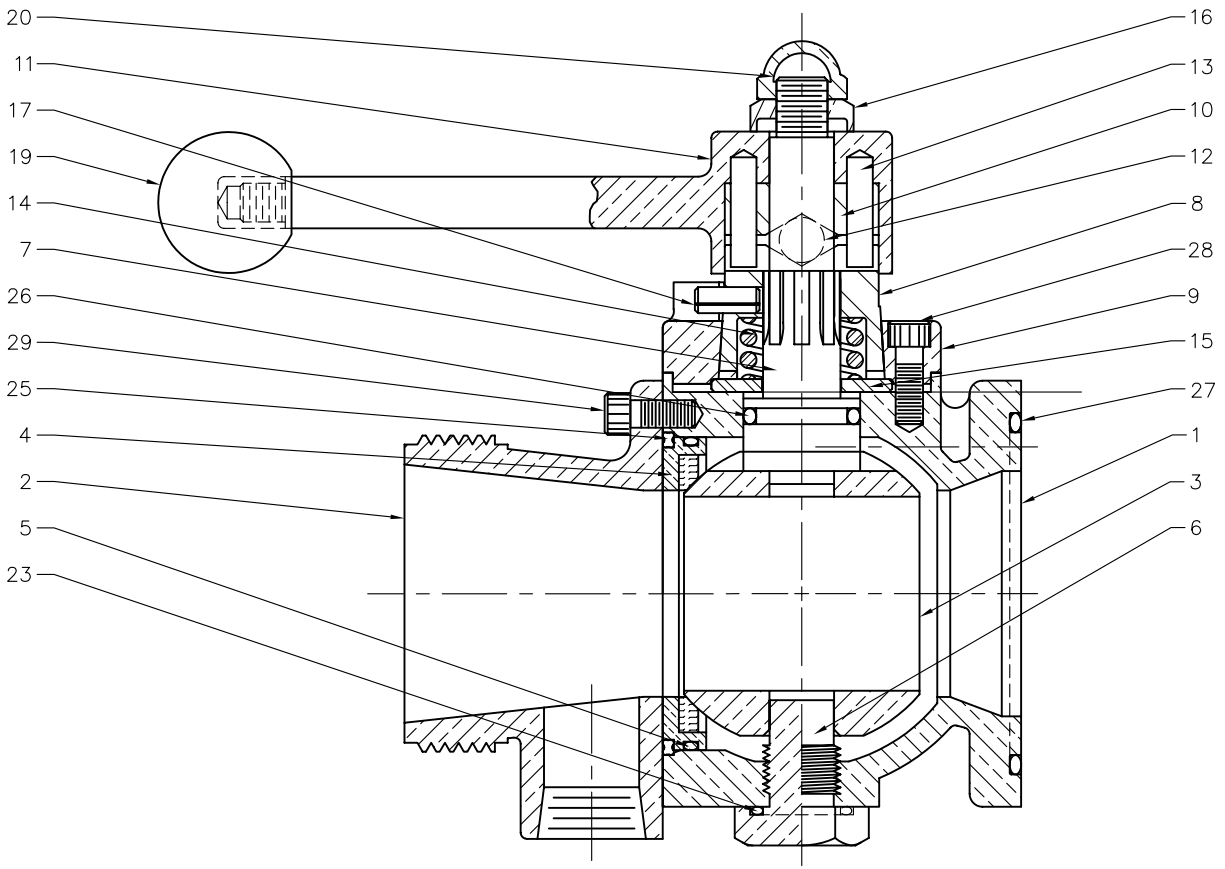
5. Place seat assembly (4), seat o-ring (5), and quad ring (25) into position.

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

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REMOTE CONTROL SUCTION RELIEF VALVE
DRAWING DGC0115

The suction relief valve bypasses water from the pump suction extension to the ground at a set pressure, preventing excessive rise of supply pressure when relay hose lines are shut off.

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

The self cleaning fine mesh strainer will prevent 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) counterclockwise 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 SUCTION RELIEF VALVE

1. Connect a discharge line from an auxiliary pump to the pump suction containing the suction relief valve. The auxiliary pump must be able to supply a pressure greater than the desired pressure setting of the suction relief valve.
2. Close all other discharge and suction valves.
3. Increase auxiliary pump engine throttle setting until pressure gage indicates the pressure that suction relief valve is open.
4. If suction relief valve opens to bypass excessive pressure, slowly turn hand wheel (14) clockwise until valve closes.
5. If suction relief valve does not open, turn hand wheel (14) counterclockwise until valve opens and begins bypassing water. Continue to turn hand wheel (14) counterclockwise 2 more complete turns. Now slowly turn hand wheel clockwise until valve closes and stops bypassing water.

The suction relief valve will now prevent damage to the pump from a pressure surge (water hammer) which is the result of rapid closing or opening of relay line valves.

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

CAUTION: With all discharge valves closed, the water in auxiliary pump casing will heat up rapidly. Avoid damage by allowing a very low flow of water to discharge when pump is running.

REMOTE CONTROL SUCTION RELIEF VALVE
WITH MECHANICAL SHUTOFF
DRAWING DGC0115

MAINTENANCE

Open the relief valve strainer flush valve (6) during every operation at 50-100 PSI supply pressure to insure against foreign material blocking the screen.

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) counterclockwise 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 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) counterclockwise 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 care when initially inserting screen into body to avoid damaging quad ring (64) or valve seat.

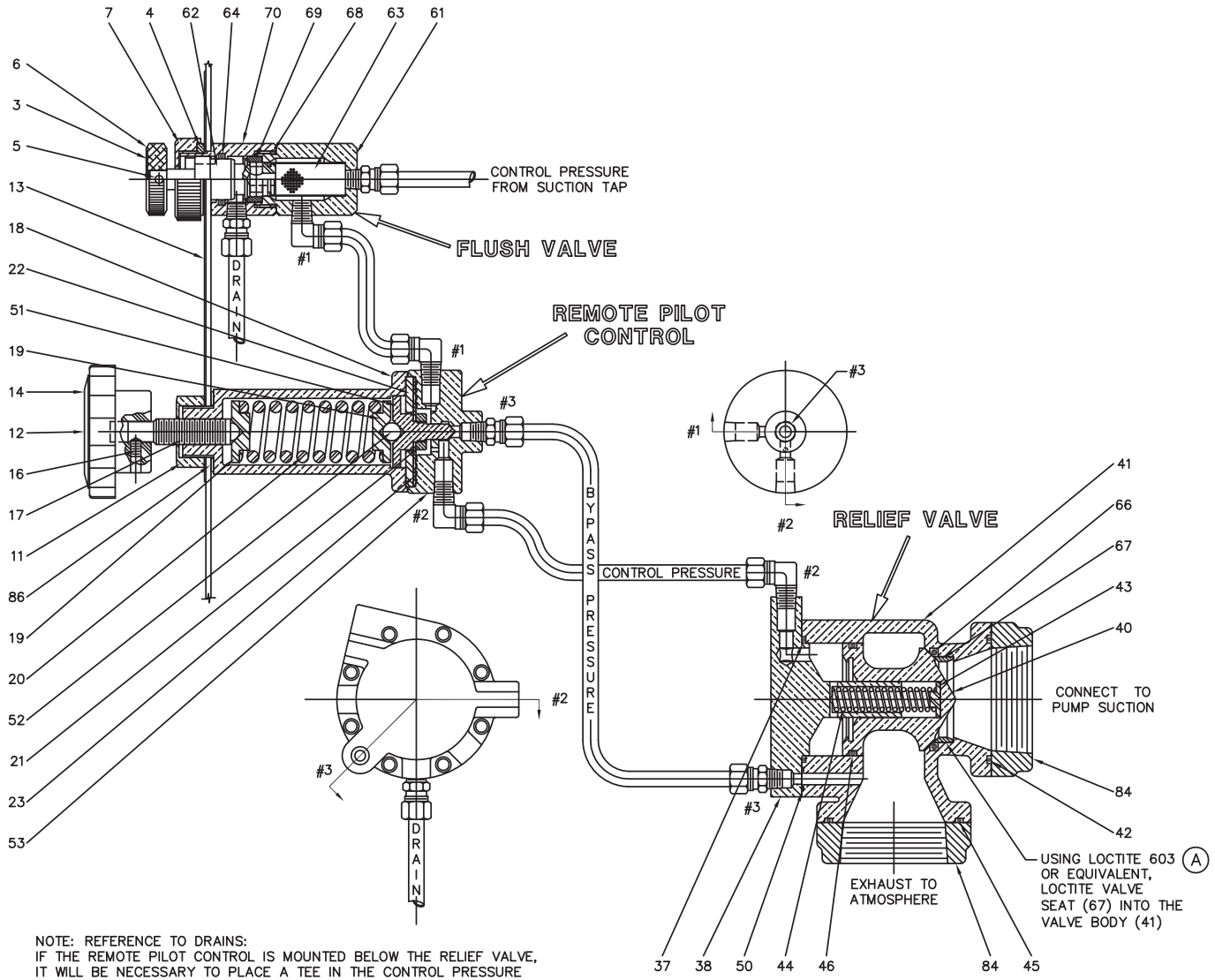
To replace flush valve seat (69), remove stem/screen assembly. Disconnect tubing lines attached to (61) body half, unscrew (61) body half from (70) body half. Replace (69) valve seat. Reverse procedure to reassemble valve.

SUCTION RELIEF VALVE PARTS LIST
DRAWING DGC0115

REP NO.	DESCRIPTION	REP NO.	DESCRIPTION
3	Decal - RV Flush	41	Relief Valve Body
4	Panel Nut	42	O-ring Flange
5	Socket Set Screw	43	Spring Centering Plug
6	Flush Valve Knob	44	Spring
7	Stop Nut	45	O-ring Body Flange
11	Panel Valve Nut	46	O-ring Piston
12	Decal - Pressure Hi-Lo	50	O-ring, Bleed Port
13	Trim Plate	51	Pilot Valve
14	Hand wheel	52	Ball
16	Socket Set Screw	53	Pilot Valve Body
17	Spring Tension Screw	61	Body Half, Flush Valve
18	Spring Housing	62	Stem
19	Spring Retainer	63	Screen
20	Regulator Spring	64	Quad Ring
21	Pilot Valve Nut	66	O-ring Valve Seat
22	Housing Pilot Ring	67	Valve Seat Ring
23	Diaphragm	68	O-ring Flush Valve Body
37	O-ring, Relief Valve Head	69	Flush Valve Seat
38	Relief Valve Head	70	Body Half, Flush Valve
40	Relief Valve Piston	84	Flange
		86	Lock Washer Internal

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	ADDED LOCTITING NOTE	4NOV2002	2002-175	TED



NOTE: REFERENCE TO DRAINS:
IF THE REMOTE PILOT CONTROL IS MOUNTED BELOW THE RELIEF VALVE, IT WILL BE NECESSARY TO PLACE A TEE IN THE CONTROL PRESSURE LINE AND BYPASS PRESSURE LINE, AT THE LOWEST POINT, TO PROVIDE DRAINING. SUCH A DRAIN, IF INSTALLED, SHOULD NOT BE CONNECTED TOGETHER WITH THE RELIEF VALVE DRAIN. CONNECT DRAIN LINES TO SEPARATE INLET TAPS OF MULTIPLE DRAIN VALVE. DRAINS MUST BE CLOSED DURING OPERATION.

MATERIAL DESCRIPTION: –	MATERIAL NO. –	OLD PART NO. G2453	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
		PATTERN NO. –	DR'N S. LEE	DWG – SUCTION RELIEF VALVE –
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 TRCD	DATE DEC17,91 SCALE 1/2 DGC0115

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.

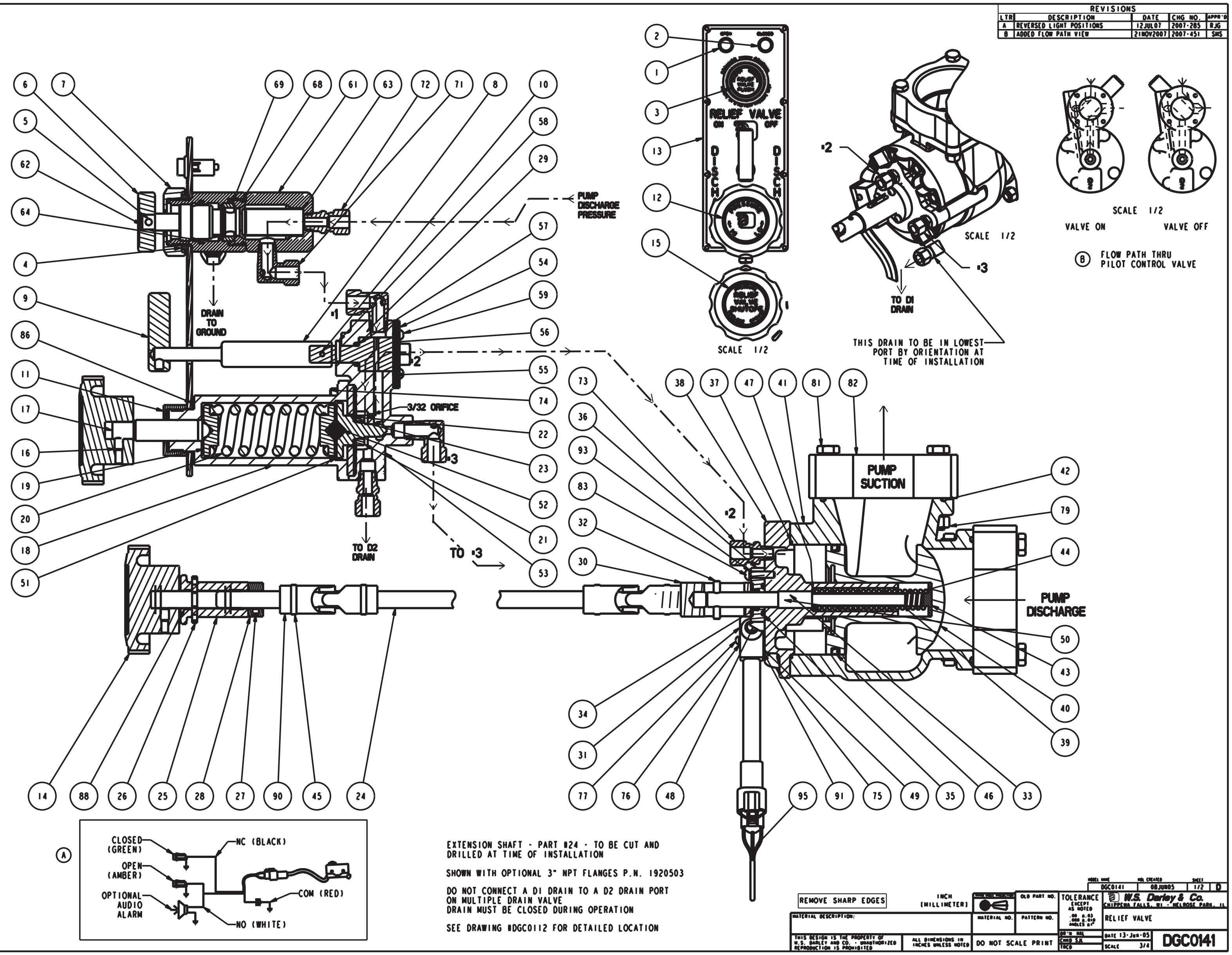
Self-cleaning strainer (63) can be removed for inspection or replacement by alternately turning valve knob (6) and stop nut (7) counter clockwise until stem is free for removal. To avoid discharging water through opening created by stem (62) removal, pump should be completely shut down before stem (62) 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

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, GRS	-	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, GRS	-	1
28	COLLAR - SHAFT, 1/2" BORE	-	1
29	SSS - .313 x 0.31, GRS	-	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, COMPLETE	-	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
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, GRS	-	8
82	FLANGE - ADAPTER, 3 NPT	-	2
83	RHMS - NO.10-24 x 0.75, GRS	-	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



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, COMPLETE	-	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
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

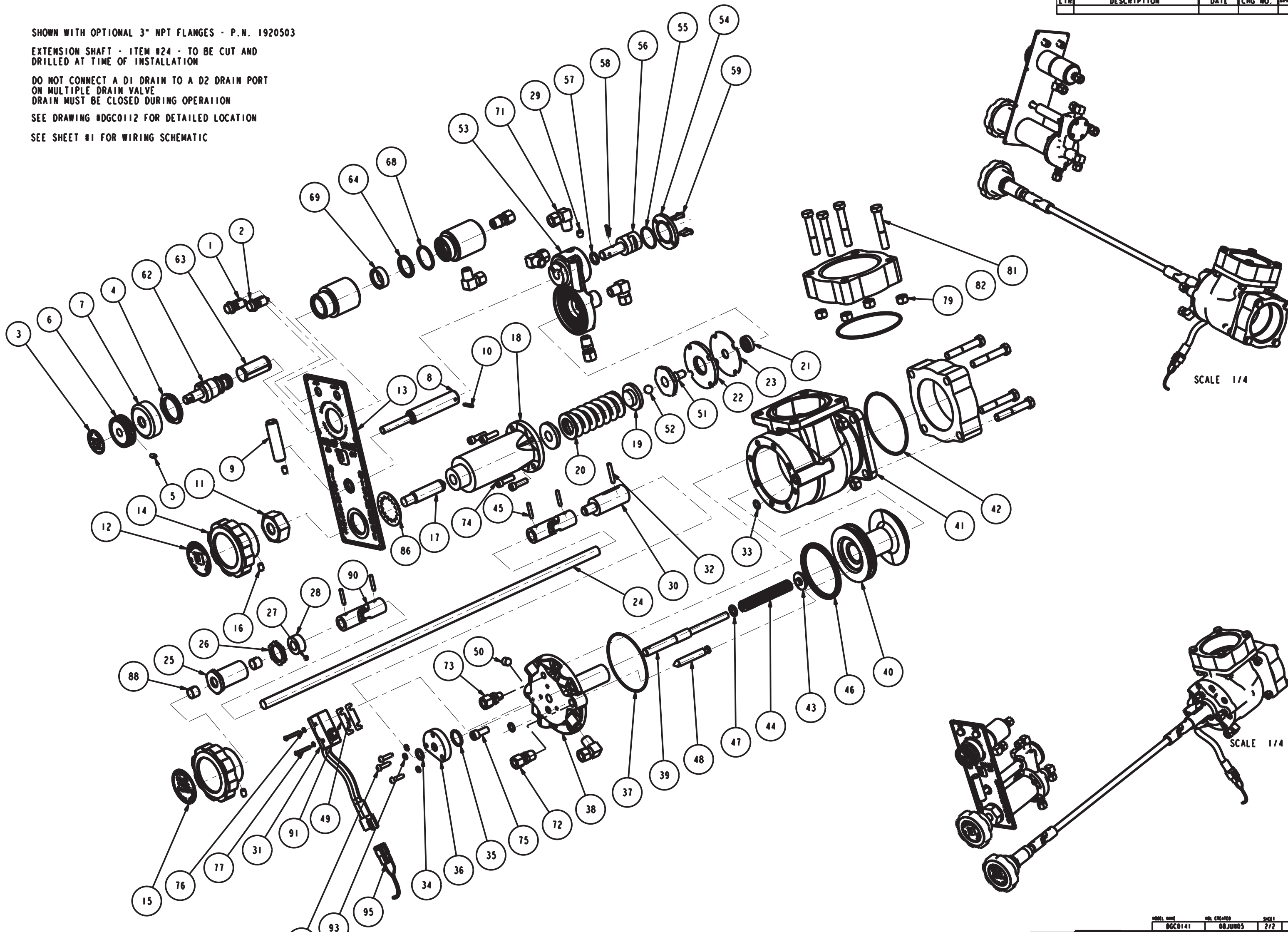
SHOWN WITH OPTIONAL 3" NPT FLANGES - P.N. 1920503

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

REMOVE SHARP EDGES

INCH (MILLIMETER)

TOLERANCE EXCEPT AS NOTED

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

RELIEF VALVE

DATE 15-Jun-05

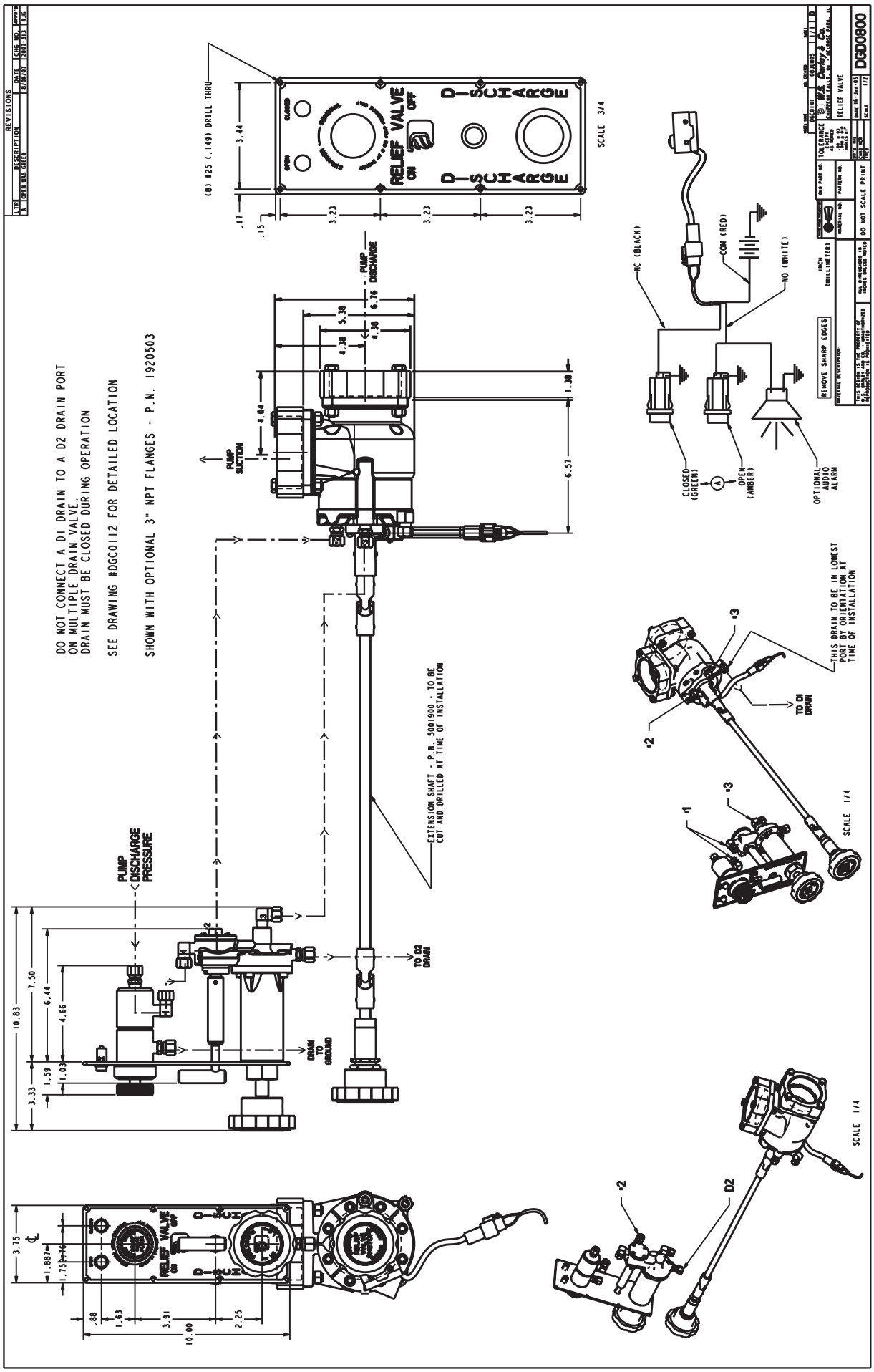
SCALE 3/4

DGC0141

DO NOT SCALE PRINT

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

ALL DIMENSIONS IN INCHES UNLESS NOTED


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
PUMP SUCTION
PUMP DISCHARGE
EXTENSION SHAFT - P.N. 5001900 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION
TO D2 DRAIN
DRAIN TO GROUND
TO D1 DRAIN
THIS DRAIN TO BE IN LOWEST PORT BY ORIENTATION AT TIME OF INSTALLATION
RELIEF VALVE
ON
OFF
D-SCHARGE
SCALE 3/4
SCALE 1/4
SCALE 1/4
NC (BLACK)
COM (RED)
NO (WHITE)
CLOSED (GREEN)
OPEN (AMBER)
OPTIONAL AUDIO ALARM
REMOVE SHARP EDGES
DO NOT SCALE PRINT
W.S. Darley & Co.
RELIEF VALVE
DGD0800

W.S. DARLEY & CO.

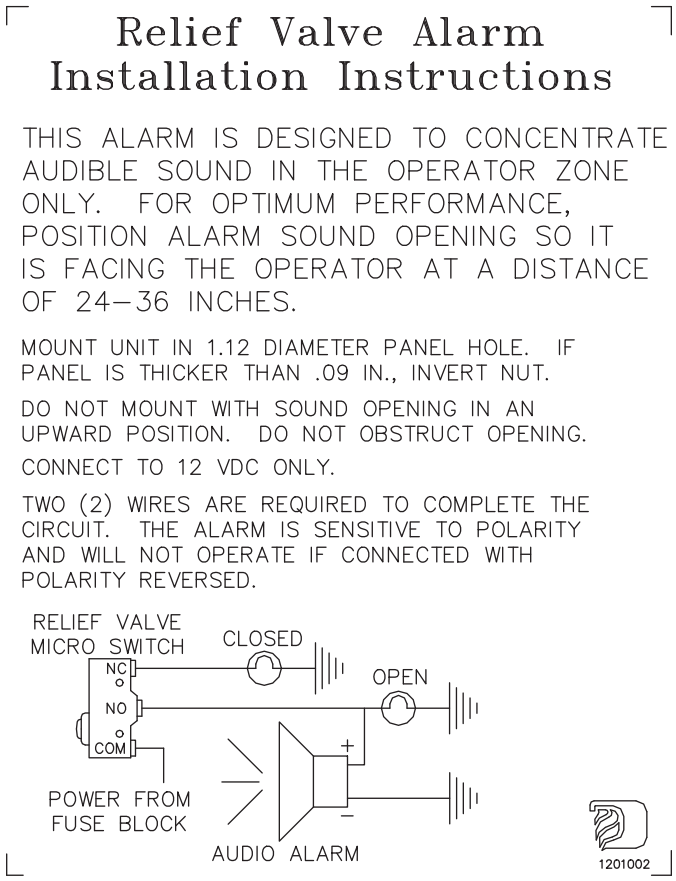
Relief Valve Alarm
Installation Instruction

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.

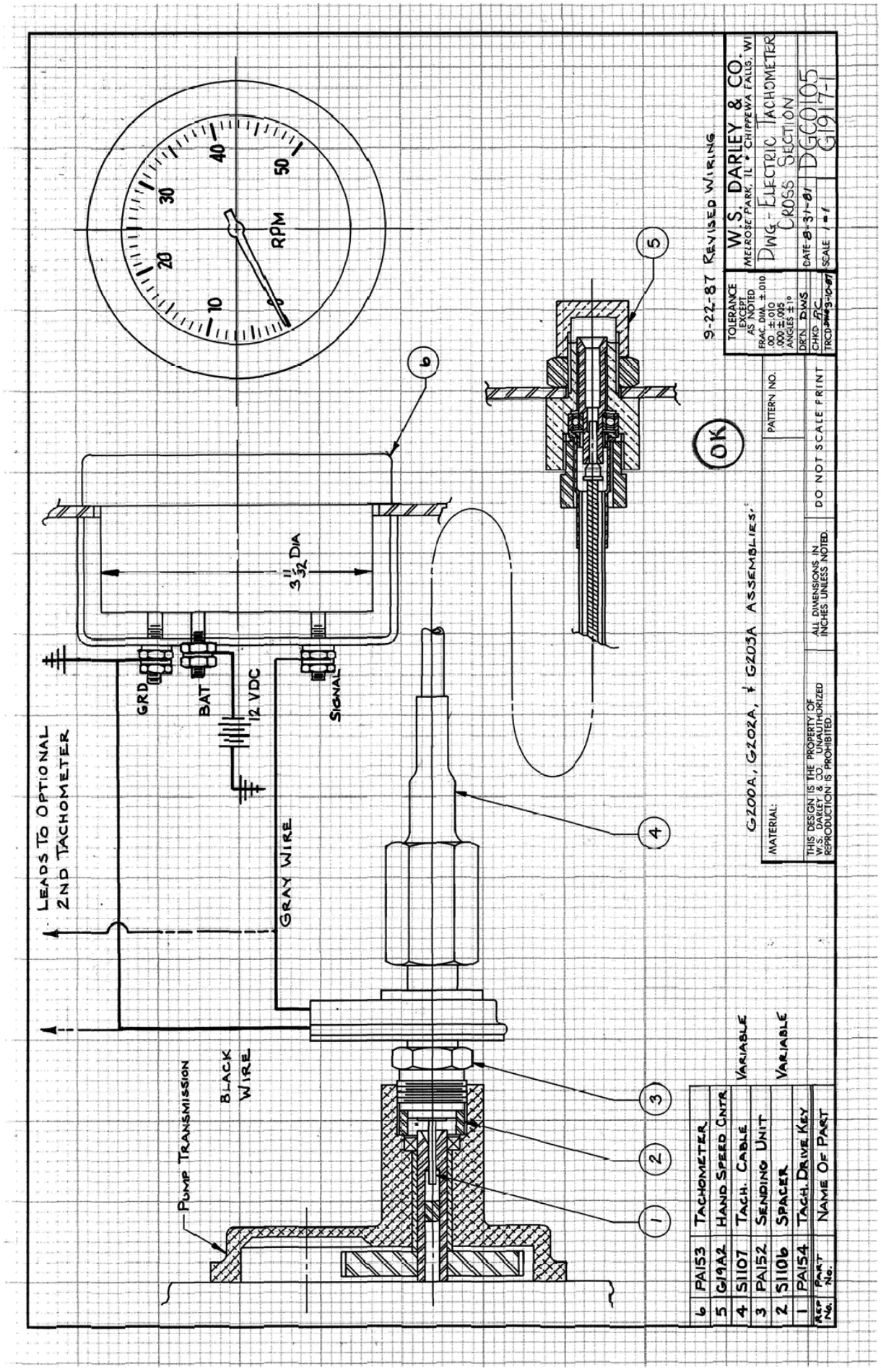
Mount unit in 1.12 diameter panel hole. If panel is thicker than .09 inches, invert nut.

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


RPM
10
20
30
40
50
0
3 11/32 DIA
GRD
BAT
12 VDC
SIGNAL
LEADS TO OPTIONAL 2ND TACHOMETER
GRAY WIRE
BLACK WIRE
PUMP TRANSMISSION
9-22-87 REVISED WIRING
OK
G200A, G202A, & G203A ASSEMBLIES
W.S. DARLEY & CO.
MELROSE PARK, IL • CHIPPEWA FALLS, WI
DWG - ELECTRIC TACHOMETER CROSS SECTION
DGC0105
G1917-1
TOLERANCE EXCEPT AS NOTED
FRAC. DIM. ± .010
.00 ± .010
.000 ± .005
ANGLES ± 1°
DRN. DWS
CHKD. AC
TRCD 8-31-87
DATE 8-31-87
SCALE 1=1
MATERIAL:
PATTERN NO.
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY & CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED.
ALL DIMENSIONS IN INCHES UNLESS NOTED.
DO NOT SCALE PRINT
Ref No. | Part No. | Name Of Part
6 | PA153 | Tachometer
5 | G192 | Hand Speed Cntr. Variable
4 | S1107 | Tach. Cable
3 | PA152 | Sending Unit Variable
2 | S1106 | Spacer
1 | PA154 | Tach. Drive Key

W.S. DARLEY & CO.

SWITCHING DIESEL TACHOMETER

1. CAUTION: Disconnect the battery during installation. Tighten nuts on back clamp only slightly more than you can tighten them with our fingers. Six inch pounds of torque is sufficient. Over tightening may result in damage to the instrument and may void your warranty!

2. Location: The tachometer should be located at least 18" from a magnetic compass. Some interference (erratic operation) may be noticed on the tachometer during radio transmission. This will neither damage a Faria tachometer nor affect accuracy when not transmitting.

3. Be certain to use insulated wire not less than 18 gauge that is approved for marine use. It is recommended that insulated wire terminals, preferably ring type, be used on all connections to the tachometer except for the light which requires a 1/4" female blade terminal.

4. The tach sender, DK-3 or equivalent, must be used in conjunction with the tachometer. One DK-3 sender will operate two tachometers. Mount the sender to the pump at the mechanical tachometer drive take-off using the correct drive tip (supplied with DK-3) to properly engage the sender.

5. Using a small screwdriver, SLIGHTLY depress and turn the selector switch on the back of the tachometer to match the tachometer drive take-off (see label on side of tachometer). DEPRESSING THE SWITCH TOO HARD MAY CAUSE DAMAGE TO THE TACHOMETER. Be sure the selector switch has locked into the detent at the correct position by slightly rotating the switch back and forth with the screwdriver. (PTO Pump tach ratio = 1/2, Midship Pump tach ratio = 1/1).

6. Cut a 3-3/8" diameter hole in the dash and mount the tach with back clamp supplied.

7. Connect a wire to the tach stud marked "BAT" (battery) and secure with nut and lockwasher. Connect opposite end of the 12 VDC circuit that is activated by the ignition switch.

8. Connect a wire to the tach stud marked "SIGNAL" and secure with a nut and lockwasher. Connect the opposite end to the gray wire of the diesel tachometer sender. Connect the black wire of the diesel tachometer sender to the engine ground.

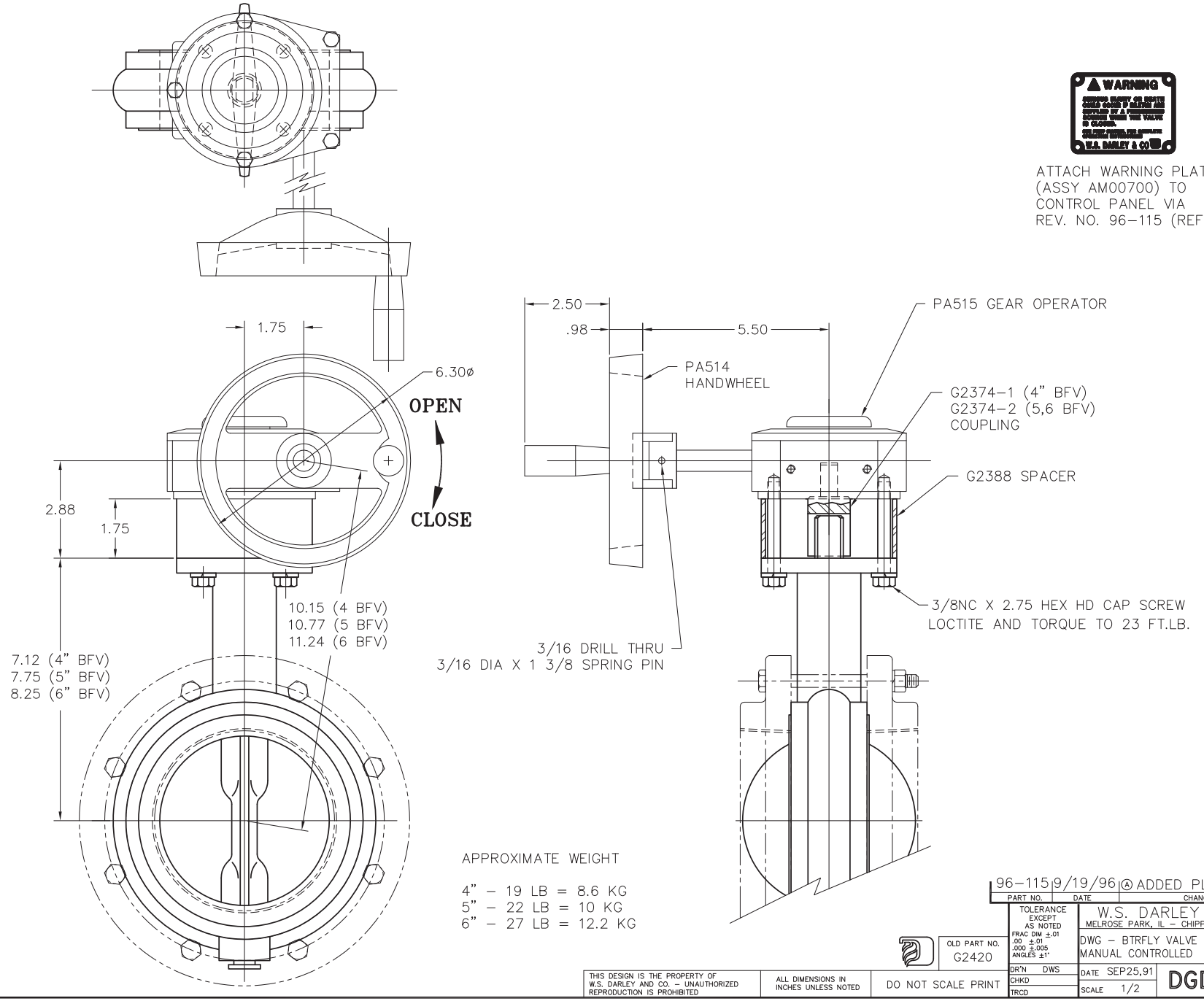
9. Connect a wire to the tach stud marked "GND" (ground) and secure with a nut and lockwasher. Connect opposite end to the electrical ground.

10. Connect the blade terminal adjacent to the twist-out light assembly to the positive "+" side of the vehicle's instrument lighting circuit. No separate ground is required for lighting.

11. Reconnect the battery.

12. NOTE: To change light bulb, twist black socket assembly one-eighth (1/8) turn counter clockwise until it pops out. Bulb pulls straight out of socket assembly. It is a GE #158 instrument lamp.

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



PART NO.	DATE	CHANGE
96–115	9/19/96	Ⓐ ADDED PLATE LMH

OLD PART NO. G2420

TOLERANCE EXCEPT AS NOTED
FRAC DIM ±.01
.00 ±.01
.000 ±.005
ANGLES ±1°

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

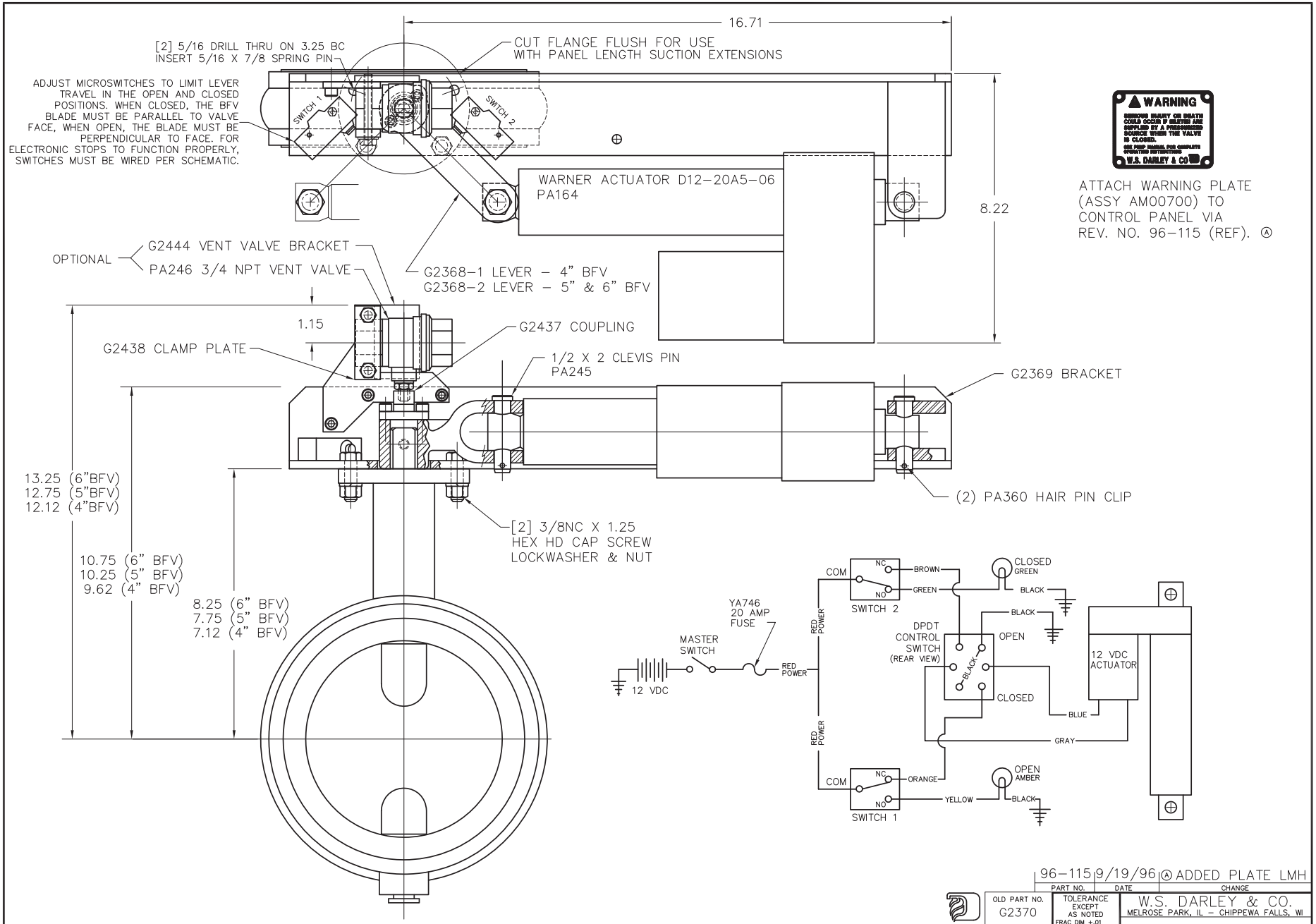
DWG – BTRFLY VALVE ASSY
MANUAL CONTROLLED

DR'N DWS
CHKD
TRCD
DATE SEP25,91
SCALE 1/2

DGD0104

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT



APPROXIMATE WEIGHT = 35 LB = 15.9 KG (6" BFV)
30 LB = 13.6 KG (5" BFV)
27 LB = 12.2 KG (4" BFV)

PART NO.	DATE	CHANGE
96-115	9/19/96	Ⓐ ADDED PLATE LMH

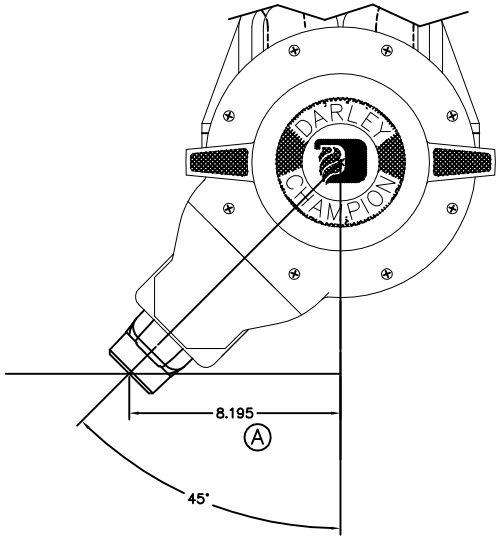
MATERIAL:	MATERIAL NO. –	OLD PART NO. G2370	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
		PATTERN NO.		DWG – BUTTERFLY VALVE ASSEMBLY ELECTRIC ACTUATED
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	DR'N SEITZ CHKD TRCD	DATE NOV20,91 SCALE 1/2
				DGD0101

INLET RELIEF VALVE INFORMATION: Ⓐ

ACTUAL PRESSURE RANGE IS 90PSI – 300PSI
THERE MAY BE SOME DIMINISH IN FLOW AT HIGHER PRESSURE SETTINGS. (SETTINGS BELOW 200 PSI RECOMMENDED FOR MOST APPLICATIONS).
RELIEF VALVE IS FACTORY SET AT 125 PSI AND WHEN PRESET AT 125 PSI, THE PRESSURE RELIEF VALVE SHALL NOT ALLOW A PRESSURE RISE GREATER THAN 60 PSI AT THE DEVICE INLET WHILE FLOWING A MINIMUM OF 150 GPM.
THIS VALVE IS NFPA 2009 1901 COMPLIANT PER SECTION 16.6.6.3

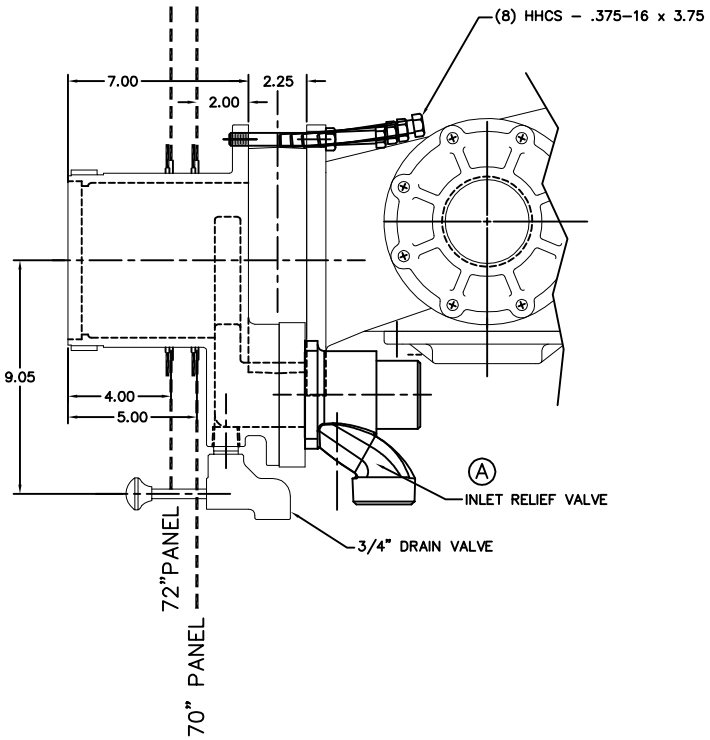
ADJUSTMENT INSTRUCTIONS (IF REQUIRED): Ⓐ

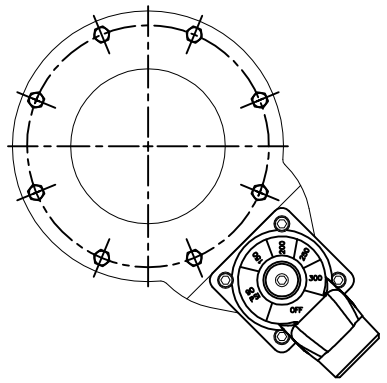
ADJUST CENTER HEX COUNTERSUNK HEX HEAD PRESSURE ADJUSTING BOLT WITH A 1/4" ALLEN WRENCH, 9/16" OR 14 MM SOCKET.
TO SET AT THE DESIRED RELIEF PRESSURE, ADJUST THE ADJUSTING BOLT HEAD SO THE TOP OF THE BOLT HEAD IS EVEN WITH THE DESIRED PRESSURE.



NOTE:
SUCTION NIPPLE WILL BE ROTATED 45° OFF CENTER WHEN MOUNTED.

Ⓐ





TYPICAL SUCTION EXTENSION CONFIGURATION FOR EM, LDM, N, & S PUMP

EXTENSION AND NIPPLE ARE THE SAME FOR 70 & 72" ASSEMBLIES WITH AND WITHOUT BUTTERFLY VALVES.
IF BFV IS NOT REQUIRED, THEN KC00300 ASSY W/2.25 THICK SPACER IS USED.
USE 1962503 STAINLESS STEEL PANEL TRIM RING

PART NO.	DATE	CHANGE
A – #8512	07/18/12	UPDATED DRAWING TO REFLECT USE OF TFT SUCTION RELIEF VALVE 8.20 WAS 5.22. UPDATED INFO AND ADJUSTMENT SECTION

TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
MATERIAL:	INSTR – INLET RV ADJUSTMENT
PATTERN NO.	–
DR'N CKE	DATE 03FEB,00
CHKD SJL	SCALE 1/4
TRCD	I200572

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

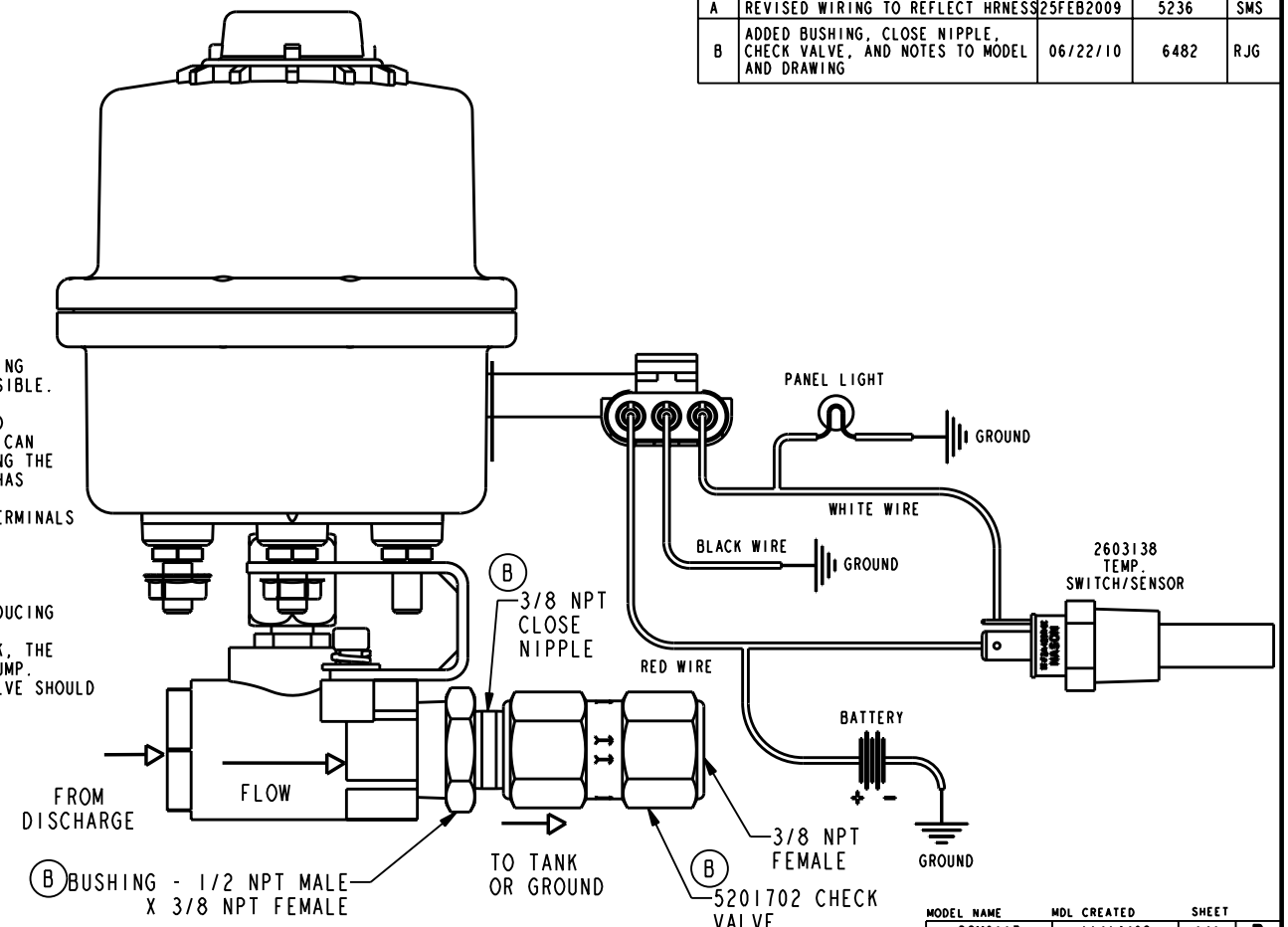
NAME:RJG OBJECT:DGM0117 DATE:22-Jun-10 14:41:12

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

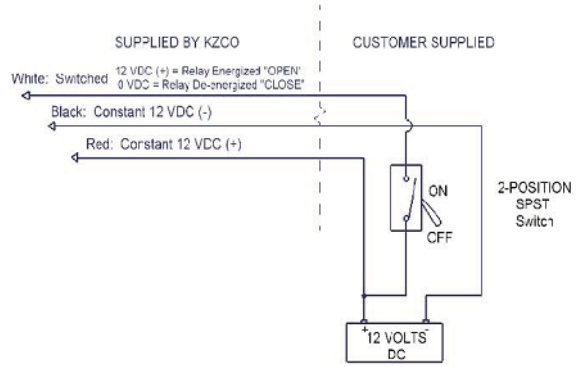
DO NOT SCALE PRINT

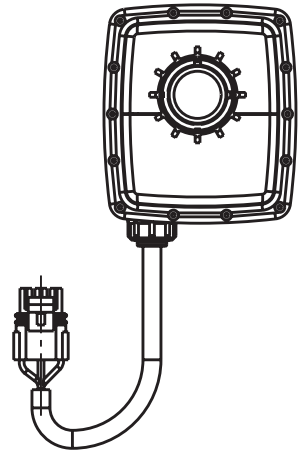
Prepared By: EAP
Revised By: EAP
Approved By: TED

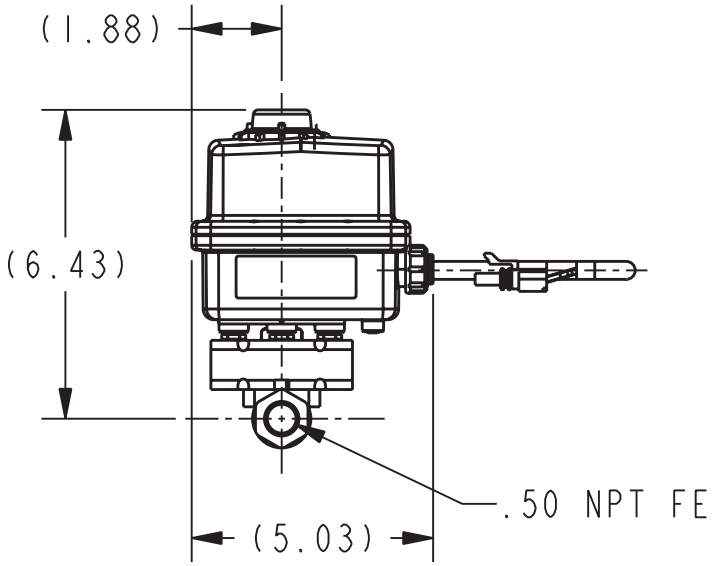
69

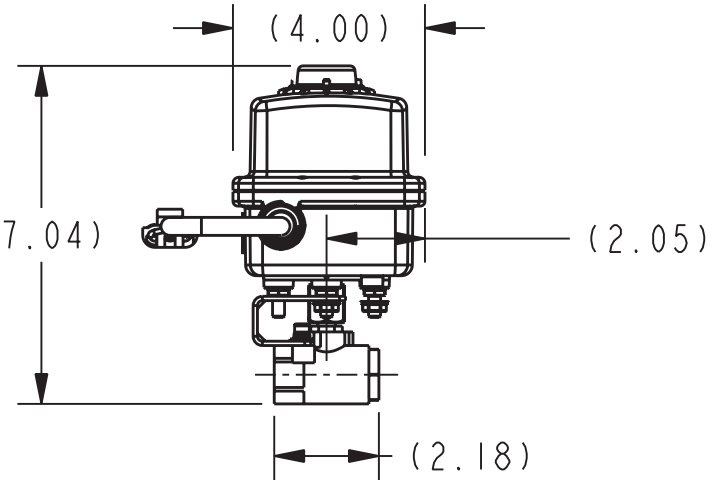
Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

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

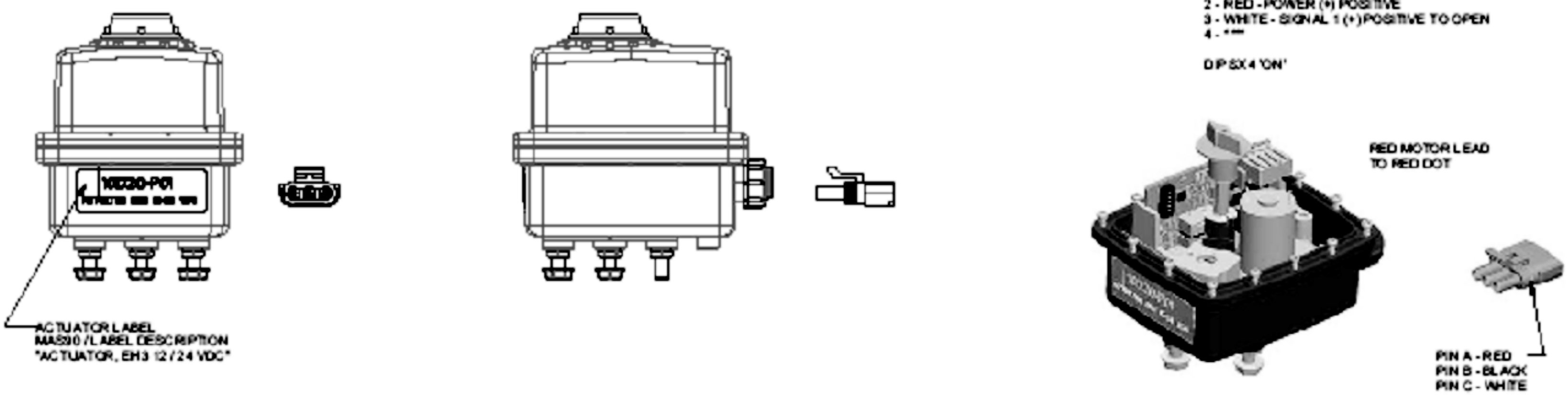
VALVE - ACTUATED, 12VDC, .50NPT FE
KZCO 84D23-10D20-P01

DATE 13-Nov-08
SCALE 1/4

5209401

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT



REV	REVISED	REV DATE	REVISED BY
-2+		7/15/2008 9:41:57 AM	bgotschall

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'

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 =

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL
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/NOLON	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_6N33L_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, #008, 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	

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 REVISION -2+
DRAWING NO. 10020-P01 SHEET 1 OF 1

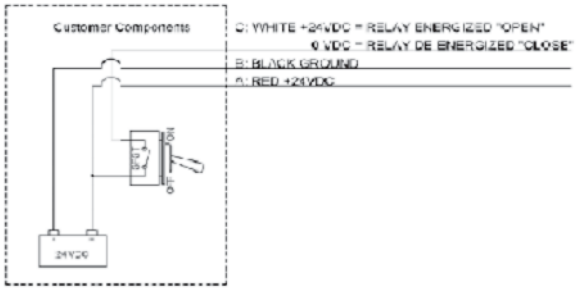
Prepared By: EAP
Revised By: EAP
Approved By: TED

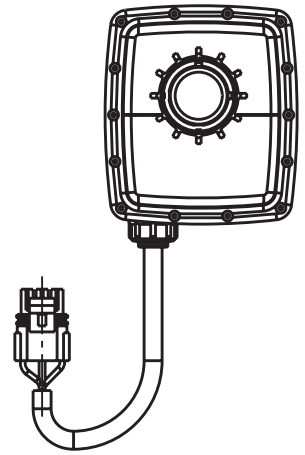
71

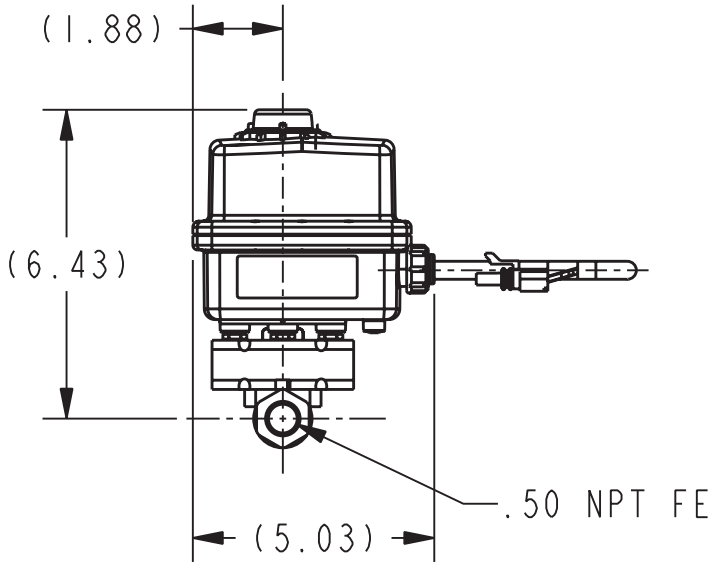
Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

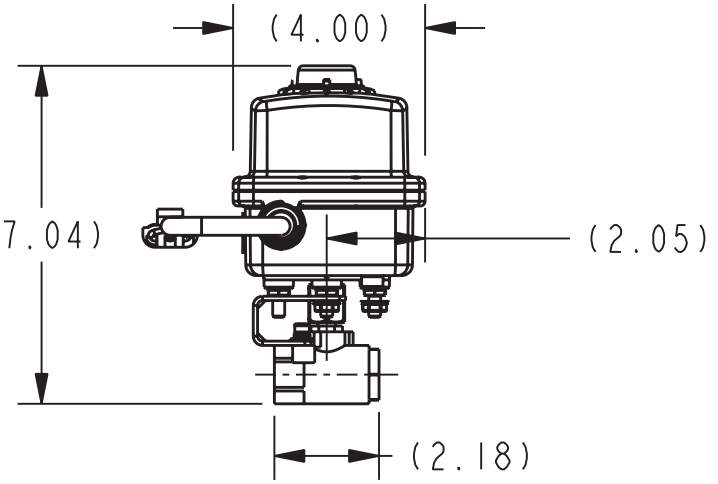
60AD WIRING
Standard On/Off applications, SPST Switch
24 VDC

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.

MATERIAL DESCRIPTION: KZCO 84D23-60AD-M

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

DATE 13-Nov-08
SCALE 1/4

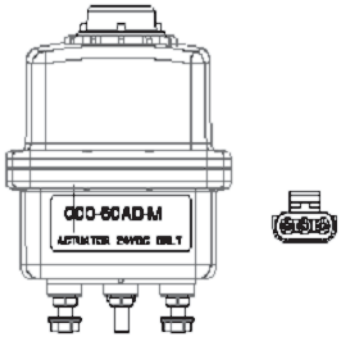
5209402

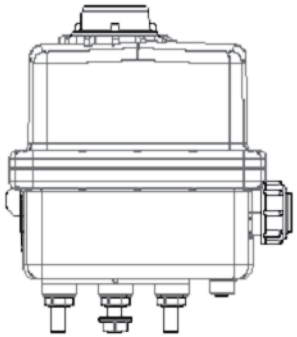
ALL DIMENSIONS IN INCHES UNLESS NOTED

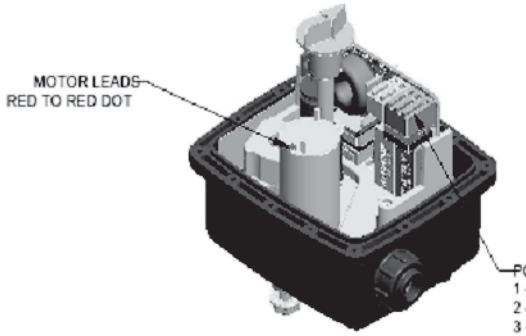
DO NOT SCALE PRINT

Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

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







SCALE .500

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, .250-28 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: .560 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:

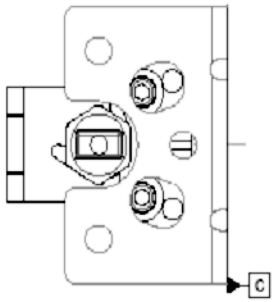
KZCO inc.
23880 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2767
FAX: +1.402.944.2402

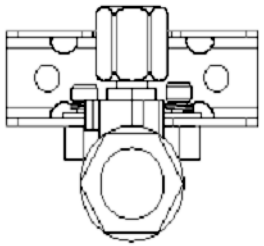
TITLE: ACTUATOR, EH3, .8S @24VDC
REF:
PART NO: 000-60AD-M
REVISER: *** .1
DRAWING NO: 000-60AD-M
SHEET: 1 OF 1

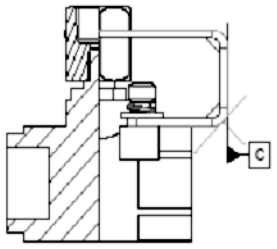
Prepared By: EAP
Revised By: EAP
Approved By: TED

Prepared By: EAP
Revised By: EAP
Approved By: TED

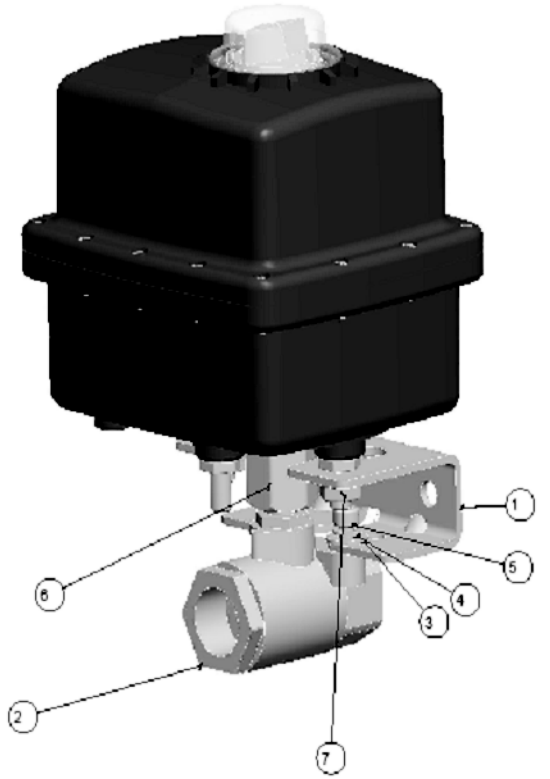
REVIVER	REVISION ECO	REVISION/VERSION DATE	REVISION/VERSION BY
-.6+		8/12/2008 9:18:50 AM	bgotschall







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-105	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: .007/.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: 2007-06-08
DESIGNED: L. ERDKAMP
DRAWN: C. HOWARD
APPROVED: L.ERDKAMP
SCALE: .750
SIZE: B
MATERIAL: AS NOTED

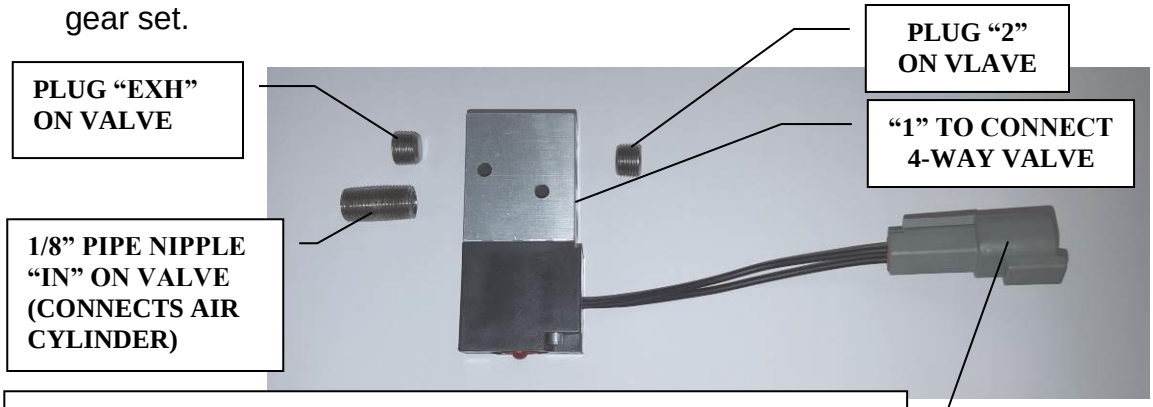
KZCO INC.
23380 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2787
FAX: +1.402.944.2402

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

Rev. 17
Date: 06/13/07
Rev Date: 06/14/12
1200517.doc

SHIFT SAFETY INTERLOCK
SCHEMATIC
MID-SHIP GEAR CASE

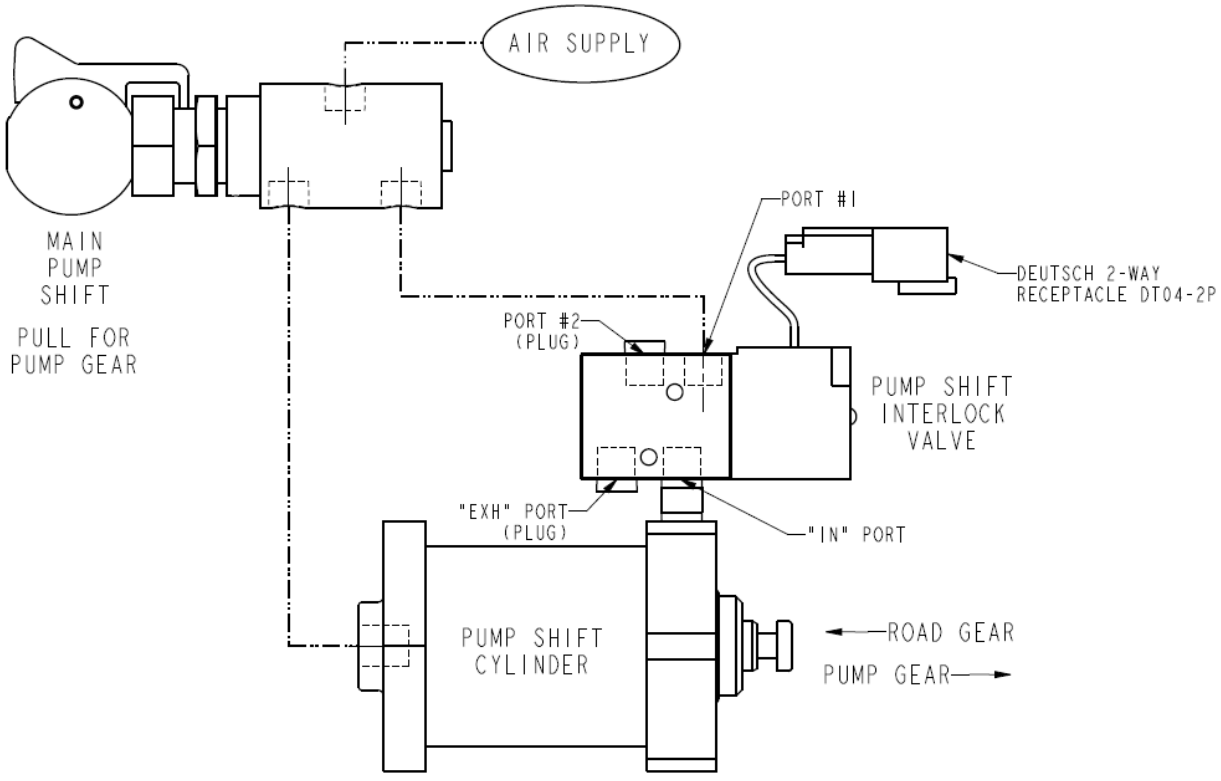
The safety interlock prevents the main pump shift from actuating while the automatic truck transmission is in drive gear. This eliminates clashing and possible damage of the pump gear set.

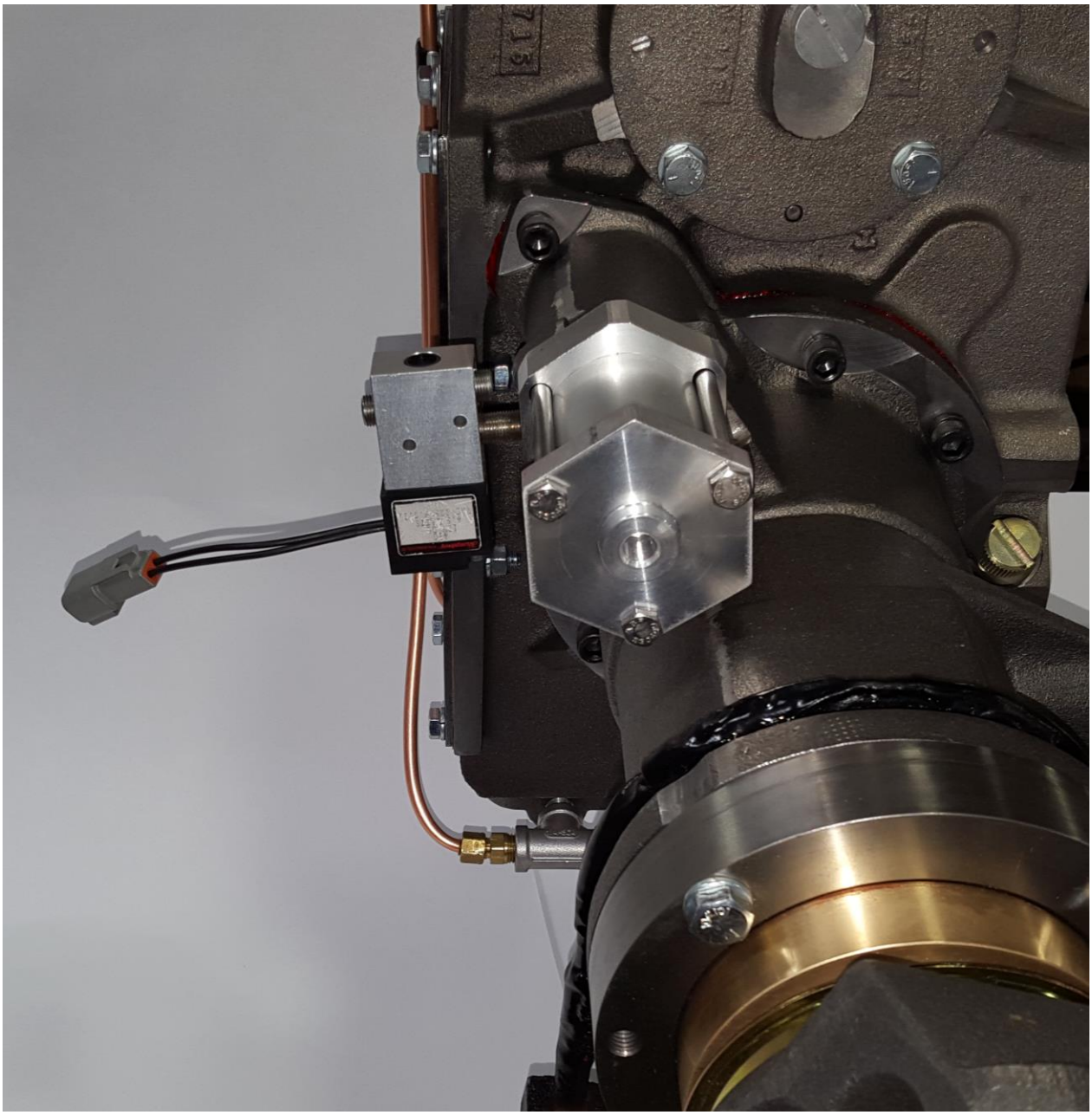


-DEUTSCH 2-WAY RECEPTACLE DT04-2P.
-SUPPLY VOLTAGE AND GROUND TO CLOSE VALVE WHEN MAIN CHASSIS TRANSMISSION IS IN PUMP GEAR (POLARITY IS NOT IMPORTANT)
-THIS WILL PREVENT THE PUMP FROM SHIFTING WHEN THE MAIN CHASSIS TRANSMISSION IS IN PUMP GEAR

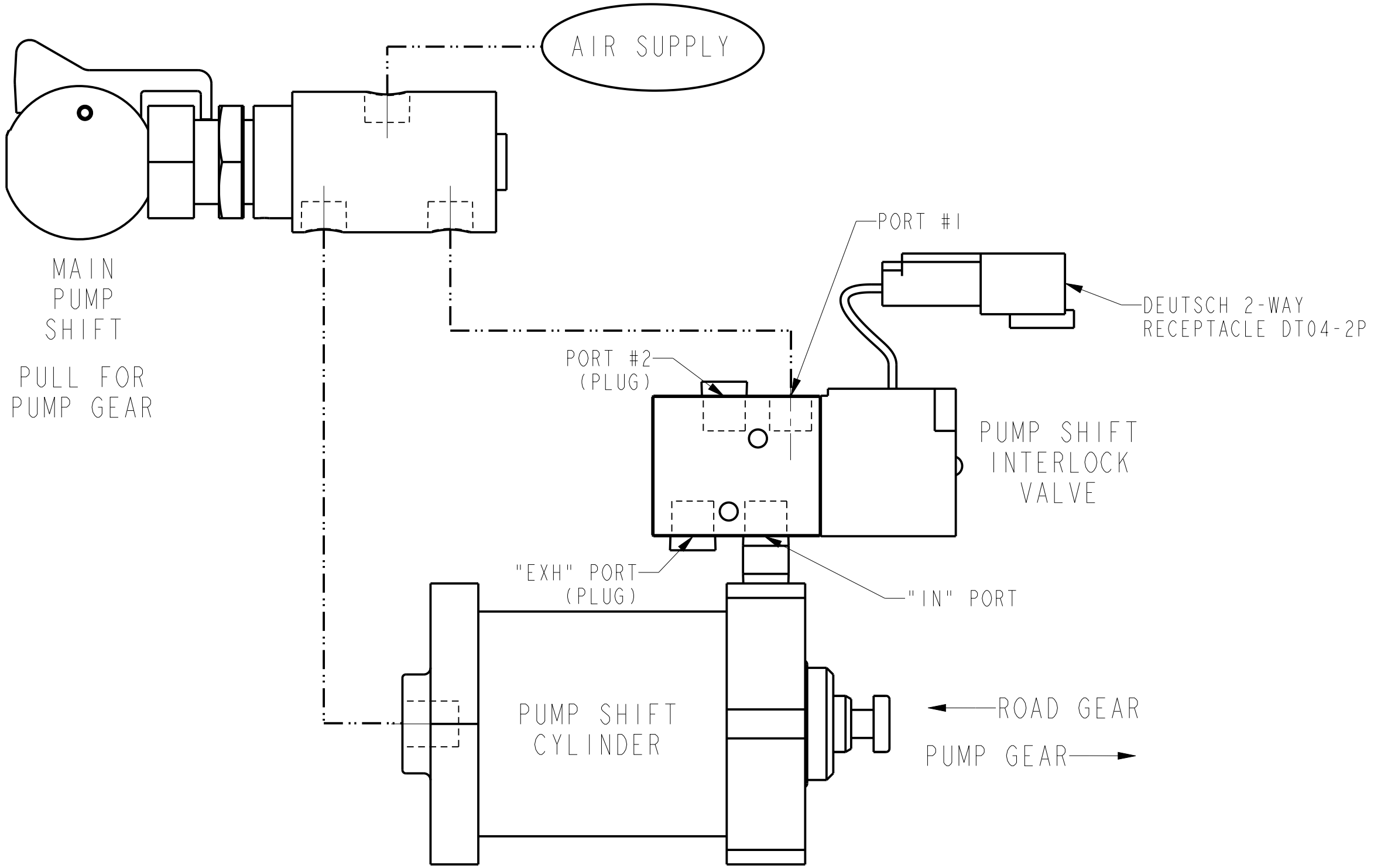
Assembly Notes:

1) Use Loctite 565 PST or equivalent pipe sealant on tapered pipe joints. (DO NOT USE TEFLON TAPE)
2) DO NOT over tighten fittings, doing so may damage thread.





REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL	MDL CREATED	SHEET	
1205562		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

INSTR - SHIFT SAFETY INTERLOCK PUMP SHIFT IN DRIVE

DR'N TED
CHKD WAH
TRCD

DATE 08-Dec-15

SCALE 1/1

1205562

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT