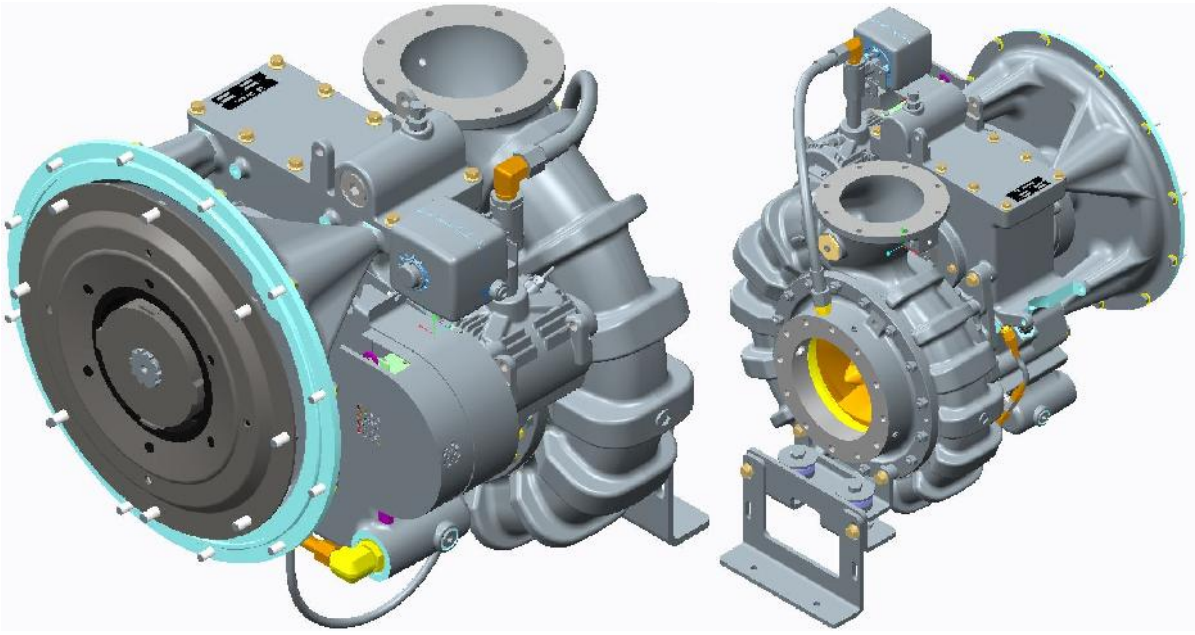
INSTALLATION, OPERATION, MAINTENANCE, REPAIR AND TROUBLESHOOTING INSTRUCTIONS FOR THE ZSE Fire Pump



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This manual is for DARLEY FIRE PUMP:

Model: **ZSE** Pump Serial Number: _____

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Rev. 0
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Rev. Date:
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Introduction

This manual provides information for the correct safety, installation, operation, maintenance, repair, and troubleshooting of the Darley ZSE pump system. Please read and follow these instructions thoroughly before putting the system in service. Doing so will ensure optimal performance and long life of your equipped apparatus.

The manual is divided into 5 sections plus an appendix. Each section details the operation, safety, use, and maintenance of the ZSE pump system. The appendix includes supplementary information.

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Type ZSE Fire Pump

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

SECTION 5 – Optional Equipment

Appendix

Section 1

Definition of Symbols and Immediate Safety Information

IMPORTANT

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

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

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

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

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

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

SAFETY

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

⚠WARNING

1) **Open and close valves slowly.**
2) **Be prepared for high nozzle reactions – open nozzle slowly.**

⚠WARNING

1) **Do not exceed system rated pressure of 250 PSI, capacity of 3500 GPM or impeller speed of 3500 RPM. If assistance is needed in determining engine speed to impeller speed correlation, contact W.S. Darley Customer Service.**
2) **Observe local regulations on the use of hearing protection.**
3) **Use only hoses with pressure rating higher than their intended use.**
4) **Remove all pressure from hoses before disconnecting.**
5) **Shutdown and depressurize completely before attempting maintenance.**
6) **Use of wheel chocks or blocks is highly recommended.**

⚠WARNING

Relay pumping is acceptable as long as system rated pressures are not exceeded. The receiving pump should be equipped with sufficient safety relief type devices, such as Suction Relief Valves and/or Discharge Relief Valves. Failure to follow this recommendation could result in phenomena such as water hammer and system pressure spikes. Such occurrences can cause severe personnel injury and severe equipment damage.

⚠WARNING

The receiving pump in a relay pumping scenario needs to have a positive pressure (non-vacuum condition) on the water being supplied to its suction at all times. Failure to do so can lead to a water hammer condition once positive pressure has been reestablished.

Section 2

General Information and Operations

SUMMARY OF THINGS TO REMEMBER

1. Close booster valves, drain valves, cooling line and discharge valves before attempting to prime the pump.
2. Always keep the primer's "Push-to-Prime" button released, except while priming or removing trapped air.
3. Press and hold the primer's "Push-to-Prime" button to eliminate trapped air from the suction line.
4. Never run the pump without water in it except momentarily while priming.
5. The primer should be evacuating air at the highest point in the suction plumbing.
6. Accelerate and decrease speed of the engine gradually.
7. Watch the engine temperature, and start the cooling water at the first signs of overheating.
8. Keep good gaskets in the suction hoses, and handle the suction hoses carefully to avoid damage to coupling threads.
9. Air leakage into suction lines is the most frequent source of trouble when pumping from a suction lift (draft).
10. Always use a suction strainer when pumping from draft.
11. Always use a hydrant strainer when pumping from a hydrant.
12. Foreign matter in an impeller is a failure to use adequate strainers and is a common source of trouble.
13. Drain the pump immediately after each run. Engage the primer after the suction hose has been disconnected and after each run to drain any trapped water. This is especially critical in freezing conditions.
14. Do not run the pump long with the discharge completely shut off.
15. Do not close a "Shutoff" nozzle when pumping with the motor throttle wide open, unless a relief valve or a pressure regulator is set for the correct pressure.
16. Keep the pump gearbox filled with oil to the level of the oil level plug/dipstick.
17. Check the oil level in the pump transmission after every 25 hours of operation or 3 months, and change the oil after every 50 hours of operation or 6 months. Use SAE 80W-90 gear oil.
18. When changing the pump gearbox's oil, 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.
19. Work all suction and discharge valves often to ensure free and easy operation.

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 the engine 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 raise 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, making the priming difficult or causing the 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 times when drafting water.

Air leakage into the 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 rigid material laid over the end of the 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 friction loss of the suction line. This friction loss must be added to the height of the pump above the water surface (static lift) to determine the “total lift” of the pump. When the entire vacuum in the pump (atmospheric pressure) is consumed in raising water through this total lift, 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 for ratings up to 1500 gpm, with 20 feet of recommended suction hose at a 2000 foot altitude. The static lift gradually decreases for flow ratings above 1500 gpm. 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 loss, 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 the 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.

With the pump dry, run the primer, until 22” of Hg is shown on the gauge. Then shut off the primer and watch how the vacuum level maintains over time. The vacuum level should not drop over 10” of Hg in 5 minutes to be considered acceptable.

If excessive leakage of vacuum occurs, the source of leaks can be located by shutting off the primer, 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 the 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 25 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 the 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 the 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 has become primed. Do not stop flowing water through the pump until you are 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. The drain valve is located at lowest point in pump casing, and usually accessible from underneath operator's panel. Once the pump has been drained, press and hold the "Push-to-Prime" button long enough to drain the last bit of water from the primer valve.

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 the cooling line to make pump ready for priming again.

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 materials, such as bronze, 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 3% higher pressure and require 3% 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 important 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 the 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 Pilot gage is not available approximate pump capacities can be determined by reference to Table No.3

ACCEPTANCE TESTS

Acceptance tests, for fire pumps, 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

A fire pump imposes heavy loads on the engine that drives it, sometimes 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, OPERATING CHARACTERISTICS OF PUMPS, AND CONVERSION FACTORS

DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OPERATING CHARACTERISTICS OF PUMPS

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

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

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

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

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

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

CONVERSION FACTORS

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

NFPA 1901 TABLES

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

DISCHARGE TABLES

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						

REACH AND FRICTION LOSS TABLES

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

Section 3

Installation

INSTALLATION OF TYPE
ZSE Fire Pump

Prepared by: WAH
Approved by: MCR
Revised by:

Rev. 0
Date: 04/24/2014
Rev. Date:
1201053.doc

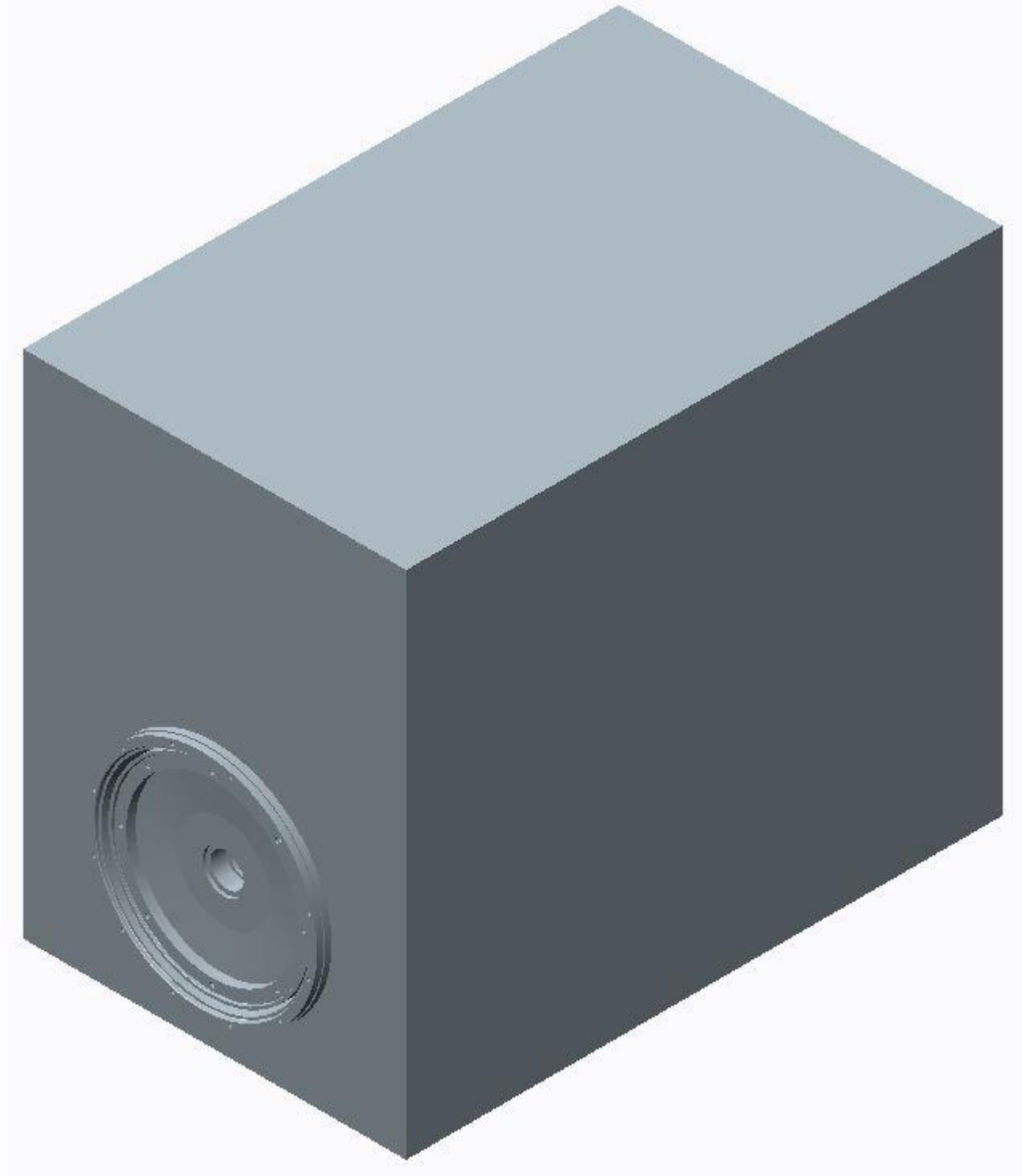


Figure 1 – Simplified image of an engine with an SAE flywheel housing and an SAE flywheel. When starting out, the engine should already be properly installed upon the apparatus, trailer or foundation. The apparatus, trailer or foundation is not shown in this image.

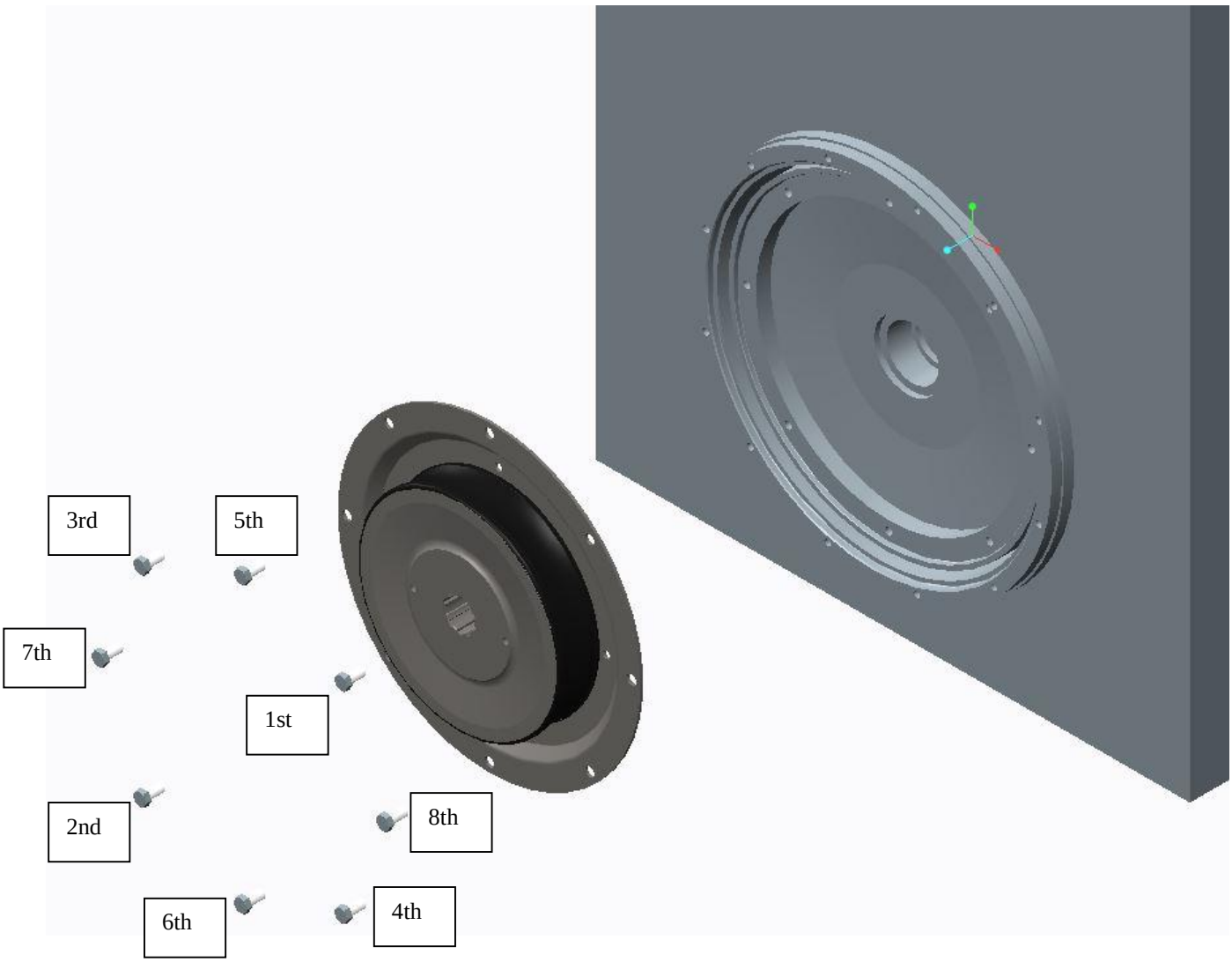


Figure 2 – Install the drive disc as shown. Apply red Loctite (262) to the bolt threads prior to insertion. If a bolt tightening torque is not provided, please follow the recommended bolt tightening torques found within Figure 4. Tighten the bolts in a star pattern as numbered above.

Figure 3 – Apply red Loctite (262) as shown above before installing the fastener.

Fastener size	Plain SAE Grade 5 tightening torque	Plated SAE Grade 5 tightening torque	Plain SAE Grade 8 tightening torque	Plated SAE Grade 8 tightening torque
¼-20 UNC	8 ft lb	76 in lb	12 ft lb	9 ft lb
¼-28 UNF	10 ft lb	87 in lb	14 ft lb	10 ft lb
5/16-18 UNC	17 ft lb	13 ft lb	25 ft lb	18 ft lb
5/16-24 UNF	19 ft lb	14 ft lb	27 ft lb	20 ft lb
3/8-16 UNC	31 ft lb	23 ft lb	44 ft lb	33 ft lb
3/8-24 UNF	35 ft lb	26 ft lb	49 ft lb	37 ft lb
7/16-14 UNC	50 ft lb	37 ft lb	70 ft lb	52 ft lb
7/16-20 UNF	55 ft lb	41 ft lb	78 ft lb	58 ft lb
½-13 UNC	76 ft lb	57 ft lb	106 ft lb	80 ft lb
½-20 UNF	85 ft lb	64 ft lb	120 ft lb	90 ft lb
9/16-12 UNC	109 ft lb	82 ft lb	153 ft lb	115 ft lb
9/16-18 UNF	122 ft lb	91 ft lb	172 ft lb	129 ft lb
5/8-11 UNC	150 ft lb	112 ft lb	212 ft lb	159 ft lb
5/8-18 UNF	170 ft lb	128 ft lb	240 ft lb	180 ft lb
¾-10 UNC	266 ft lb	200 ft lb	376 ft lb	282 ft lb
¾-16 UNF	297 ft lb	223 ft lb	420 ft lb	315 ft lb
7/8-9 UNC	430 ft lb	322 ft lb	606 ft lb	454 ft lb
7/8-14 UNF	297 ft lb	223 ft lb	668 ft lb	501 ft lb
1-8 UNC	644 ft lb	483 ft lb	909 ft lb	682 ft lb
1-12 UNF	705 ft lb	529 ft lb	995 ft lb	746 ft lb

Figure 4 – Recommended bolt tightening torques.

Figure 5 – How the drive disc should look after it has been installed upon the engine's SAE flywheel.

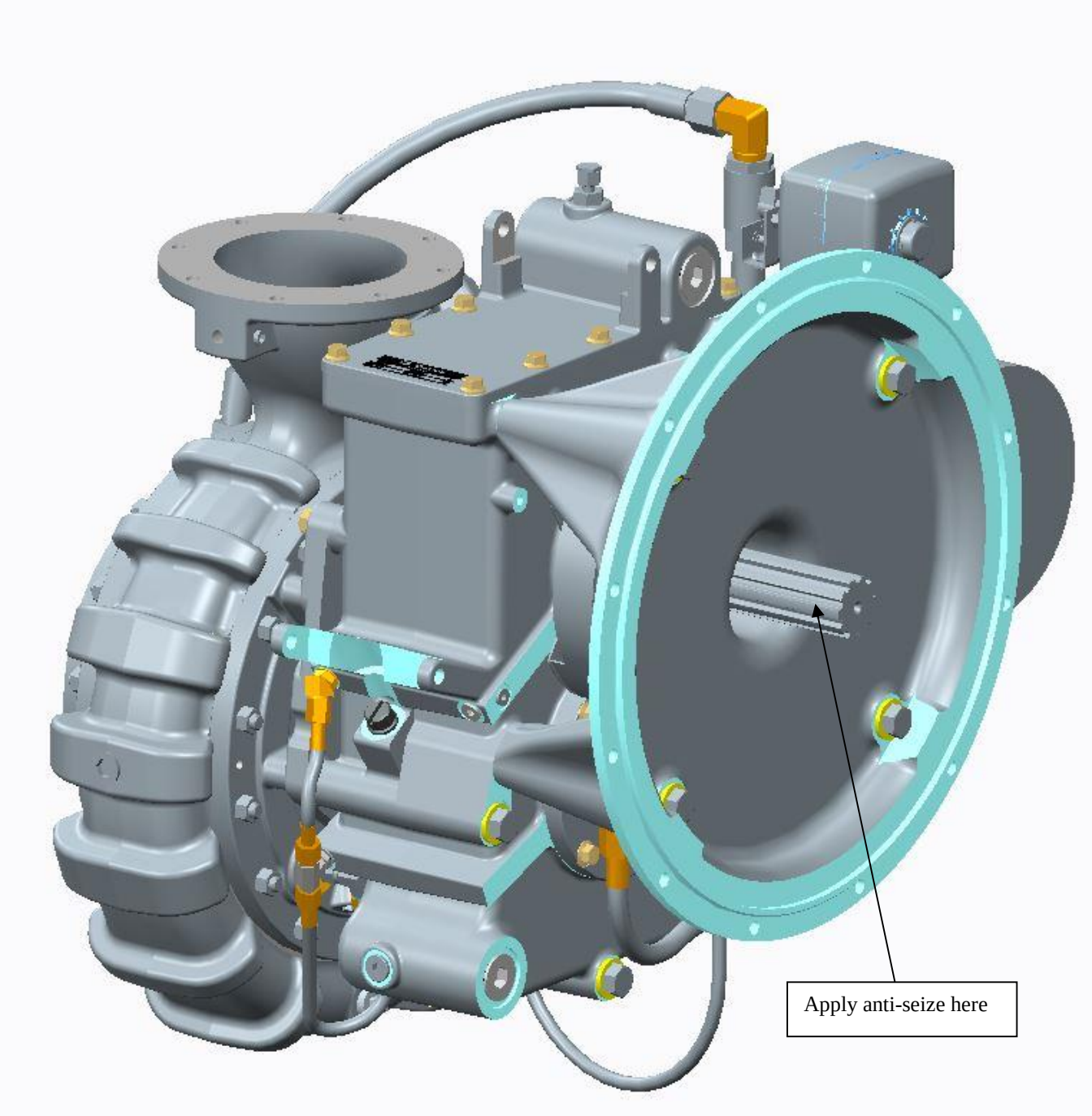


Figure 6 – Apply anti-seize compound upon the drive shaft where it will engage with the drive disc. Apply the anti-seize liberally 360 degrees around the shaft.

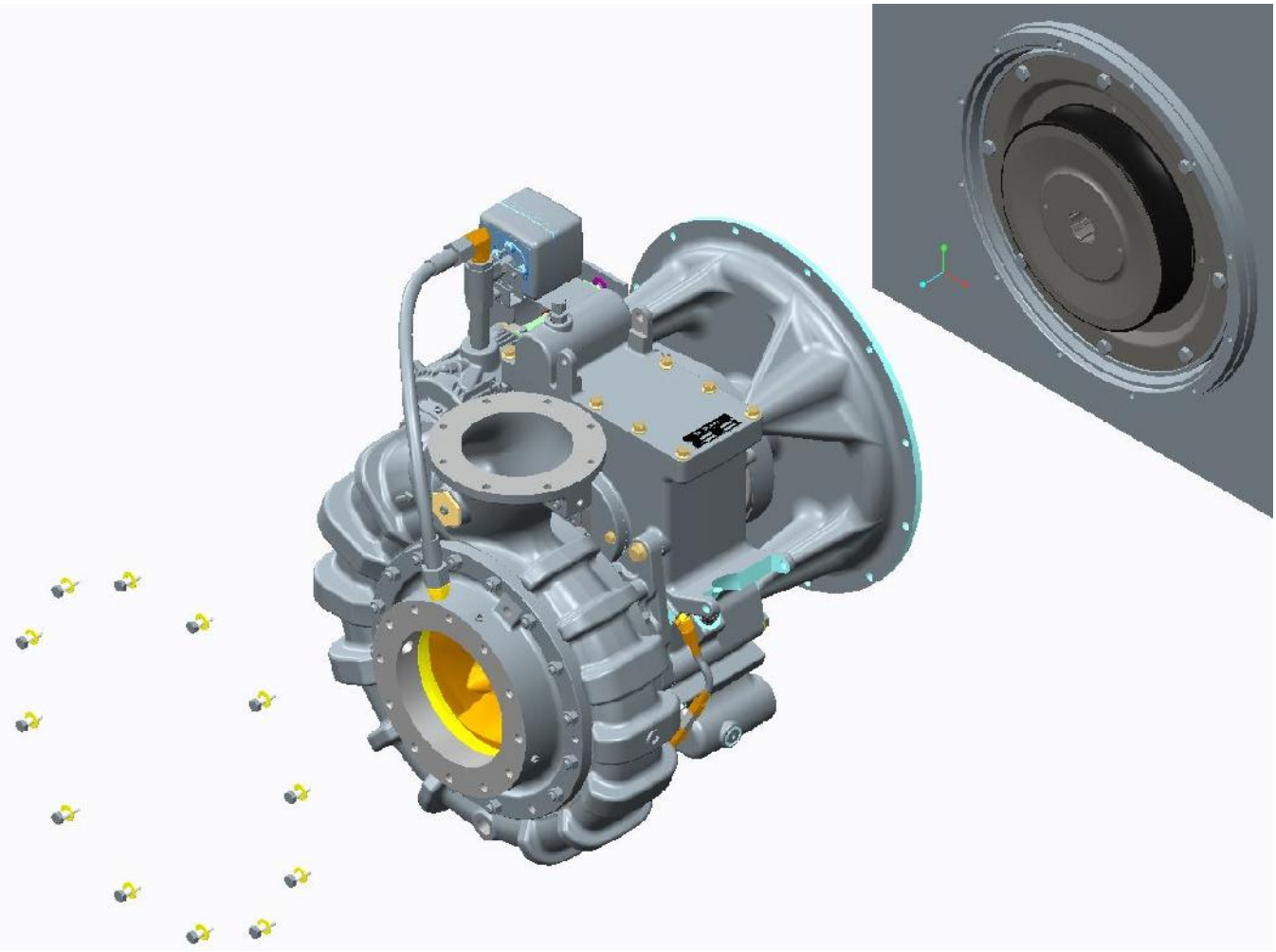


Figure 7 – Install the ZSE pump upon the engine's SAE flywheel housing as shown. Please use washers underneath the bolt heads. If a bolt tightening torque is not provided, please follow the recommended bolt tightening torque found within Figure 4. You must hold the ZSE pump at the same angle of the engine's crankshaft when inserting the drive shaft into the drive disc. Tighten the bolts in a star pattern.

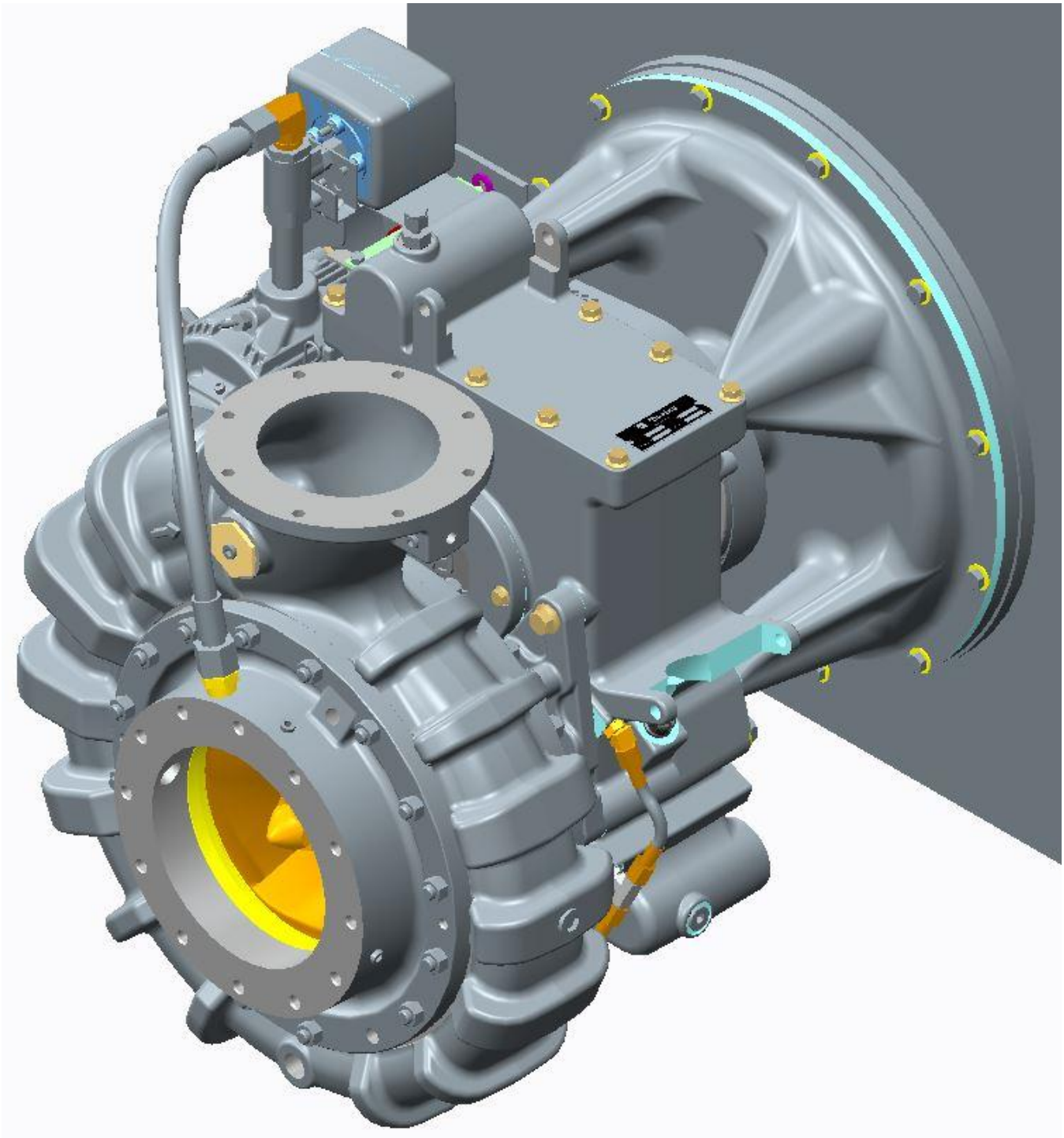


Figure 8 – How the ZSE pump should look after it has been installed upon the engine's SAE flywheel housing.

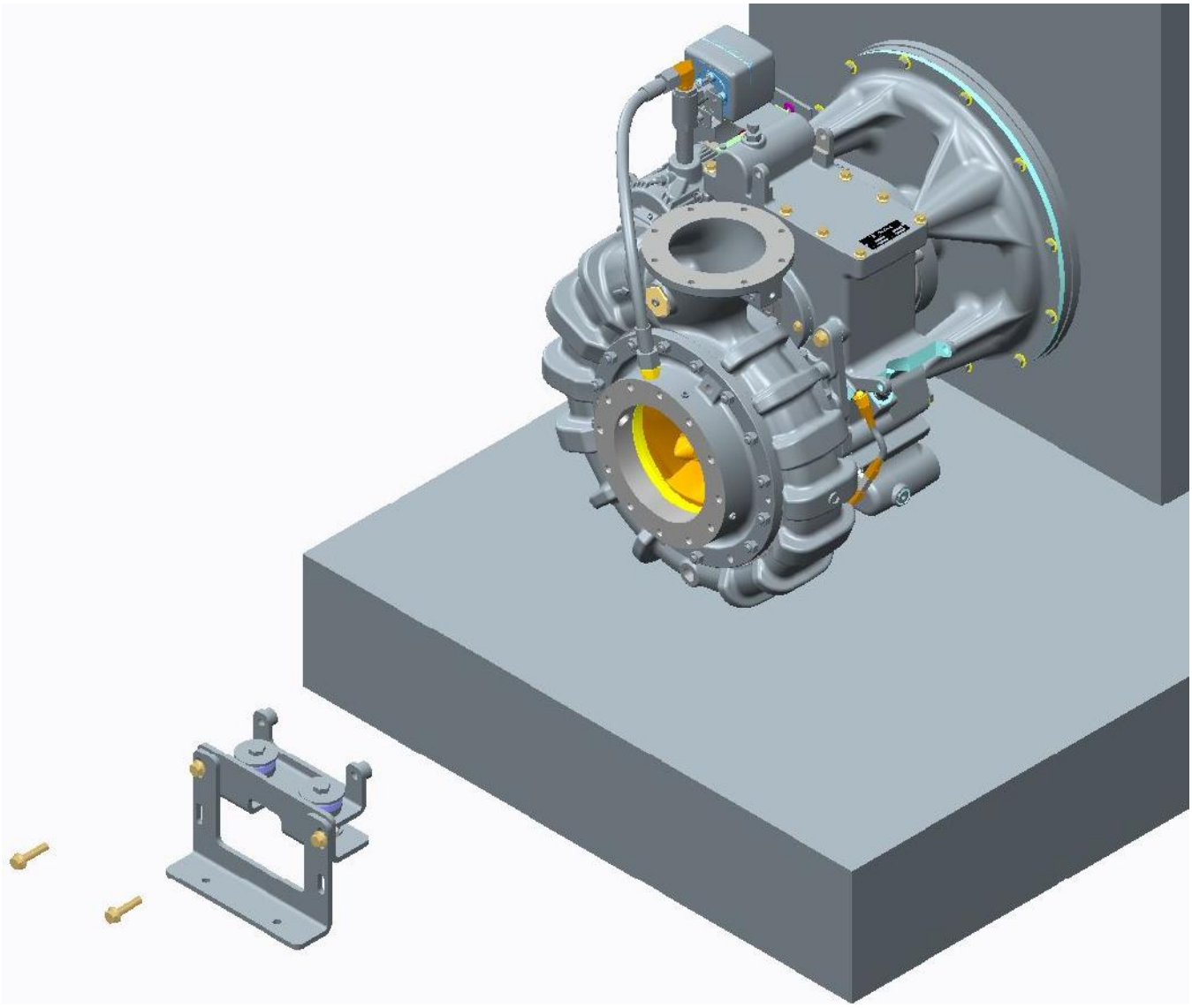


Figure 9 – Install the foot mounting bracket as shown. Before installing the foot mounting bracket please make sure the foot mounting bracket follows the assembly logic that is detailed within drawing DGM2903. The base that the engine resides upon is now shown. If a bolt tightening torque is not provided, please follow the recommended bolt tightening torques found within Figure 4.

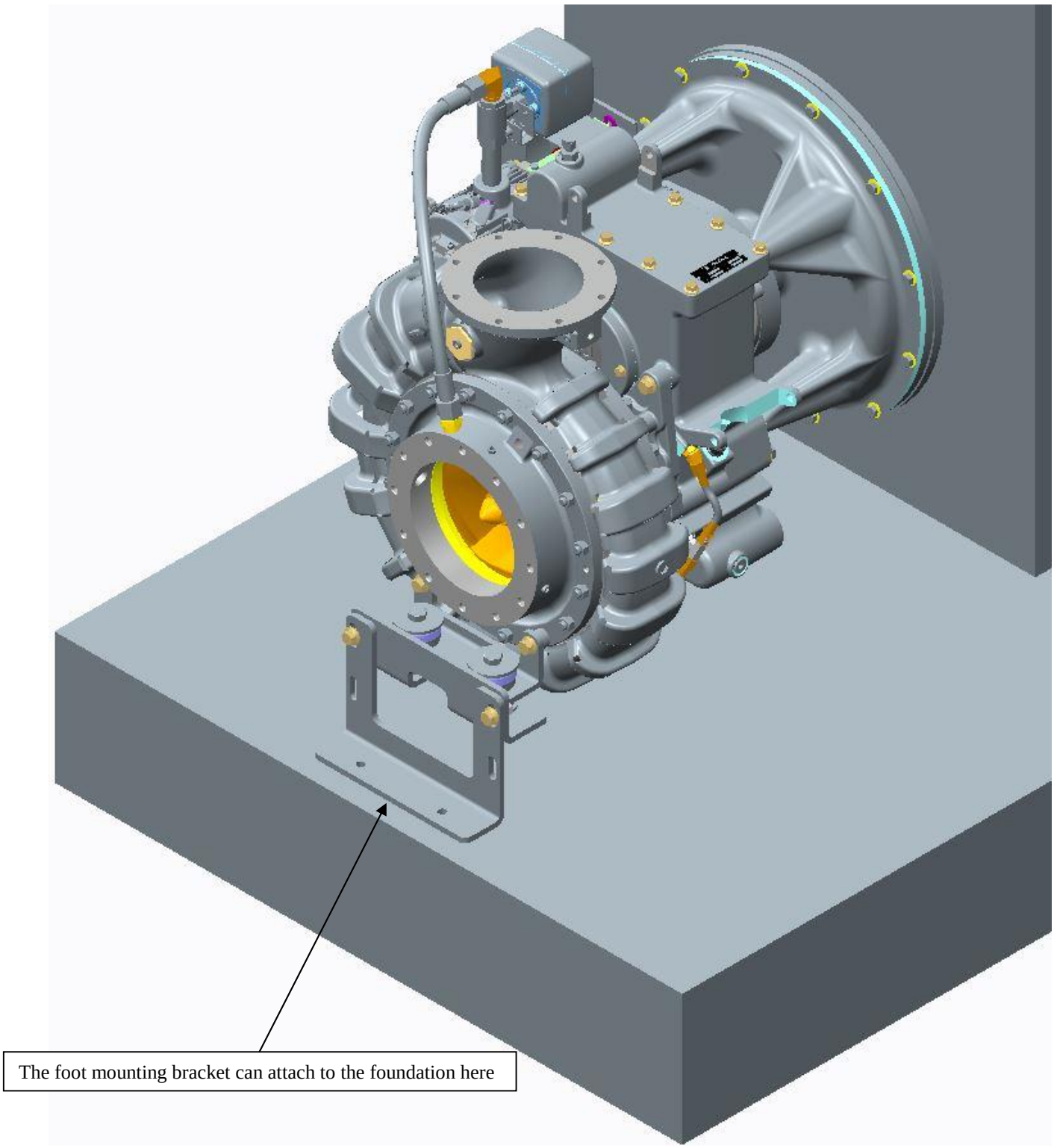


Figure 10 – How the foot mounting bracket looks after it has been installed upon the ZSE pump. The foot mounting bracket can be attached to the foundation. The foot mounting bracket should be attached to the foundation to provide a vibration isolating support.

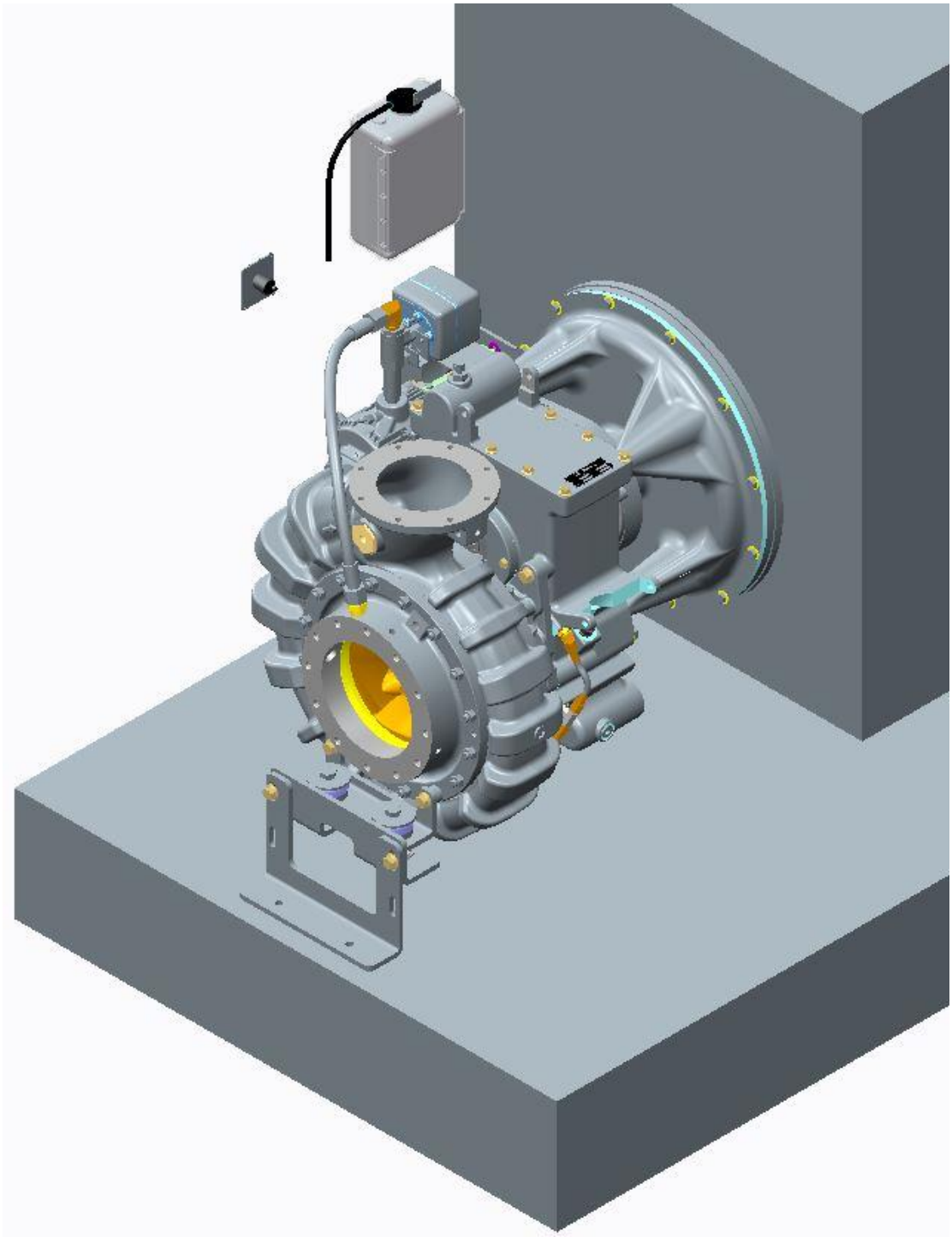


Figure 11 – The primer's "Push-to-Prime" electrical switch can be installed and wired. The primer's lubricant tank can be installed and plumbed to the primer. The primer's wiring details and plumbing details are within drawing DVC0313 or DVC0314. Please fill the primer's lubricant tank prior to using the priming system on the ZSE pump. We recommend "Prime Green" as the primer's lubricant. If desired, the pump's heater core can be plumbed to the engine per drawing DGS0400.

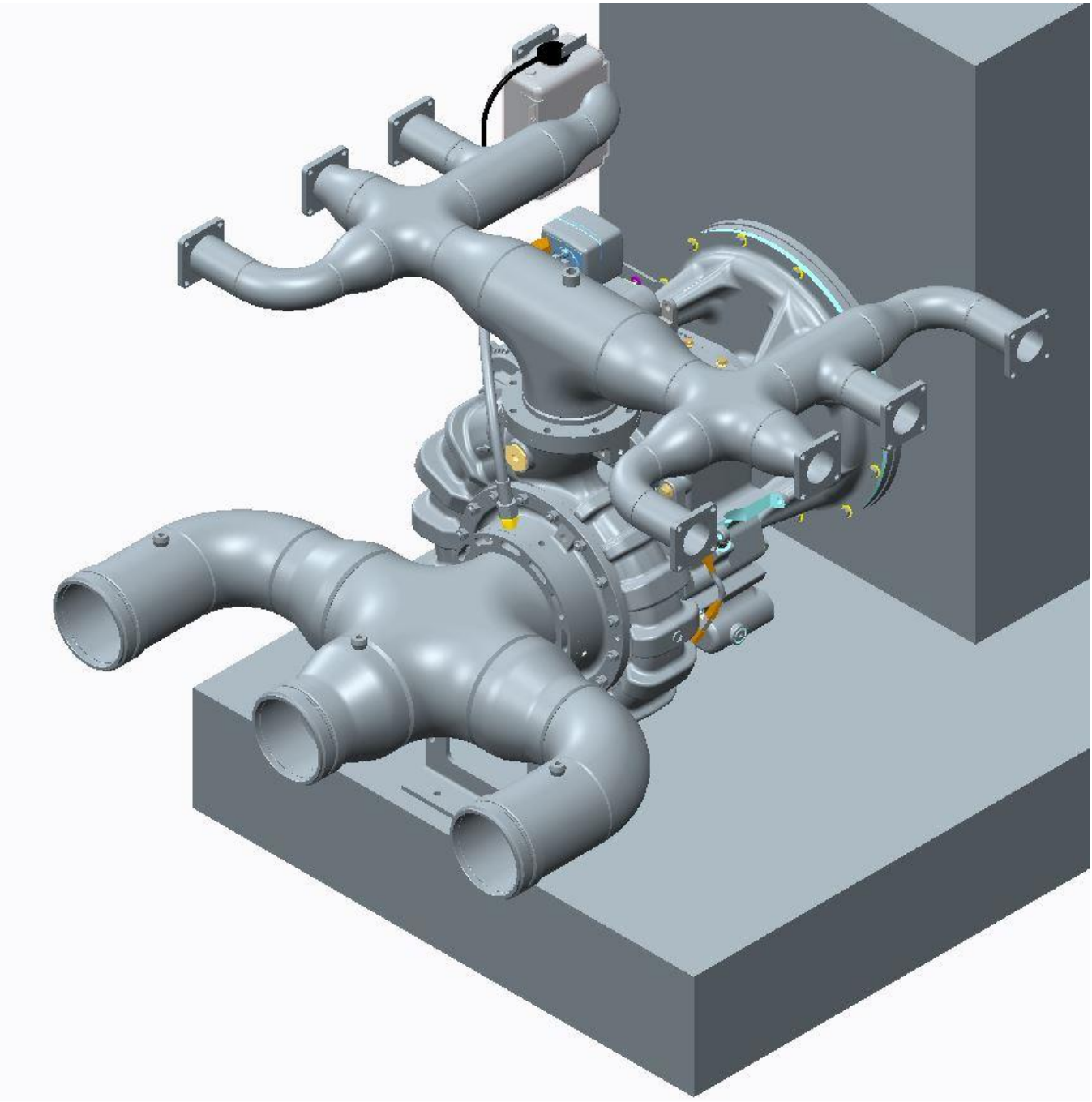
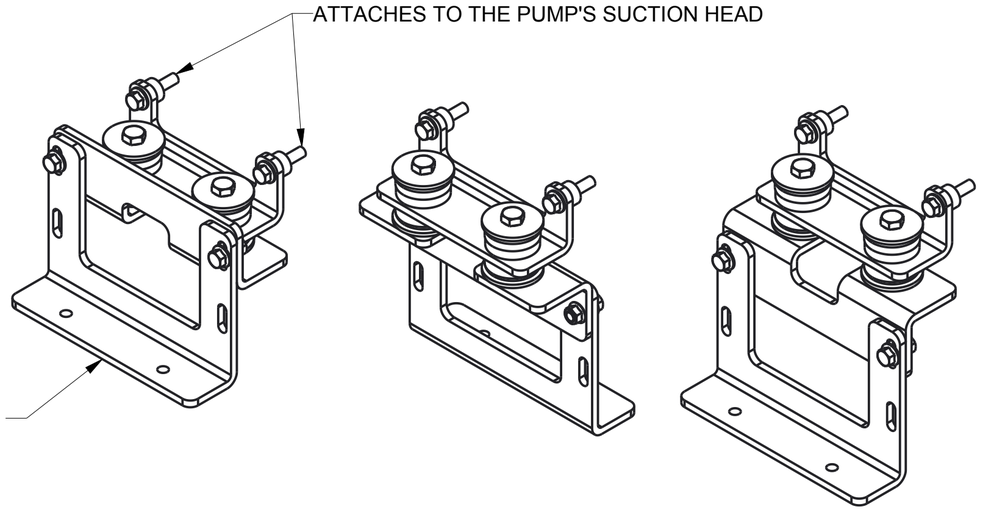


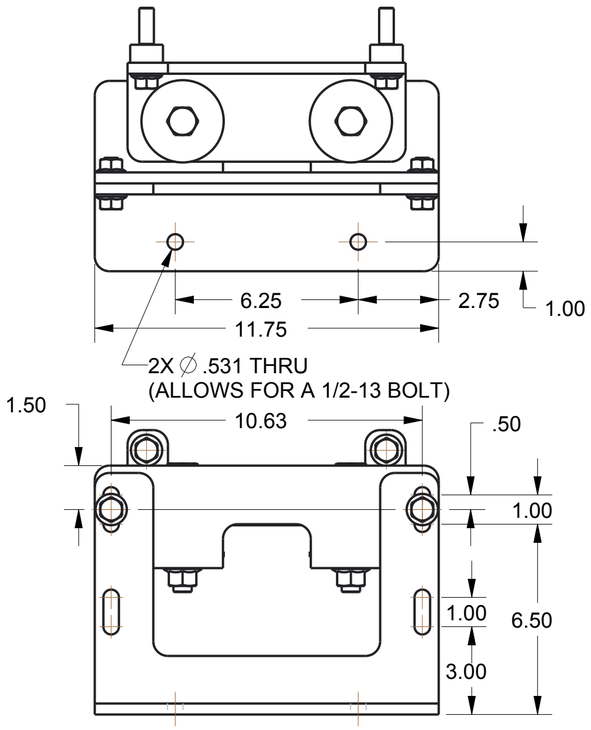
Figure 12 – Suction and discharge plumbing can now be installed upon the ZSE pump. There are many different plumbing configurations available; the above image is just one of the plumbing configurations available. Please contact Darley if you are interested in other plumbing configurations. Please remember to use hump hose or flexible hydraulic hose if your hard plumbing is going to travel a great distance (>36") from the pump. Please remember to have your primer evacuating air from the highest point on your suction plumbing.

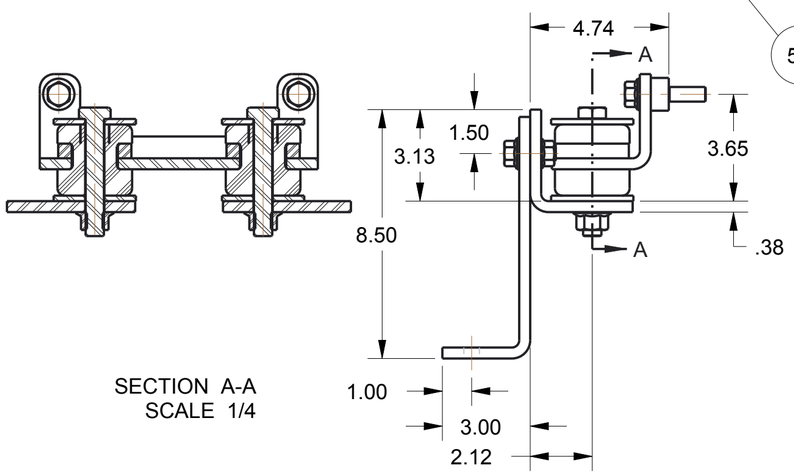
Remember to fill your ZSE pump's gearbox with SAE 80W-90 gear oil before starting the engine.

NO.	DESCRIPTION	PART NO.	QTY.
1	BRACKET - ZSE SUCTION HEAD	4042100	1
2	BRACKET - ZSE SUCTION HEAD	4042200	1
3	BRACKET - ZSE SUCTION HEAD	4042300	1
4	HHCS - .625-11 X 4.00, GR5	5400119	2
5	HHCS - FLANGED, .500-13 X 1.25	5402858	2
6	HHCS - FLANGED, .500-13 X 2.25	5402872	2
7	MOUNT - RESILIENT	4421804	2
8	NUT - .50-13NC, FLANGED	5403516	2
9	NUT-.63NC, FLNGD LOCK, DEFORM	5403515	2
10	WASHER - SPECIAL, SNUBBING	3603931	4

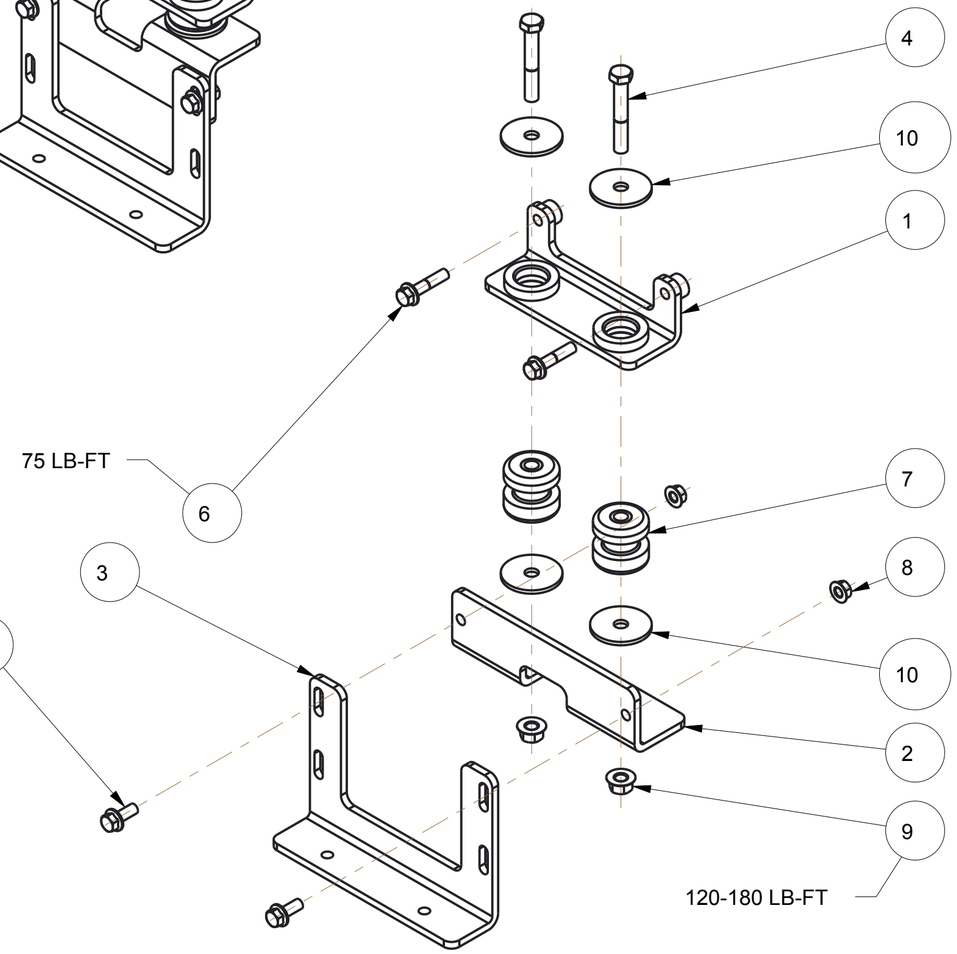
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D







SECTION A-A
SCALE 1/4



NOTES:
1) BEFORE INSTALLATION ON THE PUMP, TIGHTEN THE 5403515 NUTS TO 120-180 LB-FT.
   THEN, AFTER THIS ASSEMBLY HAS BEEN ATTACHED TO THE PUMP AND THE PUMP HAS BEEN
   ATTACHED TO THE ENGINE, THE 4042200 BRACKET CAN BE LOCATED TO A RIGID FRAME SUPPORT.
2) THE 4042300 BRACKET CAN BE WELDED OR BOLTED TO SECURE IT TO A RIGID FRAME SUPPORT.
3) THE 4042200 BRACKET AND 4042300 CAN BE ATTACHED TO THIS ASSEMBLY IN MANY DIFFERENT CONFIGURATIONS.
   THREE DIFFERENT CONFIGURATIONS ARE SHOWN ABOVE.
4) THIS ASSEMBLY IS ATTACHED TO THE PUMP SUCTION HEAD WITH THE 5402872 BOLTS.
5) THIS ASSEMBLY CAN BE ATTAHED IN ANY DESIRABLE ORIENTATION TO THE PUMP SUCTION HEAD.
6) THE 4042300 BRACKET CAN BE DISCARDED AND THE RIGID SUPPORT IS ATTACHED TO THE 4042200 BRACKET.

MODEL NAME	MDL CREATED	SHEET	
KM02100	22JAN2014	1/1	C

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

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

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

KIT-MOUNTING, ZSE SUCTION HEAD VIBRATION ISOLATORS

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

DR'N WAH | DATE 04-Apr-14

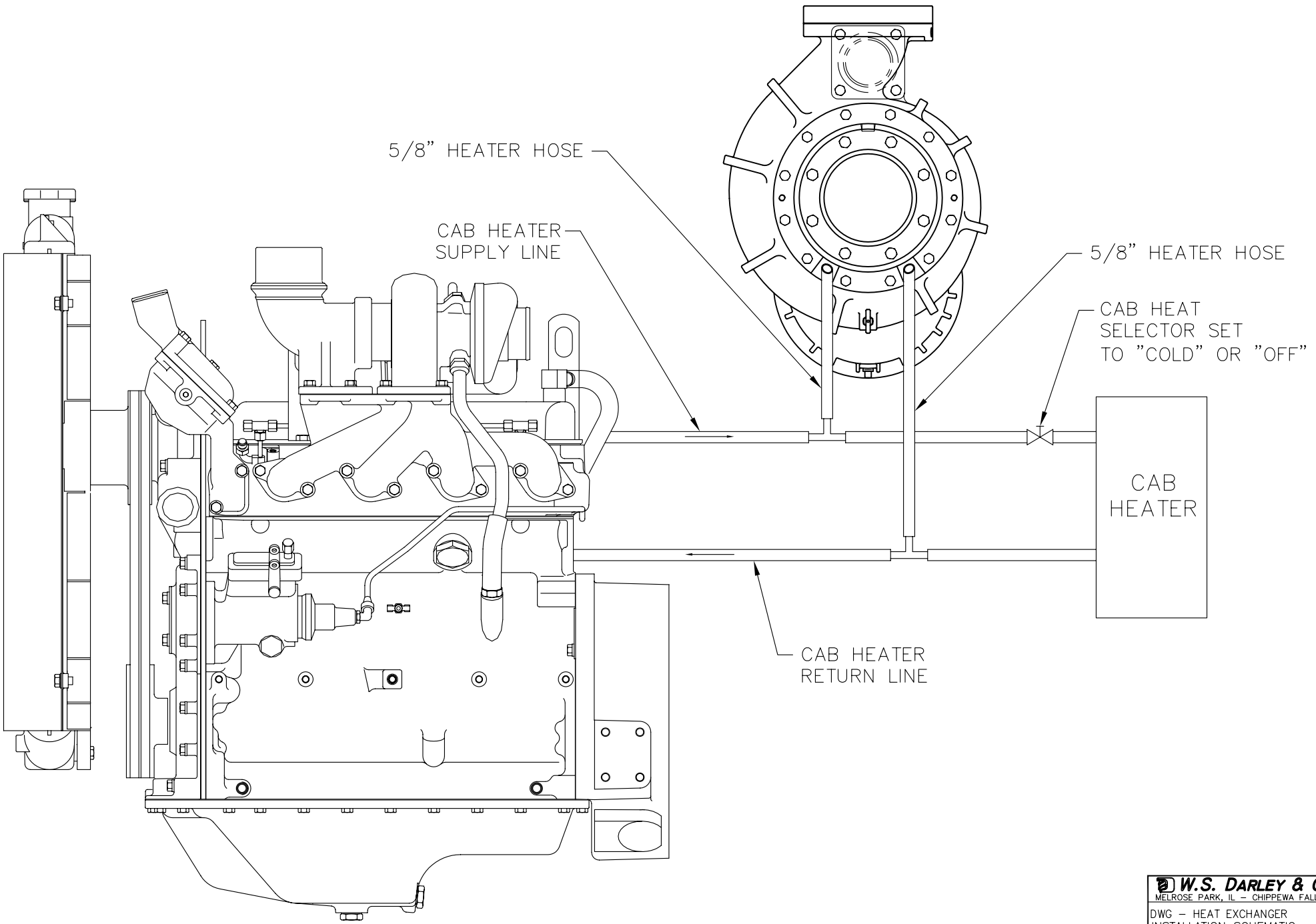
CHKD - | SCALE 3/16

TRCD

DGM2903

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

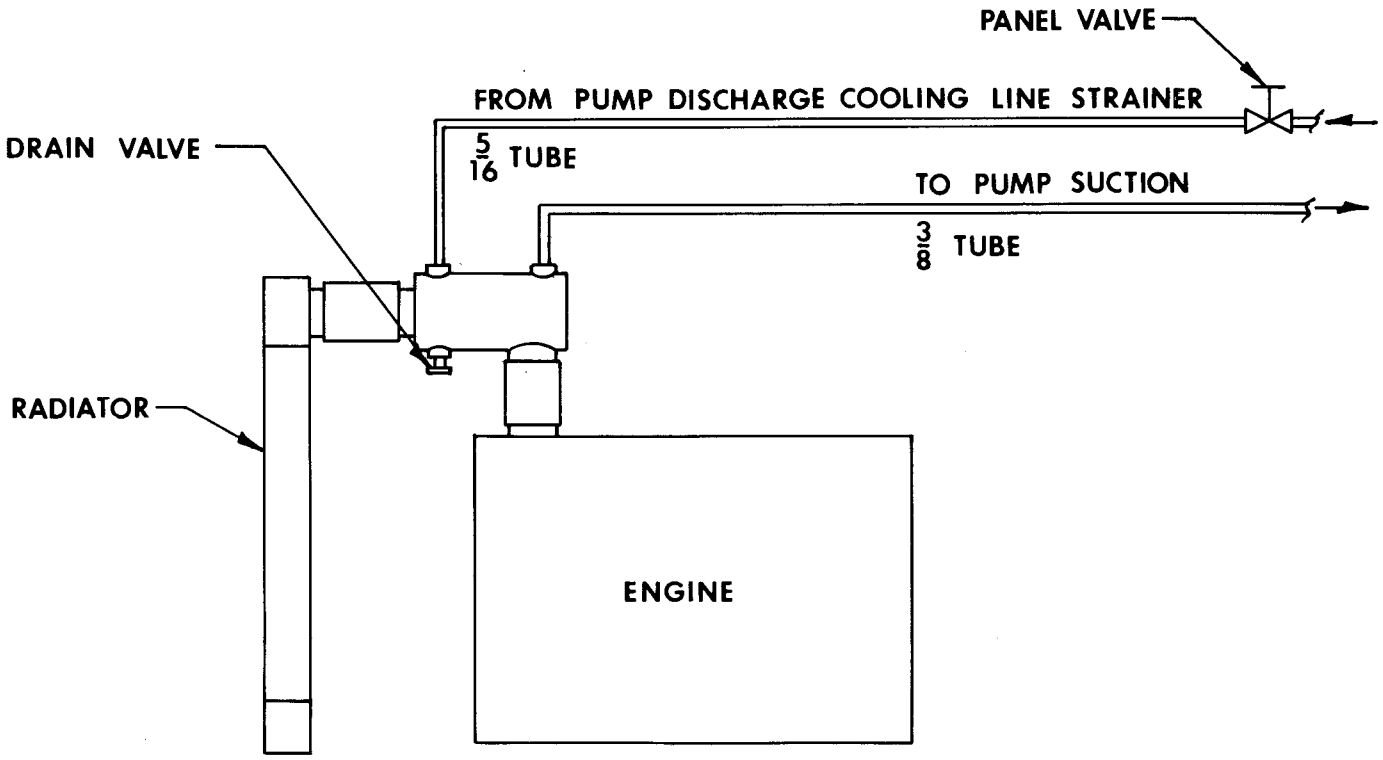


W.S. DARLEY & Co.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

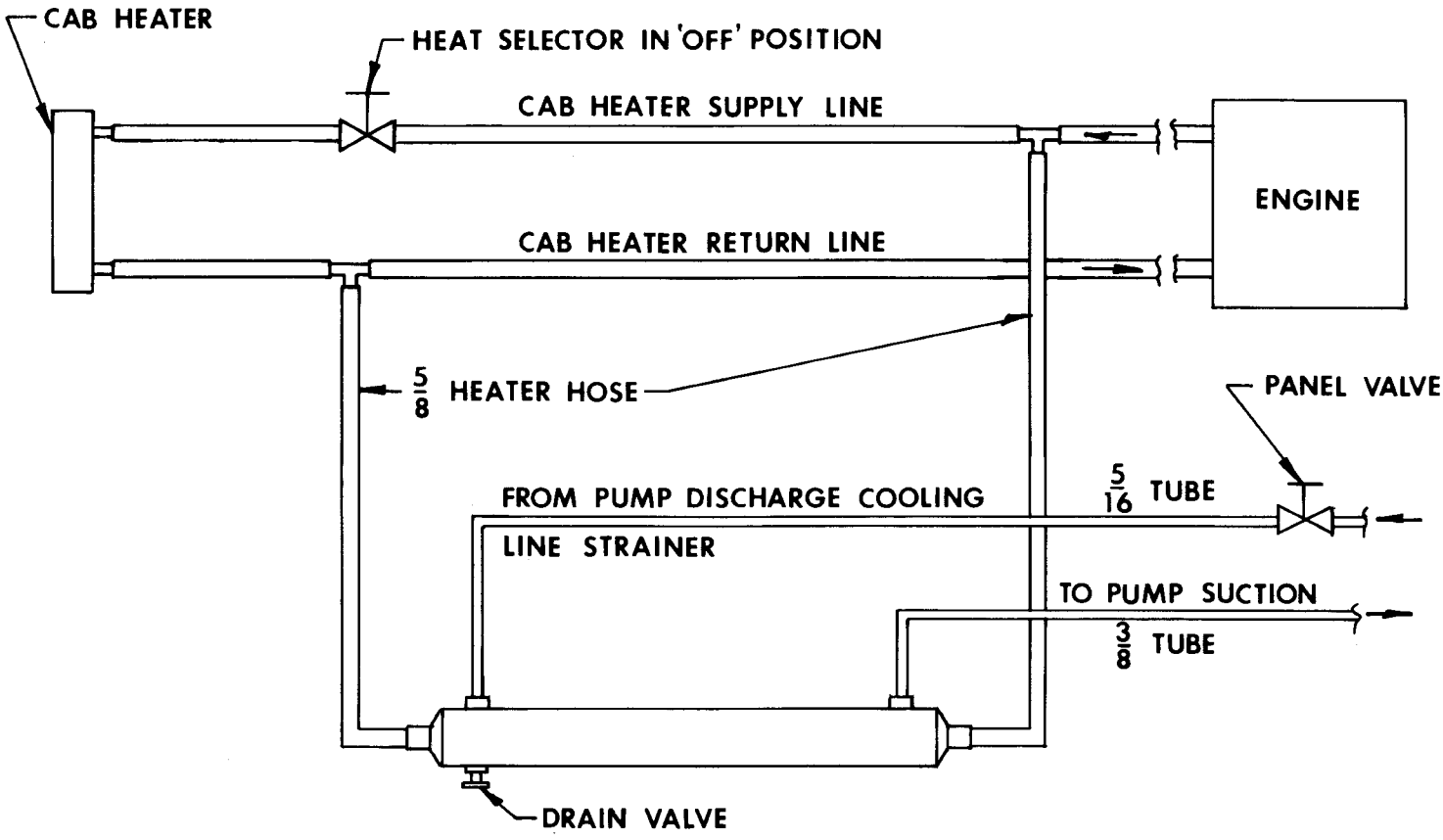
DWG – HEAT EXCHANGER
INSTALLATION SCHEMATIC

DATE NOV13,96
DRW'N BY TED

DGS0400



R592 HEAT EXCHANGER



F618 HEAT EXCHANGER

Section 4

Pump Detail

Description of Pump

The ZSE pump is a high speed, single stage, centrifugal pump with an integral gear box that has its own oil lubrication system. The pump is directly mounted to the engine's SAE bell housing and is driven by a vibration dampening flywheel drive plate that is connected to the engine's crankshaft. The mounting of the pump back to a rigid support is provided by the engine's supports and a vibration dampening bracket assembly that attaches to the pump's suction head. Control of the engine is by a control panel interface, an electronic pressure governor or another similar type of device.

OPERATION AND MAINTENANCE OF THE ZSE FIRE PUMP

Operation of Pump

Prepare the pump for operation by: ensuring all of the engine's running requirements have been met (these are detailed within the engine manufacturer's manuals), ensure there is a proper foundation for the apparatus or trailer that the pump and engine will reside upon, ensure the apparatus or trailer will not move in an undesired direction once the pump is operating and ensure there is a suitable oil level in the pump's gear box before starting the engine. The pump is intended to operate in a -40F to 120F indoor or outdoor environment and up to a 15 degree angle from horizontal (flat surface). The pump is intended to flow water (fresh water if cast iron construction on the wetted components or salt/brackish water if all bronze construction on the wetted components). This is not a material handling pump.

1. Chock the wheels of the trailer or apparatus.

If this is intended for stationary pumping operation, block both the front and rear of at least one tire using wheel chocks.

2. Connect proper discharge hoses.

The discharge hose requires a usable pressure rating at or above the discharge pressure the pump will operate at. The discharge hoses needs to be secured to the pump's discharge connection to ensure the hoses do not dis-connect during pumping operations. The water exit of a discharge hose needs to be rigidly secured to ensure there will never be a hose whipping condition and water is discharged where intended.

3. Connect proper suction hoses.

The suction hose requires a usable pressure and/or vacuum rating at or beyond the pressures the pump's inlet will endure. Hard suction hose with a suitable vacuum rating must be used if the pump is intended to draft or have to withstand a vacuum at the pump's inlet connection. The suction hose needs to be rigidly secured to the pump to ensure it does not dis-connect during pumping operations.

4. Start the engine and keep the engine speed at an idle.

Close off all pump discharge openings. You will have to confer with the guide provided by the control panel manufacturer or electronic pressure governor manufacture for exact guidance but essentially you need to turn on the engine's electrical power and push the engine start button. Once the engine starts, the engine should reside, steady state, at an idle speed of 600-1000 rpm. Note – whenever the engine crank shaft is rotating, the pump's centrifugal impeller is rotating as well.

5. Prime the pump using Darley's belt driven primer.

If drafting from a non-pressurized water source that is below the centerline of the pump impeller, press and hold the "Push-to-Prime" momentary switch. The "Push-to-Prime" momentary switch is reference #38 within drawing DVC0313. The engine speed should not exceed 1000 RPM and no more than 80

seconds should elapse for the pump to prime. The pump is primed once water discharges out of the primer's exhaust port. If you cannot identify the primer's exhaust port, its reference #11 within drawing DVC0313. Immediately release the "Push-to-Prime" momentary switch once the pump has primed. If the pump did not prime and you are attempting an additional priming attempt, check to make sure the primer body (reference #9 within drawing DVC0313) is cool to the touch (<145F or <63C) surface temperature). Wait until the primer body is cool to the touch before attempting an additional priming attempt. Failure to wait until the primer body has cooled to below a 145F or 63C surface temperature can result in primer damage. For reference, 145F or 63C is about the temperature of a hot cup of coffee.

CAUTION

- **Do not operate the engine at speeds higher than 1000 RPM during the priming cycle.**
- **If prime is not attained within 80 seconds, check your system and fittings to be air tight, resolve the matter, and reattempt prime when the primer body is cool to the touch.**
- **Running the pump dry for more than a few minutes will cause damage.**
- **Begin pumping water immediately after prime is reached.**

6. Prime the pump from a pressurized water source.

A pressurized water source can be either a hydrant, a water tank whose water surface is at or above the centerline of the pump impeller or another water source that puts positive water pressure on the pump's inlet connection. Remove all entrapped air within the suction hose and then remove all the entrapped air within the pump cavity before engaging in pumping operations. All the entrapped air should be replaced by water from your pressurized source.

7. Engage in pumping operations

Discharge valves can now be opened. The engine throttle or the discharge pressure can be increased or decreased as desired to attain your desired flow rate. The desired flow rate can be as much as what the pump was rated for on its plaque. Never operate the pump in a dead headed condition (no flow rate) for more than 5 seconds. If you have no means to know what your flow rate is, simply use the plaque performance points as the maximum engine speed allowed when at a specific discharge pressure. If while pumping, you hear sounds that resemble gravel being pumped thru your pump, this is cavitation. Please reduce your flow rate to make the cavitation sound go away. Failure to make the cavitation sound go away can result in premature pump damage. The engine can be immediately stopped if you need to immediately shut off the pump. You must have water hammer protections in place if you ever stop the pump in this manner.

CAUTION

- **Circulate water (>5 gpm) to keep the water cool within the pump cavity and hoses.**
- **Do not use this pump for hose testing.**

8. Stop pumping operations and prepare for the next usage.

Use your control panel, electronic pressure governor or other similar type of device to bring your engine to an idle. Shut off the engine. If pumping from a pressurized source, close off that pressurized source. Drain the pump of all water. Press and hold the "Push-to-Prime" button to open the primer valve thus draining all of the entrapped water above the primer valve. The primer valve is reference #43 within drawing DVC0313. Turn off the engine's electrical power. Disconnect, drain and stow away all suction hoses and all discharge hoses. After the pump's gear box has cooled to the touch, check to ensure there is a proper oil level in the gear box and that water has not contaminated the oil. Un-chock the tires when the trailer or apparatus is ready to move.

Lubricating System – Electric Priming Pump with Fluid Reservoir

The electrically-clutched belt-driven rotary-vane primer pump creates a high vacuum by continuous lubrication of rotor and vanes. Therefore the primer lubricant supply tank (4 quarts) should be kept full at all times. The primer supply tank is reference #39 within drawing DVC0313.

The 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.

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

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

The primer valve is leaking if water appears in the lubricant supply tank. The primer valve is reference #43 within drawing DVC0313.

CAUTION

FOR ALL PRIMING SCENARIOS:

If water does not discharge from the primer exhaust within 80 seconds stop the primer, check for air leaks and resolve the issue before attempting to re-prime. MAX PRIMER OPERATION TIME = 80 seconds. DO NOT EXCEED 90 SECONDS OF PRIMER OPERATION. Repeated operation should be avoided. Most priming scenarios are achieved within 20-30 seconds.

CAUTION

Dry running of the pump, especially the mechanical seal and seal rings of the pump, can be detrimental to seal life. The figures given above are within a certain safety factor to prevent premature failure of the seal as well as the primer assembly. Exceeding these figures is never recommended and will cause premature wear, blistering and failure of seal faces as well as premature failure and wear of the primer assembly including but not limited to: overheating of the body, seizure of the rotor, and cracking of primer vanes.

CAUTION

The primer pump generates heat as soon as operation begins. Extended run times (up to 80 seconds) and repeating priming cycles consecutively or within short time periods may lead to accelerated wear or premature failure of the primer pump assembly. If an attempt to prime should fail, thoroughly inspect the pump system for air leaks and resolve the issue before attempting re-prime.

Pump Gear Case Lubrication

Maintain the gear box oil level to be just below the max fill mark on the oil level dipstick which is located on the side of the pump transmission. The oil level dipstick is reference #8 within drawing DZC0015.

Check the oil level every 25 hours or every 3 months, whichever comes first. Change the oil every 50 hours or 6 months, whichever comes first. Check the oil level when the pump is on level ground.

Ensure the sump screen is clear of debris after draining oil. To do this, remove the sump screen from the transmission and use a parts washer or isopropyl alcohol to wash the screen clear of debris. The sump screen is reference #13 within drawing DZC0015.

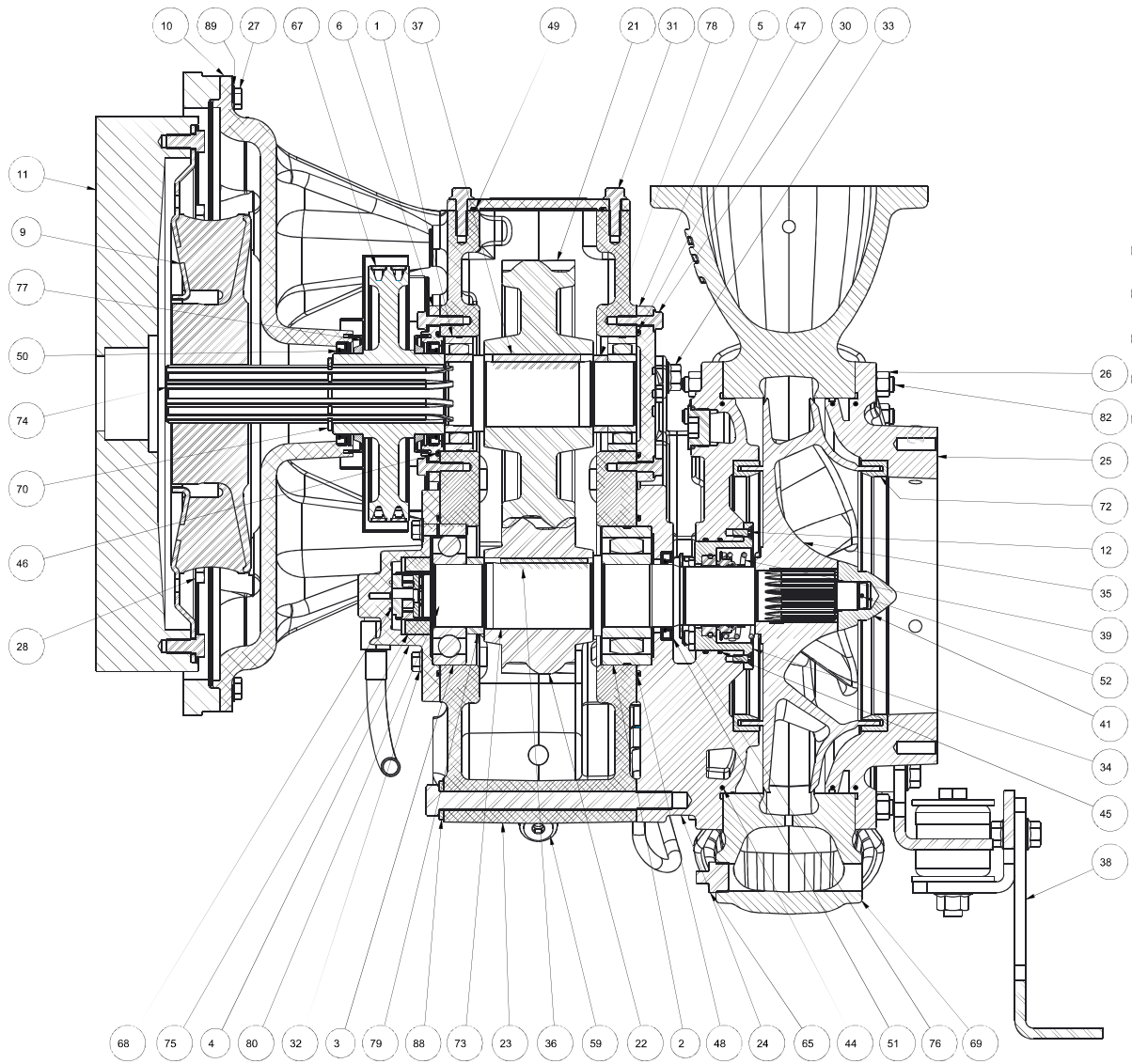
Service the pump transmission with SAE 80W/90, GL4/GL5 gear lubricant. The gear lubricant can be either petroleum based or synthetic based. Do not use grease.

CAUTION

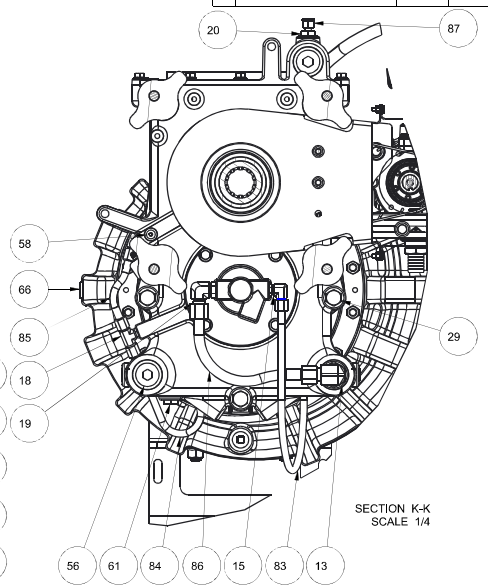
Do not overfill the pump gearbox with gear lubricant. Overfilling may cause excessive gearbox operating temperatures (>250F or >121C), foaming of the oil or the oil to exit the gear box thru the breather. The breather is reference #87 within drawing DZC0015.

PUMP
DRAWINGS

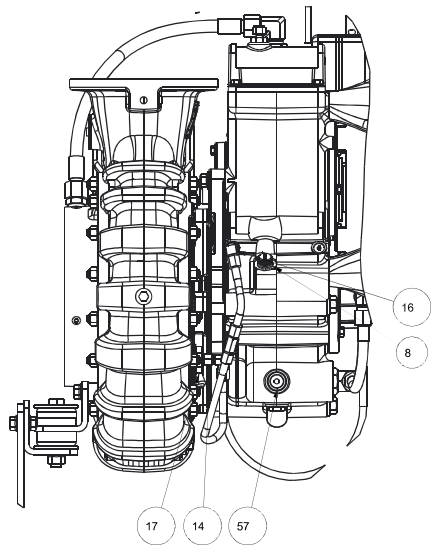
NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING - 22211E C3	1726300	2
2	BEARING - 22311E C3	1726100	1
3	BEARING - BALL, 6311,C3	1725900	1
4	CAP - BEARING, IMPELLER, ZSE	2313303	1
5	CAP - BRG, INPUT, REAR, ZSE	2314701	1
6	CAP - BRG, INPUT, ZSE 2 GEAR	2314501	1
7	COVER - OIL SUMP, ZSE 2 GEAR	2509200	1
8	DIPSTICK - -10 MORB PORT	4229104	1
9	DRIVE DISC - VKE 4011S-4000/14	2006500	1
10	ENGINE ADAPTER, ZSE, SAE 1	2006600	1
11	ENGINE SIMULATION - SAE 14 FLYWHEEL	X8353	1
12	FHMS - .250-20 x 0.63, SS	5402402	4
13	FILTER - LUBE PUMP, 100 MESH	1124300	1
14	FTG - .38 JIC FE X .38 JIC MALE X 90	3501596	2
15	FTG - .38 JICM X 9/16-18, SAE ORB	3501567	1
16	FTG - .38 JICM X 9/16-18, SAE ORB	3501576	1
17	FTG - 1.00 ORB MALE X -06 JIC MALE	3501574	2
18	FTG - BRANCH TEE ADJUSTABLE, .38	3501609	1
19	FTG-.88JICM RIGX.75MORB SVL 90	3501639	1
20	FTG-.88MORB RIGIDX1/8NPT FEMAL	3501634	1
21	GEAR - DRIVE, 51T, 6DP, RH, PTO	2719305	1
22	GEAR - PINION, 29T, 6DP, LH HELIX	2717006	1
23	GEARCASE - 2 GEAR ZSE	1806300	1
24	HEAD - INBOARD, ZS	2812600	1
25	HEAD - SUCTION, ZS	2812700	1
26	HEX NUT - .500-13, GR 2	5403005	30
27	HHCS - .438-14 x 1.25, GR5	5400060	12
28	HHCS - .500-13 x 1.00, GR8	5400687	8
29	HHCS - .625-11 x 8.00, GR5	5400108	7
30	HHCS - FLANGED, .313-18 X 1.25	5402844	4
31	HHCS - FLANGED, .375-16 X 1.25	5402856	8
32	HHCS - FLANGED, .375-16 X 1.50	5402860	4
33	HHCS - FLANGED, .500-13 X 1.75	5402853	2
34	HOUSING - MECHANICAL SEAL, ZS	1846200	1
35	IMPELLER - ZS, L.H.	2908600	1
36	KEY - SQ., 0.38 X 3.00	3602407	1
37	KEY - SQ., 0.50 x 3.00	3602456	1
38	KIT-MOUNTING, ZSE SUCTION HEAD	KM02100	1
39	MECHANICAL SEAL - 2.00", ZS	1846300	1
40	METAL TACK, 3/16 HEAD, .025 L	5402873	2
41	NUT - IMPELLER, CONE, ZS	5403477	1
42	O-RING - 0.75 x 0.94 x 0.09	3601138	2
43	O-RING - 1.47 x 1.71 x 0.09	3601401	1
44	O-RING - 13.00 x 12.75 x 0.12	3601272	3
45	O-RING - 3.75 x 3.94 X 0.09	3601133	2
46	O-RING - 3.88 x 4.12 x .12	3601252	1
47	O-RING - 4.12 x 4.38 x 0.12	3601217	1
48	O-RING - 5.25 x 5.50 x 0.12	3601232	2
49	O-RING - 9.50 x 9.25 x 0.12	3601269_FORMED	1
50	OIL SEAL - 2.750 ID X 3.505 OD	3600511	2
51	OIL SEAL - 2.125 ID X 3.000 OD	3600571	1
52	PIN - COTTER, .125 x 2.00, SST	3605207	1
53	PIN - DOWEL, .375 X 0.625, GR8	3605410	2
54	PIN - DOWEL, 0.156 x 0.50, GR8	3605407	1
55	PLATE - SERIAL NO., .COM	1963109	1
56	PLUG - 1 5/16-12 SAE ORB, HEX SOC	3501575	3
57	PLUG - 3/4-16 SAE ORB, HEX SOC	3501573	2
58	PLUG - 7/16-20 SAE ORB, HEX SOC	3501629	2
59	PLUG - 7/8-14 SAE ORB, HEX SOC	3501632	3
60	PLUG - 9/16-18 SAE ORB, HEX SOC	3501578	1
61	PLUG - MAGNETIC, 3/4-16UNF	1080545	1
62	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
63	PLUG - PIPE, 0.125, W/.125 THRU	1080553	3
64	PLUG - PIPE, 0.250, SST SOC HD	1080535	5
65	PLUG - PIPE, 0.750 SST SQ HD	1080543	1
66	PLUG - PIPE, 0.750, SST SOC HD	1080551	3
67	PRIMER - BELT DRV, 24V	AP02147	1
68	PUMP - HYD, INTERNAL GEAR, LUBE	4821020	1
69	PUMP CASING - ZS	2056400	1
70	RING - RETAINER, SHR-200 STPA	3600443	1
71	SCREEN STRAINER	1122400	1
72	SEAL RING - ZS	3407500	2
73	SHAFT - IMPELLER, ZS	5022400	1
74	SHAFT - INPUT, ZSE	5023400	1
75	SLEEVE - MEGATRANS, OIL PUMP	1887400	1
76	SLINGER - WATER, ZS, 1.894 ID	3203210	1
77	SLINGER - WATER, ZSP INPUT	3206700	2
78	SPACER - 2.17 X 2.62 X .513	3309301	1
79	SPACER - 2.17 x 2.63 x .811	3305202	1
80	SPRING CARTRIDGE - OIL PUMP	4821100	1
81	STRAINER - FITTING	1122300	1
82	STUD - 0.500-13 X 2.000, GR5	3606402	30
83	TUBE - LUBE PUMP DISCH, ZSE	4434153	1
84	TUBE - LUBE PUMP DISCH, ZSE	4434154	1
85	TUBE - LUBE PUMP DISCH, ZSE	4434155	1
86	TUBE - LUBE PUMP SUCTION, ZSE	4432160	1
87	VENT - GEARCASE, 1/8 NPT MALE	4401801	1
88	WASHER - FLAT, .641 X 1.303 X .160	3603825	7
89	WASHER - FLAT, 0.4375 ID	3603830	12



SECTION A-A



SECTION K-K
SCALE 1/4



REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

REMOVE SHARP EDGES | INCH [MILLIMETER] | SCALE 1/4

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

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

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

DRAWN / SMS | CHKD. KWH | TRCD

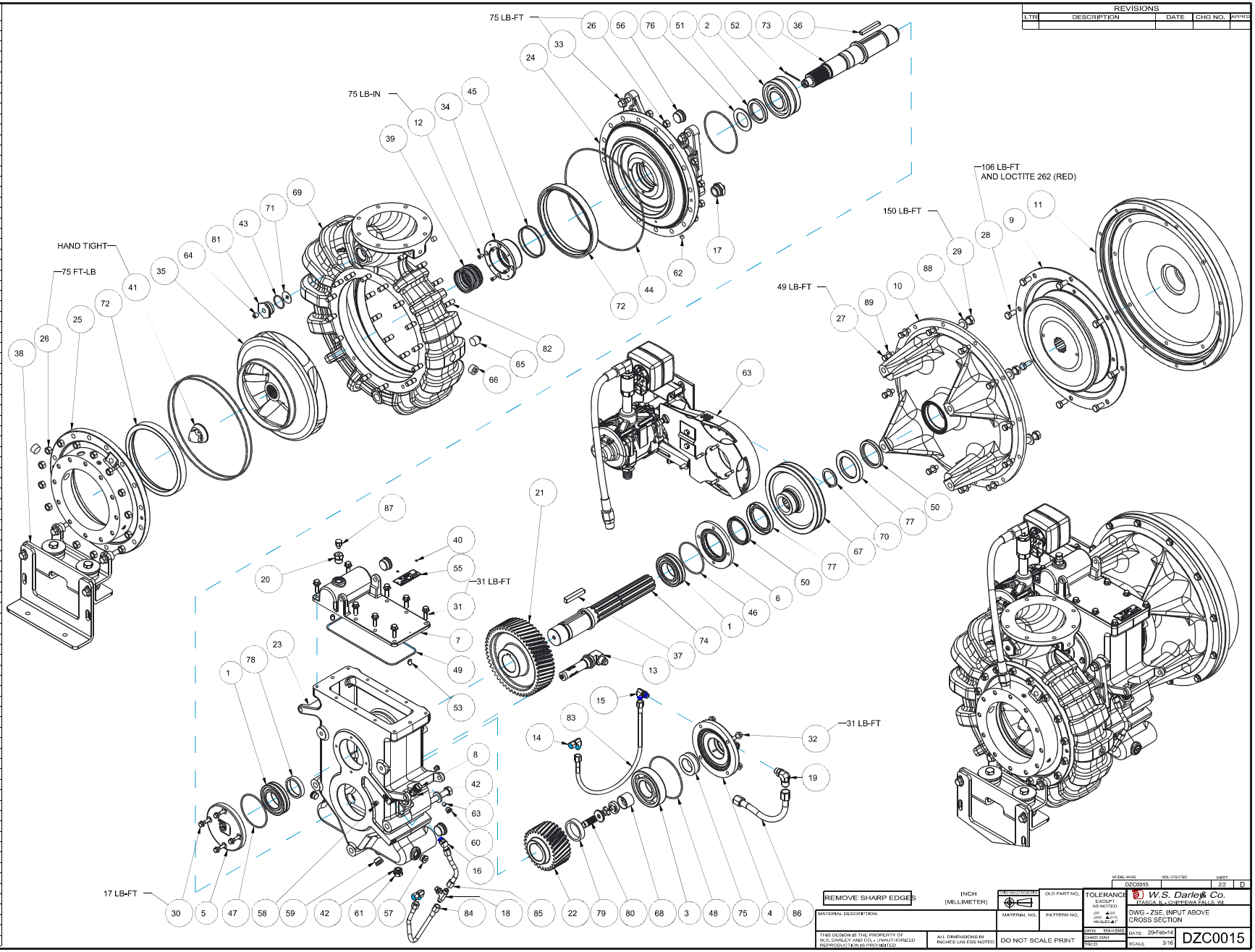
MODEL NAME: DZC0015 | MDL CREATED | SHEET: 1/2 | D

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

DWG - ZSE, INPUT ABOVE CROSS SECTION

DATE 20-Feb-14 | SCALE 1/2 | DZC0015

NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING - 22211E C3	1726300	2
2	BEARING - 22311E C3	1726100	1
3	BEARING - BALL, 6311,C3	1725900	1
4	CAP - BEARING, IMPELLER, ZSE	2313303	1
5	CAP - BRG, INPUT, REAR, ZSE	2314701	1
6	CAP - BRG, INPUT, ZSE 2 GEAR	2314501	1
7	COVER - OIL SUMP, ZSE 2 GEAR	2509200	1
8	DIPSTICK - -10 MORB PORT	4229104	1
9	DRIVE DISC - VKE 4011S-4000/14	2006500	1
10	ENGINE ADAPTER, ZSE, SAE 1	2006600	1
11	ENGINE SIMULATION - SAE 14 FLYWHEEL	X8353	1
12	FHMS - .250-20 x 0.63, SS	5402402	4
13	FILTER - LUBE PUMP, 100 MESH	1124300	1
14	FTG - .38 JIC FE X .38 JIC MALE X 90	3501596	2
15	FTG - .38 JICM X 9/16-18, SAE ORB	3501567	1
16	FTG - .38 JICM X 9/16-18, SAE ORB	3501576	1
17	FTG - 1.00 ORB MALE X -06 JIC MALE	3501574	2
18	FTG - BRANCH TEE ADJUSTABLE, .38	3501609	1
19	FTG-.88JICM RIGX.75MORB SVL 90	3501639	1
20	FTG-.88MORB RIGIDX1/8NPT FEMAL	3501634	1
21	GEAR - DRIVE, 51T, 6DP, RH, PTO	2719305	1
22	GEAR - PINION, 29T, 6DP, LH HELIX	2717006	1
23	GEARCASE - 2 GEAR ZSE	1806300	1
24	HEAD - INBOARD, ZS	2812600	1
25	HEAD - SUCTION, ZS	2812700	1
26	HEX NUT - .500-13, GR 2	5403005	30
27	HHCS - .438-14 x 1.25, GR5	5400060	12
28	HHCS - .500-13 x 1.00, GR8	5400687	8
29	HHCS - .625-11 x 8.00, GR5	5400108	7
30	HHCS - FLANGED, .313-18 X 1.25	5402844	4
31	HHCS - FLANGED, .375-16 X 1.25	5402856	8
32	HHCS - FLANGED, .375-16 X 1.50	5402860	4
33	HHCS - FLANGED, .500-13 X 1.75	5402853	2
34	HOUSING - MECHANICAL SEAL, ZS	1846200	1
35	IMPELLER - ZS, L.H.	2908600	1
36	KEY - SQ., 0.38 X 3.00	3602407	1
37	KEY - SQ., 0.50 x 3.00	3602456	1
38	KIT-MOUNTING, ZSE SUCTION HEAD	KM02100	1
39	MECHANICAL SEAL - 2.00", ZS	1846300	1
40	METAL TACK, 3/16 HEAD, .025 L	5402873	2
41	NUT - IMPELLER, CONE, ZS	5403477	1
42	O-RING - 0.75 x 0.94 x 0.09	3601138	2
43	O-RING - 1.47 x 1.71 x 0.09	3601401	1
44	O-RING - 13.00 x 12.75 x 0.12	3601272	3
45	O-RING - 3.75 x 3.94 X 0.09	3601133	2
46	O-RING - 3.88 x 4.12 x .12	3601252	1
47	O-RING - 4.12 x 4.38 x 0.12	3601217	1
48	O-RING - 5.25 x 5.50 x 0.12	3601232	2
49	O-RING - 9.50 x 9.25 x 0.12	3601269_FORMED	1
50	OIL SEAL - 2.750 ID X 3.505 OD	3600511	2
51	OIL SEAL - 2.125 ID X 3.000 OD	3600571	1
52	PIN - COTTER, .125 x 2.00, SST	3605207	1
53	PIN - DOWEL, .375 X 0.625, GR8	3605410	2
54	PIN - DOWEL, 0.156 x 0.50, GR8	3605407	1
55	PLATE - SERIAL NO., .COM	1963109	1
56	PLUG - 1 5/16-12 SAE ORB, HEX SOC	3501575	3
57	PLUG - 3/4-16 SAE ORB, HEX SOC	3501573	2
58	PLUG - 7/16-20 SAE ORB, HEX SOC	3501629	2
59	PLUG - 7/8-14 SAE ORB, HEX SOC	3501632	3
60	PLUG - 9/16-18 SAE ORB, HEX SOC	3501578	1
61	PLUG - MAGNETIC, 3/4-16UNF	1080545	1
62	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
63	PLUG - PIPE, 0.125, W/.125 THRU	1080553	3
64	PLUG - PIPE, 0.250, SST SOC HD	1080535	5
65	PLUG - PIPE, 0.750 SST SQ HD	1080543	1
66	PLUG - PIPE, 0.750, SST SOC HD	1080551	3
67	PRIMER - BELT DRV, 24V	AP02147	1
68	PUMP - HYD, INTERNAL GEAR, LUBE	4821020	1
69	PUMP CASING - ZS	2056400	1
70	RING - RETAINER, SHR-200 STPA	3600443	1
71	SCREEN STRAINER	1122400	1
72	SEAL RING - ZS	3407500	2
73	SHAFT - IMPELLER, ZS	5022400	1
74	SHAFT - INPUT, ZSE	5023400	1
75	SLEEVE - MEGATRANS, OIL PUMP	1887400	1
76	SLINGER - WATER, ZS, 1.894 ID	3203210	1
77	SLINGER - WATER, ZSP INPUT	3206700	2
78	SPACER - 2.17 X 2.62 X .513	3309301	1
79	SPACER - 2.17 x 2.63 x .811	3305202	1
80	SPRING CARTRIDGE - OIL PUMP	4821100	1
81	STRAINER - FITTING	1122300	1
82	STUD - 0.500-13 X 2.000, GR5	3606402	30
83	TUBE - LUBE PUMP DISCH, ZSE	4434153	1
84	TUBE - LUBE PUMP DISCH, ZSE	4434154	1
85	TUBE - LUBE PUMP DISCH, ZSE	4434155	1
86	TUBE - LUBE PUMP SUCTION, ZSE	4432160	1
87	VENT - GEARCASE, 1/8 NPT MALE	4401801	1
88	WASHER - FLAT, .641 X 1.303 X .160	3603825	7
89	WASHER - FLAT, 0.4375 ID	3603830	12



REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

REMOVE SHARP EDGES | INCH [MILLIMETER] | OLD PART NO. | TOLERANCE EXCEPT AS NOTED .20 ▲.03 .200 ▲.010 ANGLES ▲1° | W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI

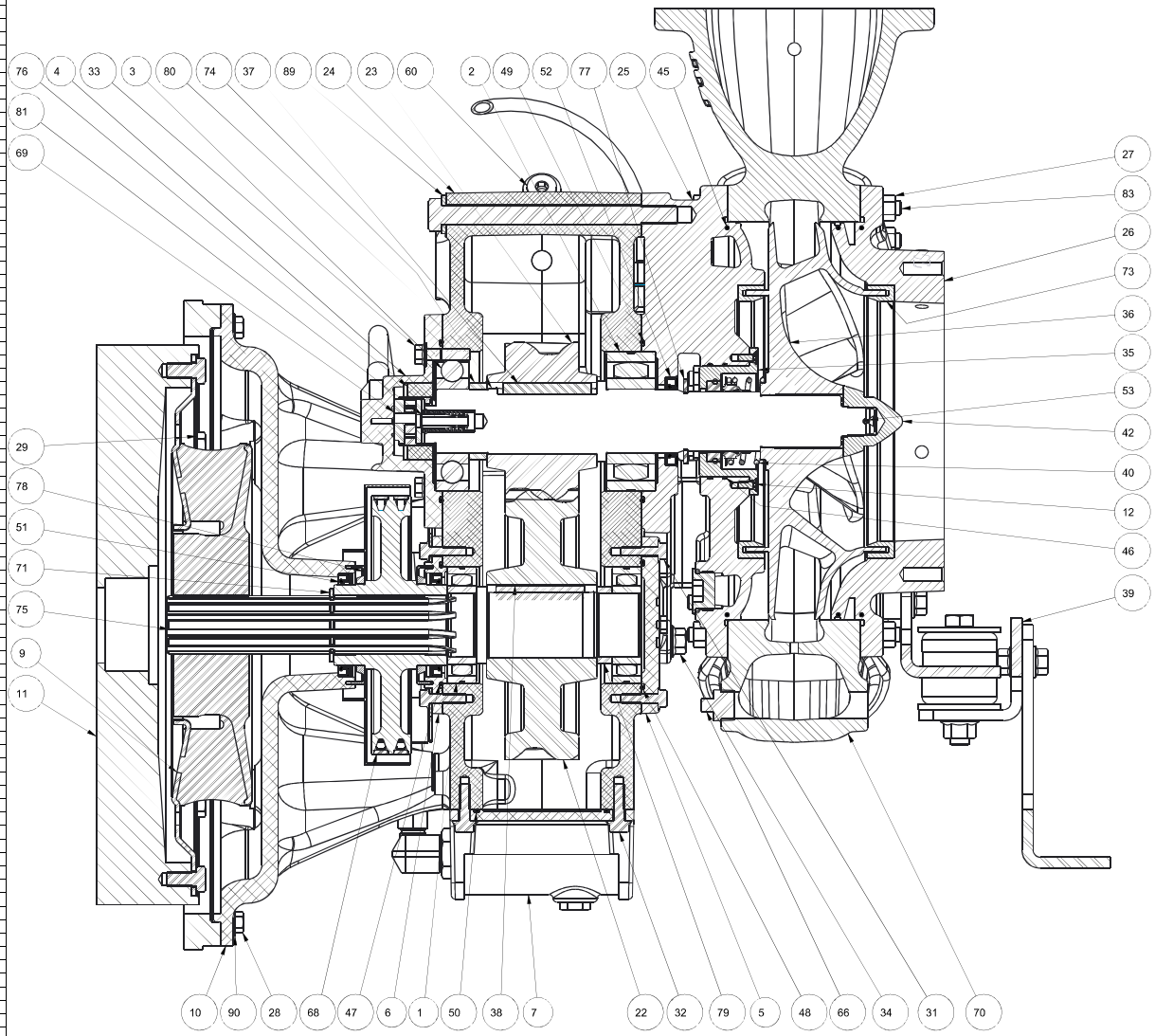
MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO. | DWG - ZSE, INPUT ABOVE CROSS SECTION

THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT | DRN WA/SMS | CHKD JWH | TRCD | DATE 20-Feb-14 | SCALE 3/16

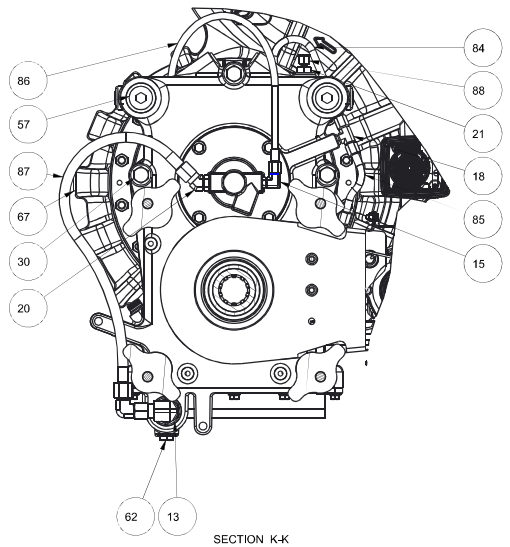
MODEL NAME: DZC0015 | MDL CREATED | SHEET 2/2 | D

DZC0015

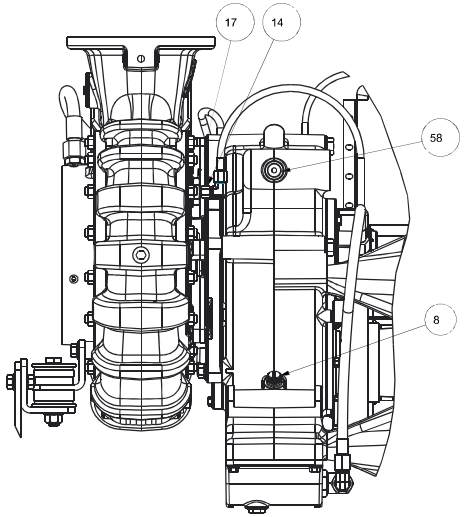
NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING - 22211E C3	1726300	2
2	BEARING - 22311E C3	1726100	1
3	BEARING - BALL, 6311,C3	1725900	1
4	CAP - BEARING, IMPELLER, ZSE	2313303	1
5	CAP - BRG, INPUT, REAR, ZSE	2314701	1
6	CAP - BRG, INPUT, ZSE 2 GEAR	2314501	1
7	COVER - OIL SUMP, ZSE 2 GEAR	2509200	1
8	DIPSTICK --10 MORB PORT	4229105	1
9	DRIVE DISC - VKE 40115-4000/14	2006500	1
10	ENGINE ADAPTER, ZSE, SAE 1	2006600	1
11	ENGINE SIMULATION - SAE 14 FLYWHEEL	X8353	1
12	FHMS - .250-20 x 0.63, SS	5402402	4
13	FILTER - LUBE PUMP, 100 MESH	1124300	1
14	FTG - .38 JIC FE X .38 JIC MALE X 90	3501596	2
15	FTG - .38 JICM X 9/16-18, SAE ORB	3501567	1
16	FTG - .38 JICM X 9/16-18, SAE ORB	3501576	1
17	FTG - 1.00 ORB MALE X -08 JIC MALE	3501574	2
18	FTG - BRANCH TEE ADJUSTABLE, .38	3501609	1
19	FTG - SWIVEL ELBOW, .62	3501583	1
20	FTG-.88JICM RIGX.75MORB SVL 45	3501608	1
21	FTG-.88MORB RIGIDX1/8NPT FEMAL	3501634	1
22	GEAR - DRIVE, 51T, 6DP, RH, PTO	2719305	1
23	GEAR - PINION, 29T, 6DP, LH HELIX	2717006	1
24	GEARCASE - 2 GEAR ZSE	1806300	1
25	HEAD - INBOARD, ZS	2812600	1
26	HEAD - SUCTION, ZS	2812700	1
27	HEX NUT - .500-13, GR 2	5403005	30
28	HHCS - .438-14 x 1.25, GR5	5400060	12
29	HHCS - .500-13 x 1.00, GR8	5400687	8
30	HHCS - .625-11 x 8.00, GR5	5400108	7
31	HHCS - FLANGED, .313-18 X 1.25	5402844	4
32	HHCS - FLANGED, .375-16 X 1.25	5402856	8
33	HHCS - FLANGED, .375-16 X 1.50	5402860	4
34	HHCS - FLANGED, .500-13 X 1.75	5402853	2
35	HOUSING - MECHANICAL SEAL, ZS	1846200	1
36	IMPELLER - ZS, L.H.	2908600	1
37	KEY - SQ., 0.38 X 3.00	3602407	1
38	KEY - SQ., 0.50 x 3.00	3602456	1
39	KIT-MOUNTING, ZSE SUCTION HEAD	KM02100	1
40	MECHANICAL SEAL - 2.00", ZS	1846300	1
41	METAL TACK, 3/16 HEAD, .025 L	5402873	2
42	NUT - IMPELLER, CONE, ZS	5403477	1
43	O-RING - 0.75 x 0.94 x 0.09	3601138	2
44	O-RING - 1.47 x 1.71 x 0.09	3601401	1
45	O-RING - 13.00 x 12.75 x 0.12	3601272	3
46	O-RING - 3.75 x 3.94 X 0.09	3601133	2
47	O-RING - 3.88 x 4.12 x .12	3601252	1
48	O-RING - 4.12 x 4.38 x 0.12	3601217	1
49	O-RING - 5.25 x 5.50 x 0.12	3601232	2
50	O-RING - 9.50 x 9.25 x 0.12	3601269_FORMED	1
51	OIL SEAL - 2.750 ID X 3.505 OD	3600511	2
52	OIL SEAL - 2.125 ID X 3.000 OD	3600571	1
53	PIN - COTTER, .125 x 2.00, SST	3605207	1
54	PIN - DOWEL, .375 X 0.625, GR8	3605410	2
55	PIN - DOWEL, 0.156 x 0.50, GR8	3605407	1
56	PLATE - SERIAL NO., .COM	1963109	1
57	PLUG - 1 5/16-12 SAE ORB, HEX SOC	3501575	3
58	PLUG - 3/4-16 SAE ORB, HEX SOC	3501573	2
59	PLUG - 7/16-20 SAE ORB, HEX SOC	3501629	2
60	PLUG - 7/8-14 SAE ORB, HEX SOC	3501632	3
61	PLUG - 9/16-18 SAE ORB, HEX SOC	3501578	1
62	PLUG - MAGNETIC, 3/4-16UNF	1080545	1
63	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
64	PLUG - PIPE, 0.125, W/.125 THRU	1080553	3
65	PLUG - PIPE, 0.250, SST SOC HD	1080535	5
66	PLUG - PIPE, 0.750 SST SQ HD	1080543	1
67	PLUG - PIPE, 0.750, SST SOC HD	1080551	3
68	PRIMER - BELT DRV, 24V	AP02147_STANDARD	1
69	PUMP - HYD, INTERNAL GEAR, LUBE	4821020	1
70	PUMP CASING - ZS	2056400	1
71	RING - RETAINER, SHR-200 STPA	3600443	1
72	SCREEN STRAINER	1122400	1
73	SEAL RING - ZS	3407500	2
74	SHAFT - IMPELLER, ZS	5022400	1
75	SHAFT - INPUT, ZSE	5023400	1
76	SLEEVE - MEGATRANS, OIL PUMP	1887400	1
77	SLINGER - WATER, ZS, 1.894 ID	3203210	1
78	SLINGER - WATER, ZSP INPUT	3206700	2
79	SPACER - 2.17 X 2.62 X .513	3309301	1
80	SPACER - 2.17 x 2.63 x .811	3305202	1
81	SPRING CARTRIDGE - OIL PUMP	4821100	1
82	STRAINER - FITTING	1122300	1
83	STUD - 0.500-13 X 2.000, GR5	3606402	30
84	TUBE - LUBE PUMP DISCH, ZSE	4434154	1
85	TUBE - LUBE PUMP DISCH, ZSE	4434155	1
86	TUBE - LUBE PUMP DISCH, ZSE	4434153_STANDARD	1
87	TUBE - LUBE PUMP SUCTION, ZSE	4432161	1
88	VENT - GEARCASE, 1/8 NPT MALE	4401801	1
89	WASHER - FLAT, .641 X 1.303 X .160	3603825	7
90	WASHER - FLAT, 0.4375 ID	3603830	12



SECTION A-A



SECTION K-K
SCALE 1/4



SCALE 1/4

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

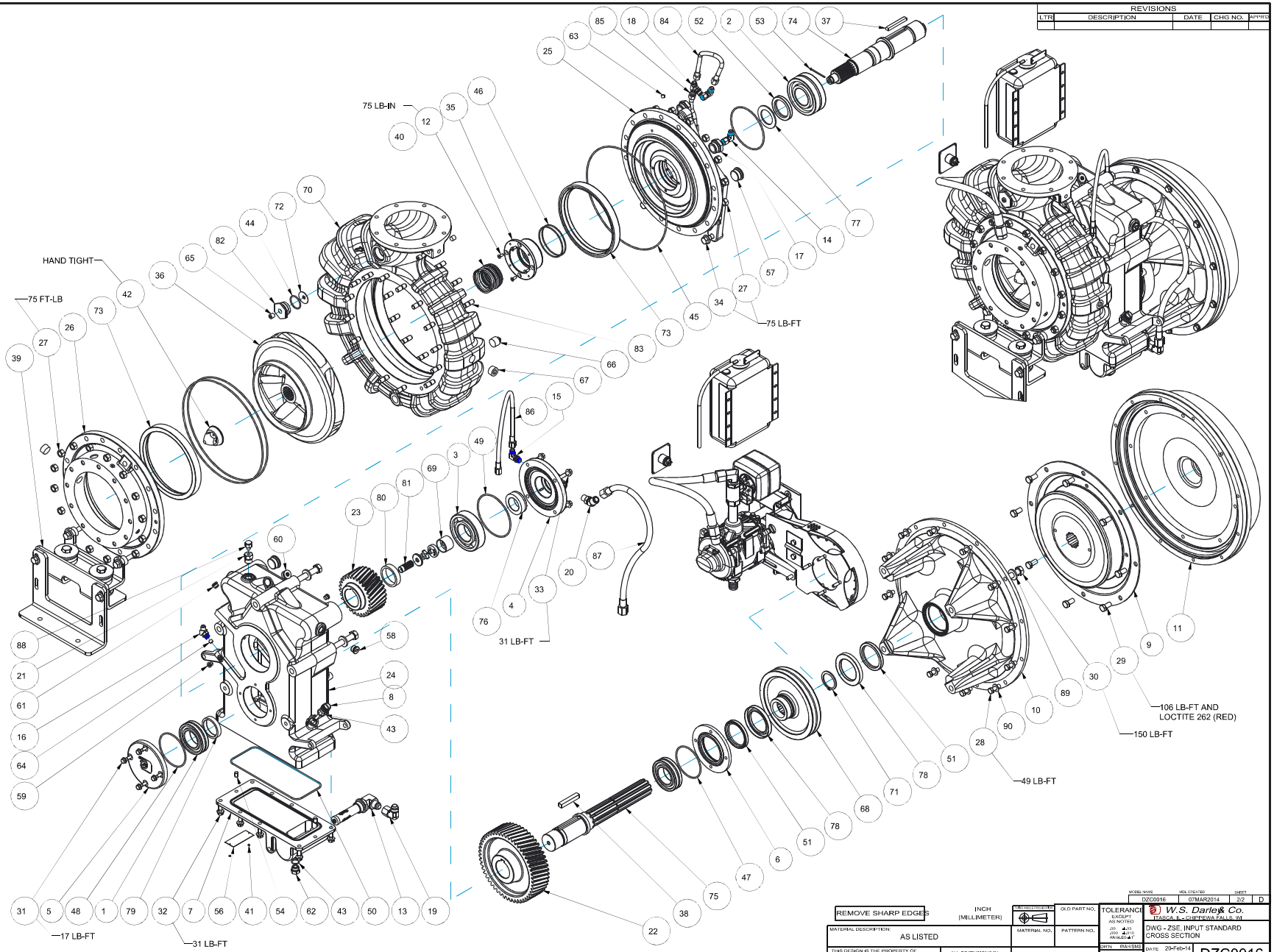
REMOVE SHARP EDGES | INCH [MILLIMETER] | OLD PART NO. | TOLERANCE EXCEPT AS NOTED .20 ▲.03 .200 ▲.010 ANGLES ▲1° | W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI

MATERIAL DESCRIPTION: AS LISTED | MATERIAL NO. | PATTERN NO. | DWG - ZSE, INPUT STANDARD CROSS SECTION

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 | DRAWN/ISMS | CHKD. KWH | TRCD. | DATE 20-Feb-14 | SCALE 1/2 | DZC0016

MODEL NAME	MDL CREATED	SHEET	
DZC0016	07MAR2014	1/2	D

NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING - 22211E C3	1726300	2
2	BEARING - 22311E C3	1726100	1
3	BEARING - BALL, 6311,C3	1725900	1
4	CAP - BEARING, IMPELLER, ZSE	2313303	1
5	CAP - BRG, INPUT, REAR, ZSE	2314701	1
6	CAP - BRG, INPUT, ZSE 2 GEAR	2314501	1
7	COVER - OIL SUMP, ZSE 2 GEAR	2509200	1
8	DIPSTICK --10 MORB PORT	4229105	1
9	DRIVE DISC - VKE 40115--6000/14	2006500	1
10	ENGINE ADAPTER, ZSE, SAE 1	2006600	1
11	ENGINE SIMULATION - SAE 14 FLYWHEEL	X8353	1
12	FHMS - .250-20 x 0.63, SS	5402402	4
13	FILTER - LUBE PUMP, 100 MESH	1124300	1
14	FTG - .38 JIC FE X .38 JIC MALE X 90	3501596	2
15	FTG - .38 JICM X 9/16-18, SAE ORB	3501567	1
16	FTG - .38 JICM X 9/16-18, SAE ORB	3501576	1
17	FTG - 1.00 ORB MALE X -08 JIC MALE	3501574	2
18	FTG - BRANCH TEE ADJUSTABLE, .38	3501609	1
19	FTG - SWIVEL ELBOW, .62	3501583	1
20	FTG-.88JICM RIGX.75MORB SVL 45	3501608	1
21	FTG-.88MORB RIGIDX1/8NPT FEMAL	3501634	1
22	GEAR - DRIVE, 51T, 6DP, RH, PTO	2719305	1
23	GEAR - PINION, 29T, 6DP, LH HELIX	2717006	1
24	GEARCASE - 2 GEAR ZSE	1806300	1
25	HEAD - INBOARD, ZS	2812600	1
26	HEAD - SUCTION, ZS	2812700	1
27	HEX NUT - .500-13, GR 2	5403005	30
28	HHCS - .438-14 x 1.25, GR5	5400060	12
29	HHCS - .500-13 x 1.00, GR8	5400687	8
30	HHCS - .625-11 x 8.00, GR5	5400108	7
31	HHCS - FLANGED, .313-18 X 1.25	5402844	4
32	HHCS - FLANGED, .375-16 X 1.25	5402856	8
33	HHCS - FLANGED, .375-16 X 1.50	5402860	4
34	HHCS - FLANGED, .500-13 X 1.75	5402853	2
35	HOUSING - MECHANICAL SEAL, ZS	1846200	1
36	IMPELLER - ZS, L.H.	2908600	1
37	KEY - SQ., 0.38 X 3.00	3602407	1
38	KEY - SQ., 0.50 x 3.00	3602456	1
39	KIT-MOUNTING, ZSE SUCTION HEAD	KM02100	1
40	MECHANICAL SEAL - 2.00", ZS	1846300	1
41	METAL TACK, 3/16 HEAD, .025 L	5402873	2
42	NUT - IMPELLER, CONE, ZS	5403477	1
43	O-RING - 0.75 x 0.94 x 0.09	3601138	2
44	O-RING - 1.47 x 1.71 x 0.09	3601401	1
45	O-RING - 13.00 x 12.75 x 0.12	3601272	3
46	O-RING - 3.75 x 3.94 X 0.09	3601133	2
47	O-RING - 3.88 x 4.12 x .12	3601252	1
48	O-RING - 4.12 x 4.38 x 0.12	3601217	1
49	O-RING - 5.25 x 5.50 x 0.12	3601232	2
50	O-RING - 9.50 x 9.25 x 0.12	3601269_FORMED	1
51	OIL SEAL - 2.750 ID X 3.505 OD	3600511	2
52	OIL SEAL - 2.125 ID X 3.000 OD	3600571	1
53	PIN - COTTER, .125 x 2.00, SST	3605207	1
54	PIN - DOWEL, .375 X 0.625, GR8	3605410	2
55	PIN - DOWEL, 0.156 x 0.50, GR8	3605407	1
56	PLATE - SERIAL NO., .COM	1963109	1
57	PLUG - 1 5/16-12 SAE ORB, HEX SOC	3501575	3
58	PLUG - 3/4-16 SAE ORB, HEX SOC	3501573	2
59	PLUG - 7/16-20 SAE ORB, HEX SOC	3501629	2
60	PLUG - 7/8-14 SAE ORB, HEX SOC	3501632	3
61	PLUG - 9/16-18 SAE ORB, HEX SOC	3501578	1
62	PLUG - MAGNETIC, 3/4-16UNF	1080545	1
63	PLUG - PIPE, 0.125, SST SOC HD	1080533	1
64	PLUG - PIPE, 0.125, W/.125 THRU	1080553	3
65	PLUG - PIPE, 0.250, SST SOC HD	1080535	5
66	PLUG - PIPE, 0.750 SST SQ HD	1080543	1
67	PLUG - PIPE, 0.750, SST SOC HD	1080551	3
68	PRIMER - BELT DRV, 24V	AP02147_STANDARD	1
69	PUMP - HYD, INTERNAL GEAR, LUBE	4821020	1
70	PUMP CASING - ZS	2056400	1
71	RING - RETAINER, SHR-200 STPA	3600443	1
72	SCREEN STRAINER	1122400	1
73	SEAL RING - ZS	3407500	2
74	SHAFT - IMPELLER, ZS	5022400	1
75	SHAFT - INPUT, ZSE	5023400	1
76	SLEEVE - MEGATRANS, OIL PUMP	1887400	1
77	SLINGER - WATER, ZS, 1.894 ID	3203210	1
78	SLINGER - WATER, ZSP INPUT	3206700	2
79	SPACER - 2.17 X 2.62 X .513	3309301	1
80	SPACER - 2.17 x 2.63 x .811	3305202	1
81	SPRING CARTRIDGE - OIL PUMP	4821100	1
82	STRAINER - FITTING	1122300	1
83	STUD - 0.500--13 X 2.000, GR5	3606402	30
84	TUBE - LUBE PUMP DISCH, ZSE	4434154	1
85	TUBE - LUBE PUMP DISCH, ZSE	4434155	1
86	TUBE - LUBE PUMP DISCH, ZSE	4434153_STANDARD	1
87	TUBE - LUBE PUMP SUCTION, ZSE	4432161	1
88	VENT - GEARCASE, 1/8 NPT MALE	4401801	1
89	WASHER - FLAT, .641 X 1.303 X .160	3603825	7
90	WASHER - FLAT, 0.4375 ID	3603830	12



REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

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

MATERIAL DESCRIPTION: AS LISTED | MATERIAL NO. | PATTERN NO. | DRWN WAH/BMS | CHKD JWH | TRCD

DWG - ZSE, INPUT STANDARD CROSS SECTION

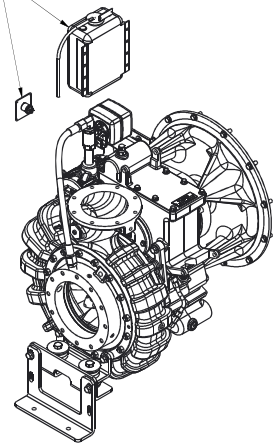
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED | ALL DIMENSIONS IN INCHES UNLESS NOTED | DO NOT SCALE PRINT

MODEL WAVE: DZC0016 | MDL CREATED: 07MAR2014 | SHEET: 2/2 | D

DATE: 20-Feb-14 | SCALE: 3/16 | DZC0016

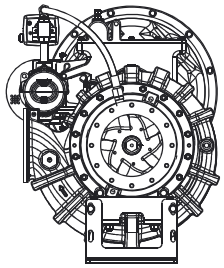
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

REMOTE MOUNT PRIMER
TANK AND CONTROL SWITCH

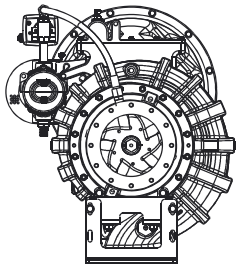


SCALE 1/8

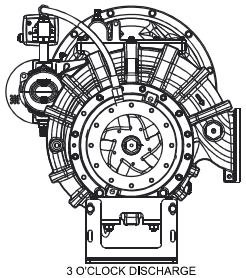
OPTIONAL PUMP CASING POSITIONS
DISCHARGE CENTERED TO SUCTION



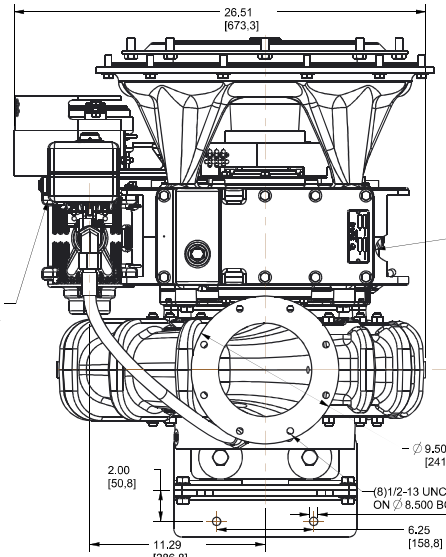
9 O'CLOCK DISCHARGE

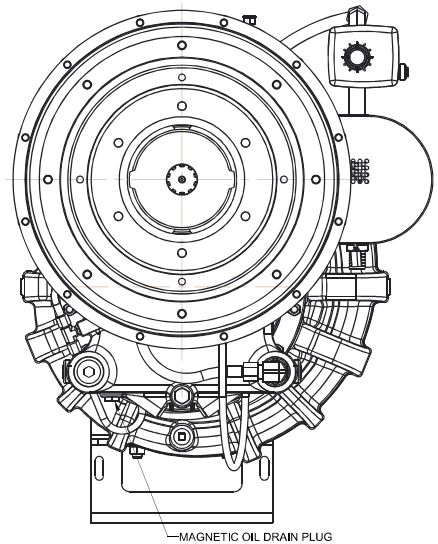


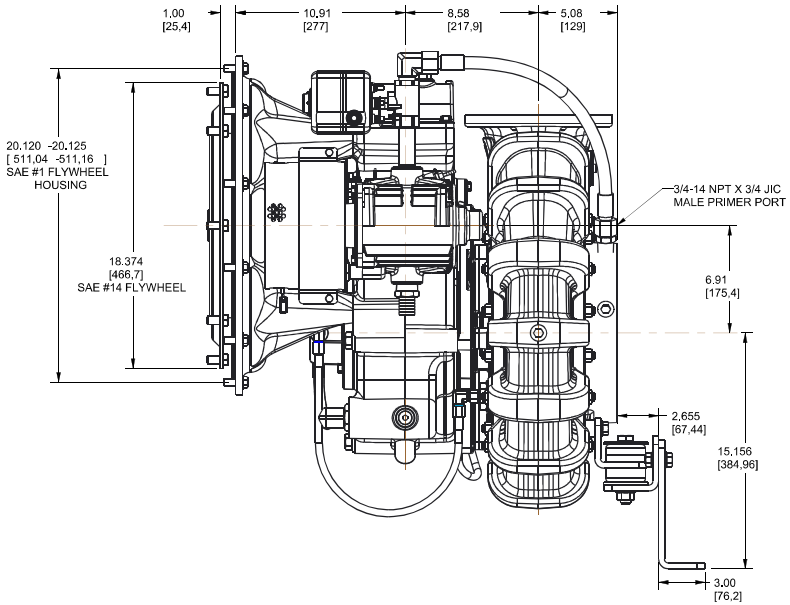
6 O'CLOCK DISCHARGE

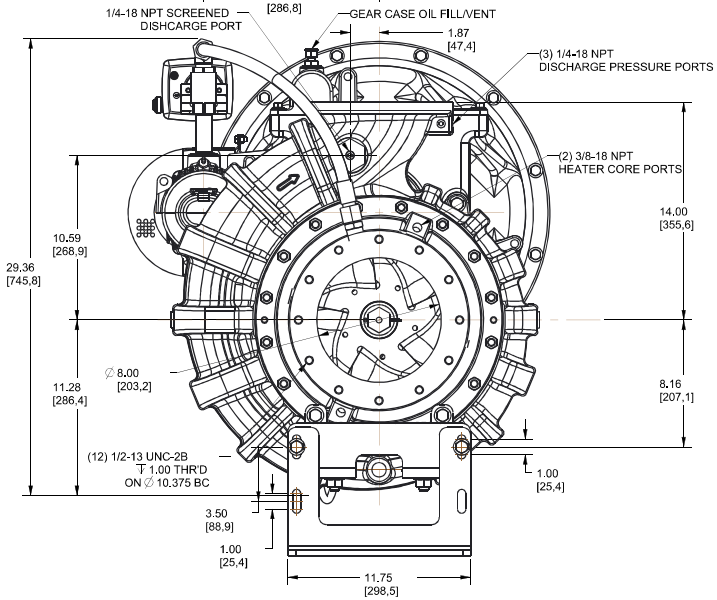


3 O'CLOCK DISCHARGE







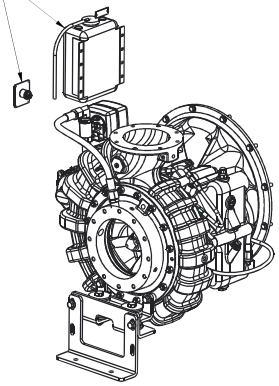


APPROXIMATE WEIGHT 735 LBS [333KG]

REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI	MODEL NAME DZC0015	MDL CREATED	SHEET 1/1 D
MATERIAL DESCRIPTION:		MATERIAL NO.	PATTERN NO.		DWG - DIMENSIONAL, ZSE, INPUT ABOVE SAE #1 X SAE#14			
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		DRAWN/ISSUED CHKD: KWH TRCD	DATE 03-Mar-14 SCALE 1/4	DZD0028		

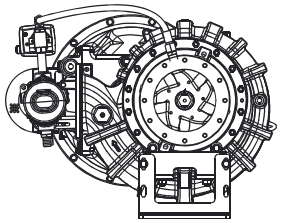
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

REMOTE MOUNT PRIMER
TANK AND CONTROL SWITCH

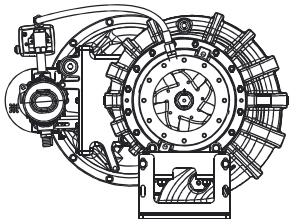


SCALE 1/8

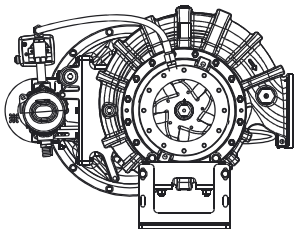
OPTIONAL PUMP CASING POSITIONS
DISCHARGE CENTERED TO SUCTION



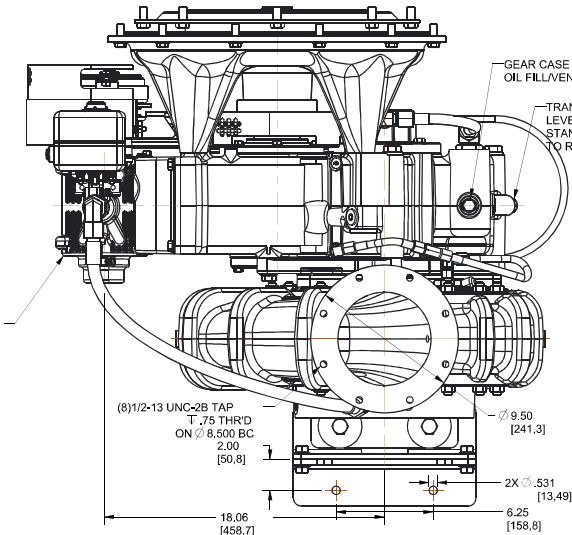
9 O'CLOCK DISCHARGE

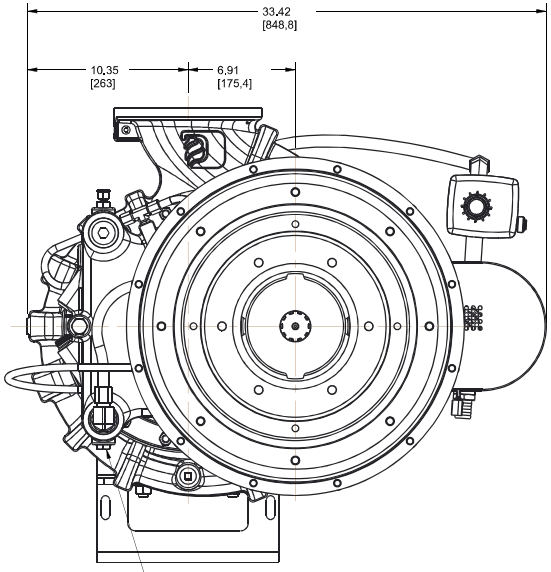


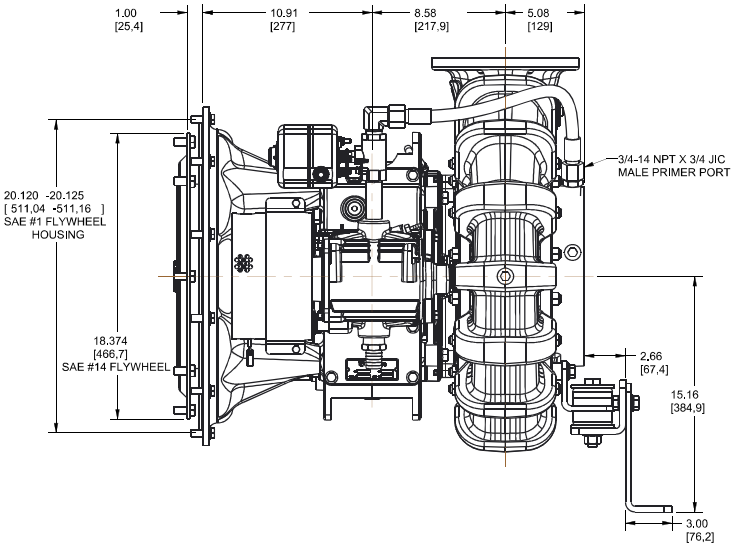
6 O'CLOCK DISCHARGE

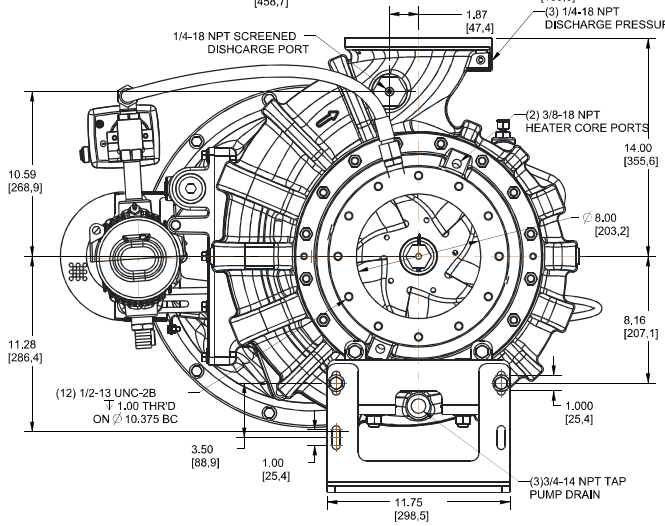


3 O'CLOCK DISCHARGE









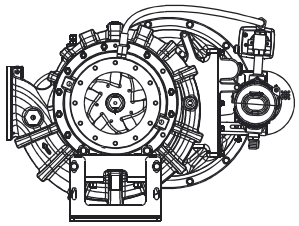
APPROXIMATE WEIGHT 735 LBS [333KG]

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	MODEL NAME DZD0029	MDL CREATED	SHEET 1/1 D
MATERIAL DESCRIPTION:		MATERIAL NO.	PATTERN NO.		DWG - DIMENSIONAL, ZSE, INPUT LEFT SAE #1 X SAE#14			
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		DRAWN TSMS CHKD KWH TRCD	DATE 03-Mar-14 SCALE 1/4	DZD0029		

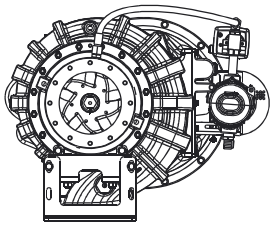
REMOTE MOUNT PRIMER
TANK AND CONTROL SWITCH

SCALE 1/8

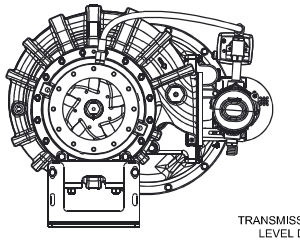
OPTIONAL PUMP CASING POSITIONS
DISCHARGE CENTERED TO SUCTION



9 O'CLOCK DISCHARGE



6 O'CLOCK DISCHARGE



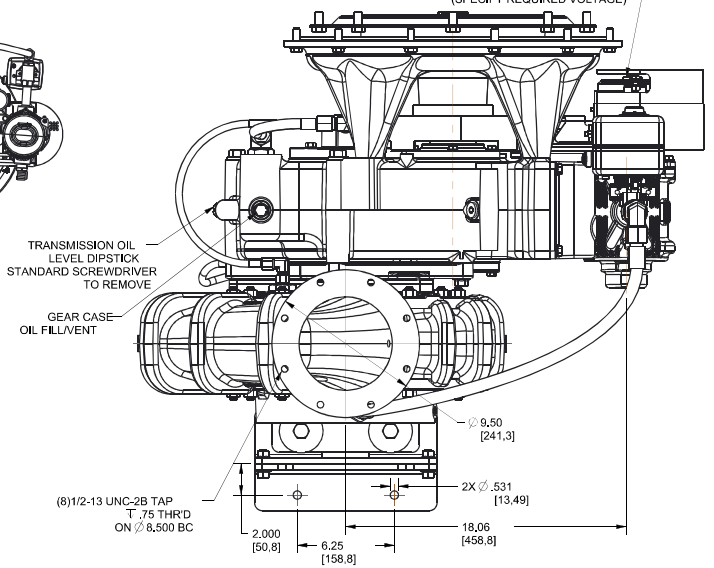
3 O'CLOCK DISCHARGE

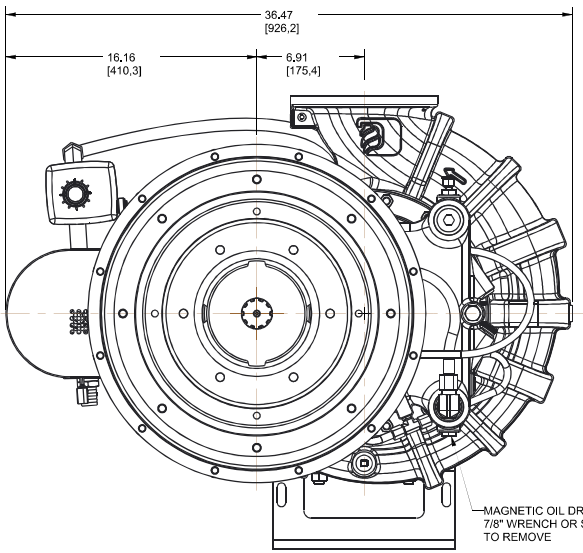
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD

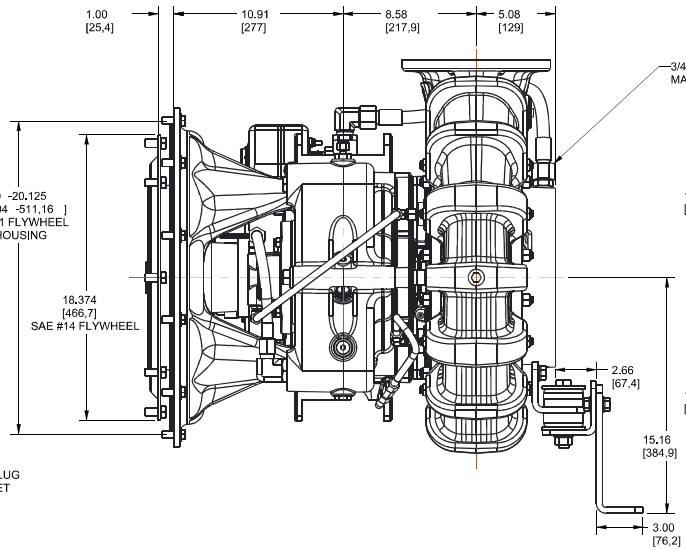
DARLEY 12VDC OR 24VDC
BELT DRIVEN PRIMER
(SPECIFY REQUIRED VOLTAGE)

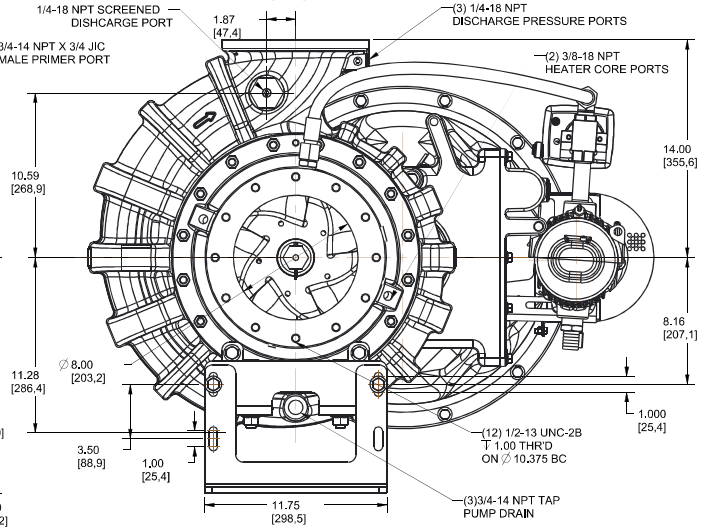
TRANSMISSION OIL
LEVEL DIPSTICK
STANDARD SCREWDRIVER
TO REMOVE

GEAR CASE
OIL FILL/VENT







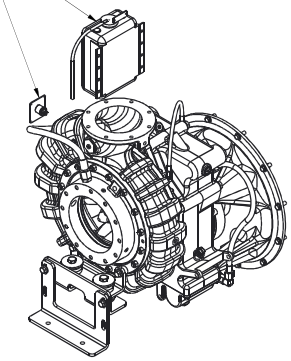


APPROXIMATE WEIGHT 735 LBS [333KG]

REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI	
MATERIAL DESCRIPTION:		MATERIAL NO.	PATTERN NO.		DWG - DIMENSIONAL, ZSE, INPUT RIGHT SAE #1 X SAE#14	
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		DRAWN/ISSUED	DATE 03-Mar-14	DZD0030
				CHKD KWH	SCALE 1/4	
				TRCD		

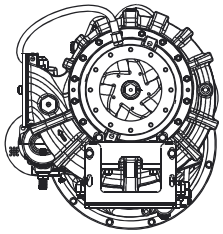
MODEL NAME: DZD0030 | MDL CREATED | SHEET: 1/1 | D

REMOTE MOUNT PRIMER
TANK AND CONTROL SWITCH

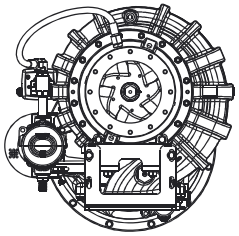


SCALE 1/8

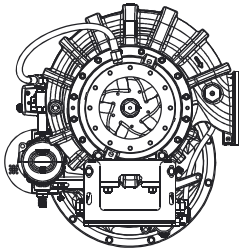
OPTIONAL PUMP CASING POSITIONS
DISCHARGE CENTERED TO SUCTION



9 O'CLOCK DISCHARGE

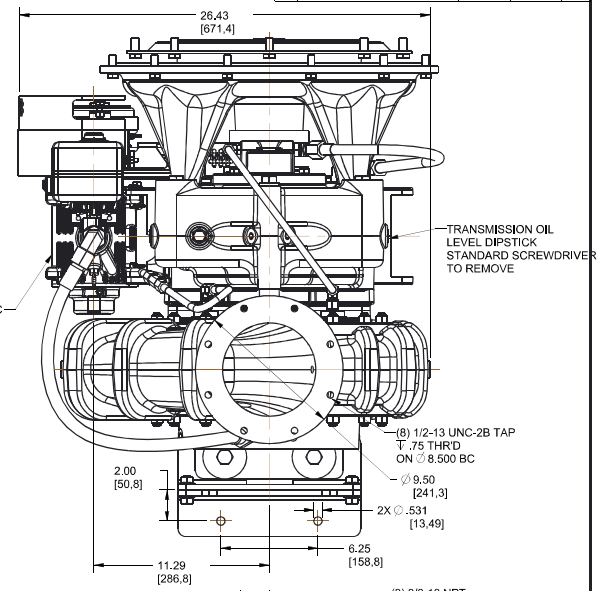


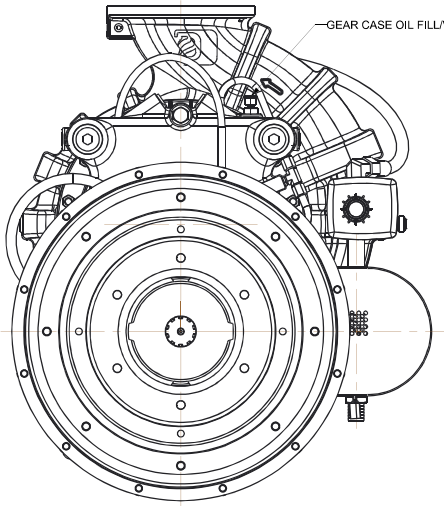
6 O'CLOCK DISCHARGE

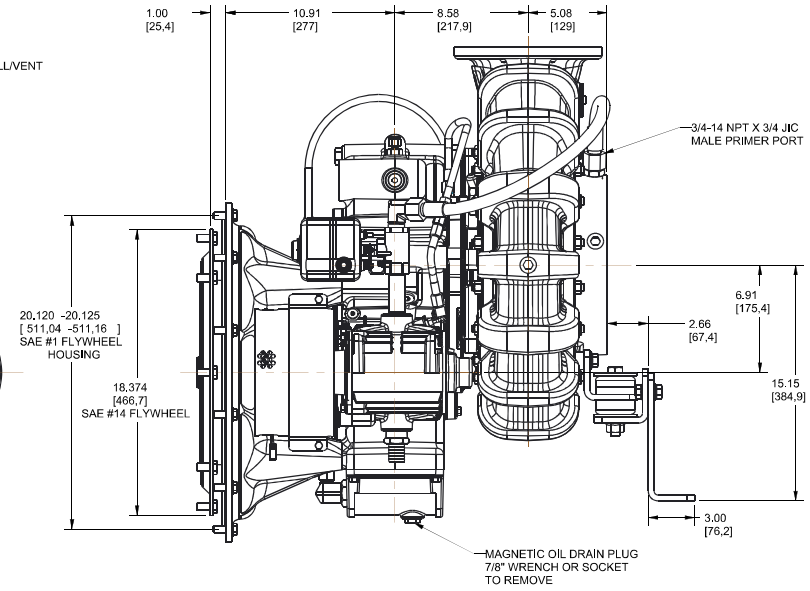


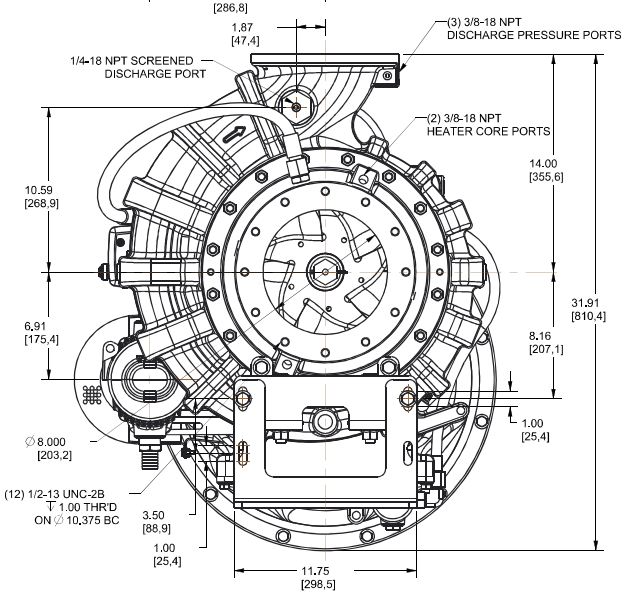
3 O'CLOCK DISCHARGE

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPRD









REMOVE SHARP EDGES	INCH [MILLIMETER]		OLD PART NO.	TOLERANCE EXCEPT AS NOTED .20 ±.20 .200 ±.010 ANGLES ±1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI
MATERIAL DESCRIPTION: AS LISTED			MATERIAL NO. / PATTERN NO.		DWG - DIMENSIONAL, ZSE, INPUT STD SAE #1 X SAE # 14
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		DRAWN/ISMS CHKD TRCD	DATE 12-Mar-14 SCALE 1/4

MODEL NAME	MDL CREATED	SHEET	
DZC0016	07MAR2014	1/1	D

DZD0031

MECHANICAL SEAL

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.

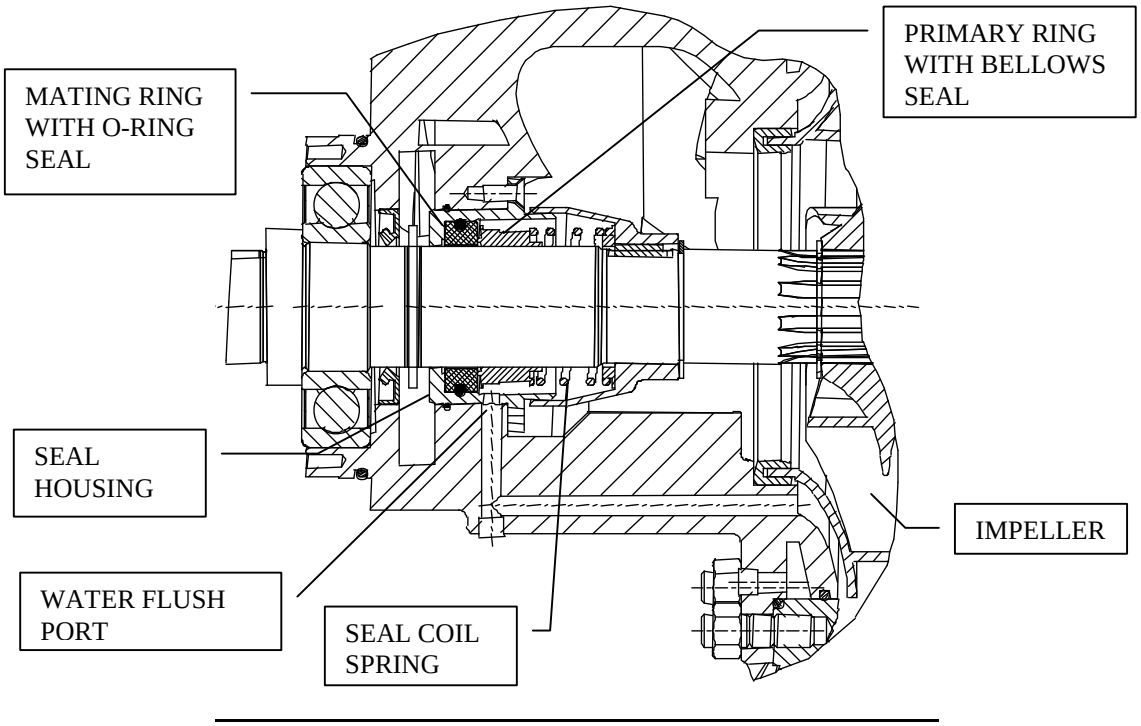
Mechanical Seal Basics

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

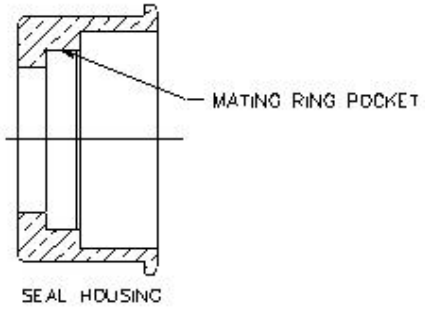
SPECIAL HANDLING

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.

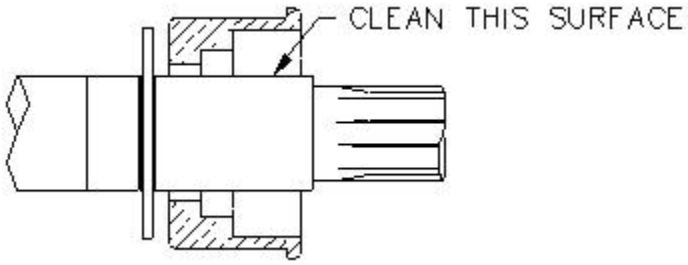
INSTRUCTION STEPS:

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.

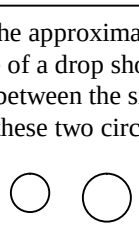


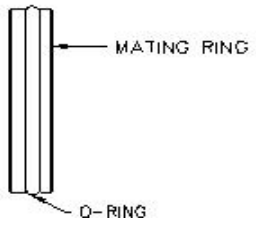
2. Inspect the pump shaft surface under the bellows, ensuring it is clean and nick free to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

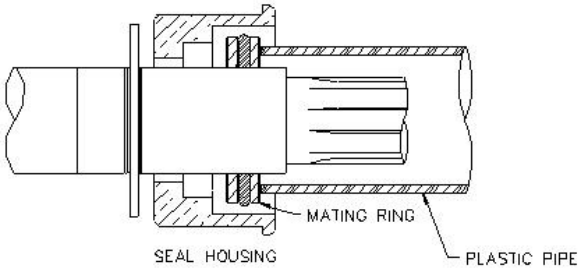


3. Lightly lubricate the o-ring on the mating ring with a single drop of P-80 water soluble rubber lubricant (do not over lubricate) and push it into the cavity using the recommended installation tool or other suitable plastic tube free of contaminants, firmly seating the mating ring square.
   Note: 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.





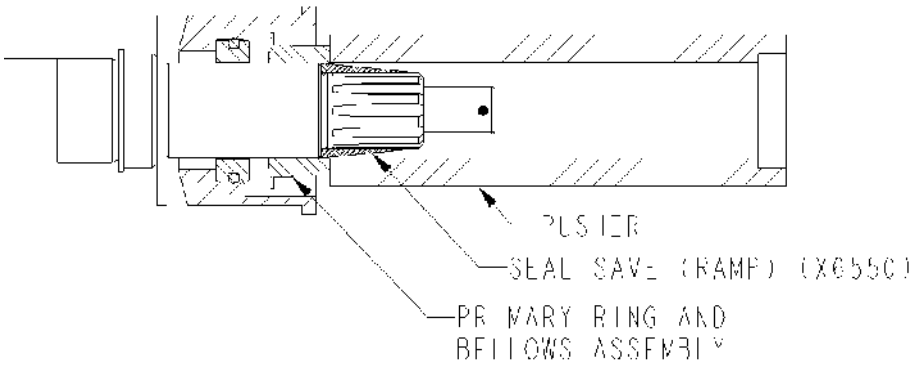


4. Clean the mating ring surface with isopropyl alcohol to remove any fingerprints and any other contaminants left on mating ring.

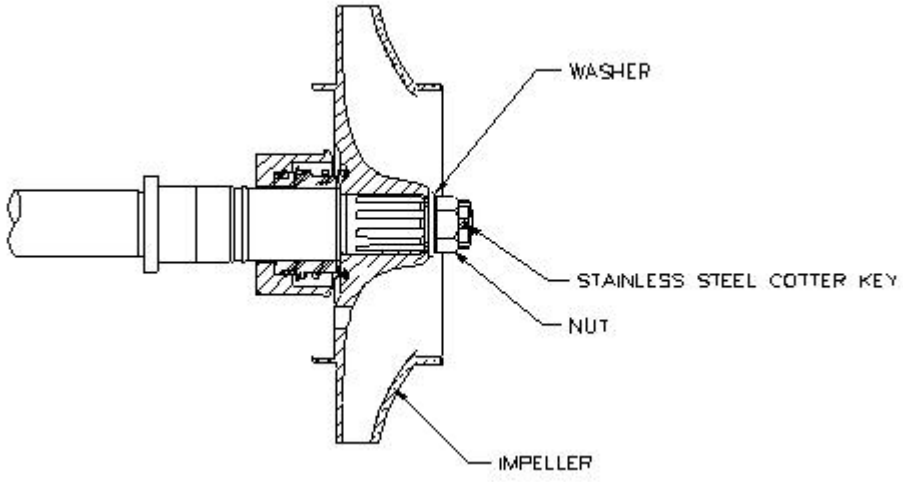
Note: Steps 5 – 9 need to all be completed with in 15 minutes or less.

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.



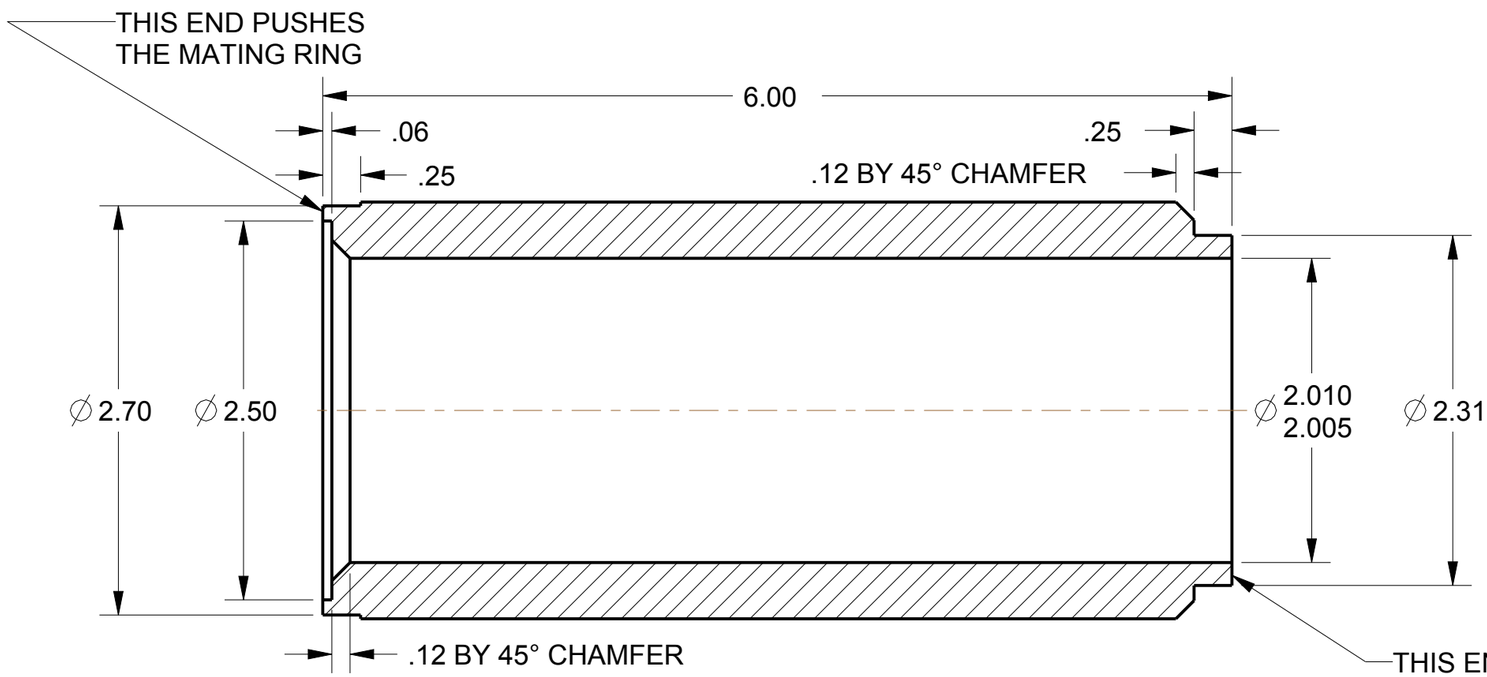
*** Reference pump configuration for individual mechanical seal instructions.*
*** Reference pump assembly drawings and pump assembly tips for further assembly.*

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.

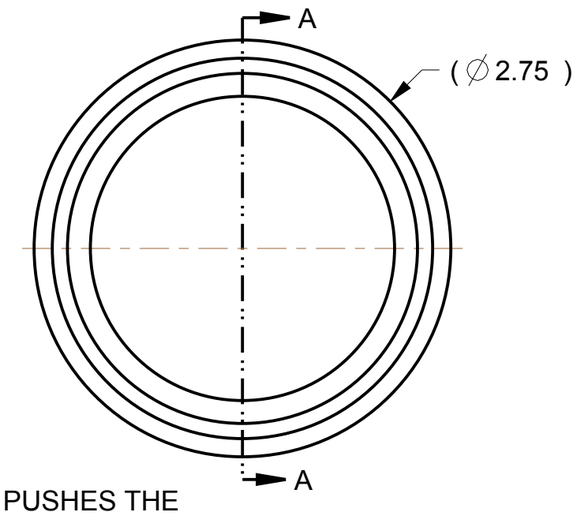
Once a mechanical seal has been installed, it is recommended that it not be reused.

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

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



SECTION A-A



NOTES:
1) THIS PUSHER INSTALLS THE 1846300 MECHANICAL SEAL ON A ZS PUMP.

MODEL	MDL CREATED	SHEET	
X8104	17APR2012	1/1	B

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: ROD - 2.75 DIA UHMW/PE BY 6.13 LONG

MATERIAL NO. 1102756

PATTERN NO. -

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

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

MECH SEAL ASSY TUBE, ZS PUMP
2.000" SEAL

DR'N WAH
CHKD -
TRCD

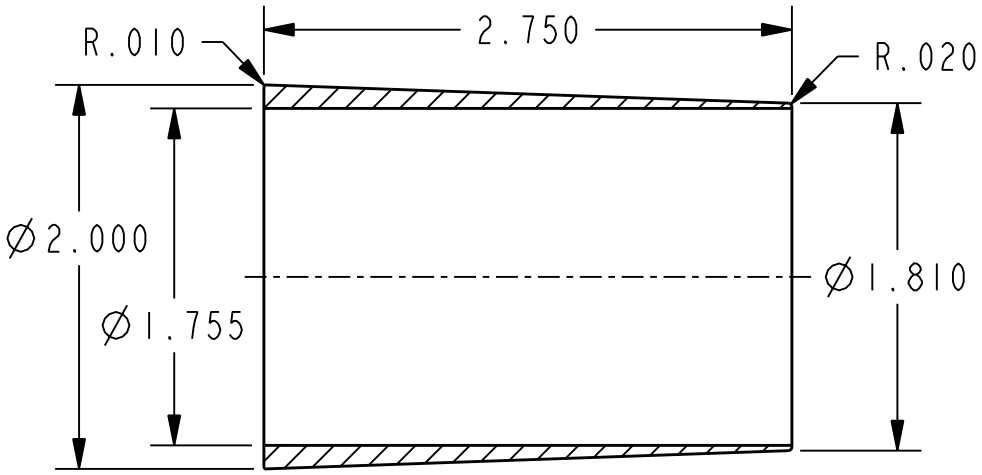
DATE 17APR2012
SCALE 1/1

X8104

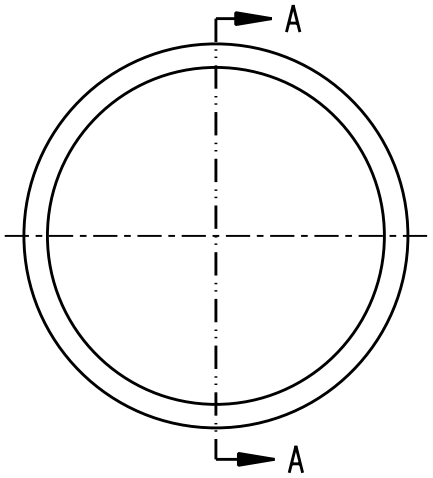
ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



SECTION A-A



NOTES:
1) INTENDED TO HELP INSTALL A 1846300 MECHANICAL SEAL OVER A 5022400 IMPELLER SHAFT.

MODEL NAME	MDL CREATED	SHEET	
X8105	17APR2012	1/1	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

INSTALL SLEEVE, MECH SEAL
2.000 SEAL, SPLINE RAMP

MATERIAL DESCRIPTION:	MATERIAL NO.	PATTERN NO.
BAR - ROUND, 2.125", 4340H BY 2.875" LONG	1100200	-

DR'N	WAH
CHKD	-
TRCD	

DATE 17APR2012

SCALE 1/1

X8105

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NAME:WAH OBJECT:X8105 DATE:19-Apr-12 15:34:47

ELECTRICALLY-CLUTCHED BELT-DRIVEN ROTARY VANE PRIMER TROUBLESHOOTING

Prepared by: WAH
Approved by: MCR
Revised by:

Rev. 0
Date: 04/22/14
Rev. Date:
1200655.doc

W.S. DARLEY & CO.

Operating/Troubleshooting Instructions for Darley Electrically-Clutched Belt-Driven Priming Pump

The Darley electrically-clutched belt-driven primer will develop up to 25 in. Hg. in an air tight pumping system.

The Primer is activated by a push-button momentary electric switch. Pushing and holding this switch in opens the 12/24 VDC electric ¼ turn ¾" ball valve and closes the electrical circuit to energize the clutch, engaging the belt drive system, in turn spinning the primer rotor within the primer body. Releasing this switch will close the ¼ turn electric valve and disengage the primer clutch, ending the priming cycle.

The 12/24 VDC electric ¼ turn valve utilized in this system has a 0.8 second cycle time as well as a logic controller to make necessary adjustments internally depending on input voltage, therefore maintaining a constant 0.8 seconds open/close cycle time. This valve will act as a bubble tight check valve, therefore once the momentary push to prime switch is released, this ¼ turn valve will automatically close and contain the prime of the pump system.

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. In cases where the discharge side of the pump is sealed by a check valve, 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 must be engaged to initiate priming

CAUTION

FOR ALL PRIMING SCENARIOS:
If water does not discharge from the primer exhaust within 80 seconds stop the primer pump, check for air leaks and resolve the issue before attempting to re-prime. MAX PRIMER OPERATION TIME = 80 seconds. DO NOT EXCEED 80 SECONDS OF PRIMER OPERATION. Repeated operation should be avoided.

CAUTION

The primer pump generates heat as soon as operation begins. Extended run times (up to 80 seconds) and repeating priming cycles consecutively or within short time periods may lead to accelerated wear or premature failure of the primer pump assembly. If an attempt to prime should fail, thoroughly inspect the pump system for air leaks and resolve the issue before attempting re-prime.

Priming Procedure:

To prime the pump a certain amount of dry running of the pump along with a recommended engine speed are given. Significant testing has proven these figures at W.S. Darley and should never be exceeded without W.S Darley Customer Service approval.

Priming time should not exceed 80 seconds. If pump fails to prime within 80 seconds, shut down and thoroughly inspect the pump system for air leaks and resolve the issue before attempting to re-prime.

Engine speed during priming should NOT exceed 1000 RPM regardless of the pump and/or PTO ratio in relation to engine speed.

To Prime: Engage the pump per the shifting procedure outlined in Section 2, and ramp engine speed to no more than 1000 RPM. Press the "Push-to-Prime" momentary switch and hold. Prime should occur within 80 seconds. Indication of Prime should be noticed when water discharges from the primer pump exhaust port. Releasing the momentary switch will disengage the primer clutch and close the primer ¼ turn ball valve. Prime should now be attained and contained.

Under normal conditions, the primer will evacuate the pump and 20' of 8" hose within 24 seconds.

As soon as prime is reached the pump will develop pressure. Once the pump has developed pressure the Push to Prime button will no longer work, due to a 15 PSI pressure switch installed on the discharge side of the pump.

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 Pump with Fluid Reservoir

The electrically-clutched belt-driven rotary-vane 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 of lubricant from the tank after the pump is stopped. Do not increase the size of this 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-rings as necessary.

Troubleshooting:

-If the electric clutch is not functioning / slipping beyond normal operating characteristic:

- Check system supplied voltage. Under a static energized condition the clutch should be pulling 12 VDC @ 4.89 Amps with 2.45 Ohms (+/- 5%) of resistance across the coil and 24 VDC @ 1.26 Amps with 9.51 Ohms (+/- 5%) of resistance across the coil; depending on the clutch (12 or 24 VDC) being used. Note that these figures are at an ambient temperature of 68°F.

- These figures can be checked with the correct measuring/inspection equipment. Such as a properly calibrated Multi Meter with a Current Clamp.

- Any deviation from these figures when experiencing clutch challenges could indicate a problem with the clutch coil or an insufficient supply voltage and current. Contact W.S. Darley Customer Service if these problems occur.

-Vibration in belt/clutch assembly:

- Could be indicated by:
  - Damaged Belt
  - Contaminated Bearing
  - Loose clutch body mounting bolt (through clutch bore into primer rotor/shaft assembly)
  - Loose bolts holding belt tension
    - Revisit the primer assembly drawing and contact W.S. Darley Customer Service if necessary. Proper belt tension is a must.
    - Belt tension can be inspected and validated by:
      - Placing a 6 lb– 7 lb force on the belt along its periphery directly between the center axis of each pulley. The belt should deflect approximately 5/32” +/-.015”; beyond these figures in either direction +/- will yield a belt tension that is to loose or to tight and will detrimentally affect belt, sheave and clutch life.
  - Damaged rotor/shaft assembly
  - Damaged or broken primer vane
  - Particulate trapped in primer/rotor body vane area
  - Excessive slipping in between clutch armature assembly and friction material
    - If this occurs, excessive heat may generate, causing warpage and damage to the armature and friction material

- Heat signs will show, bluing and blackening of surrounding areas from heat source

- Trapped particulate entrained in air gap (between armature assembly and friction material)

- Damage or Failure of 1, 2 or all 3 of the clutches spring plates.

  - These plates hold the pulley sheave to the armature assembly, transferring rotational energy of the pulley sheave through the belt drive to the clutch friction material (when the clutch coil is energized) and correspondingly through the primer rotor/shaft assembly creating a vacuum in the rotary vane primer pump. These spring plates allow for this transfer as well as allow the energized clutch coil to overcome the spring force in these plates and close the air gap between the armature assembly and the friction material, or vice versa re-establishing the air gap and preventing the belt drive system from transferring rotational energy to the rotary vane primer pump.

-Excessive belt wear

- Could be indicated by:

  - Misalignment between Driver and Driven pulleys

    - Axial or Angular

    - Revisit the primer assembly drawing and contact W.S. Darley Customer Service if necessary. Belt drives must have nearly zero misalignment for long life and proper function.

-Minimal vacuum creation by Primer

- Damaged vanes

- Loss of original lubrication in primer rotor housing and vanes

- Particulate trapped in vane housing

  - Causing vane(s) not to fully engage and disengage in vane housing/rotor

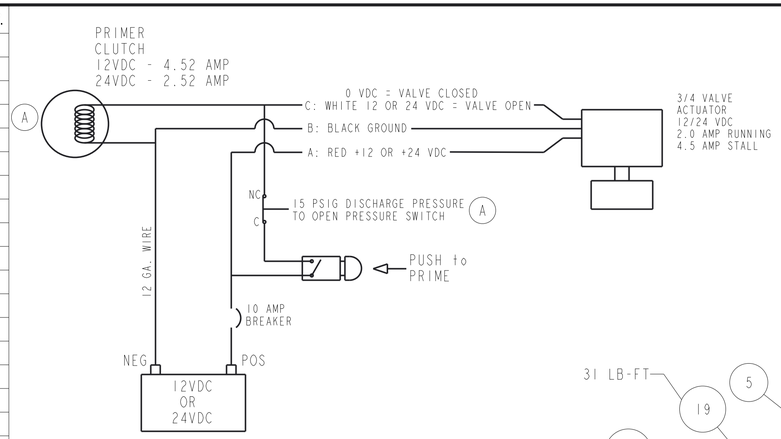
    - Would prevent vacuum creation or severely inhibit such

- Other challenges may occur that have not been listed here, we kindly ask that you document these challenges as best you can and contact W.S. Darley Customer Service to identify the root cause and evaluate any necessary changes in the design.

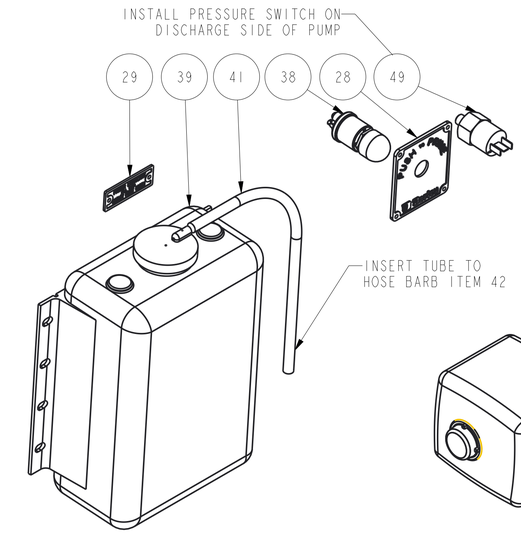
For challenges and assembly/disassembly assistance:

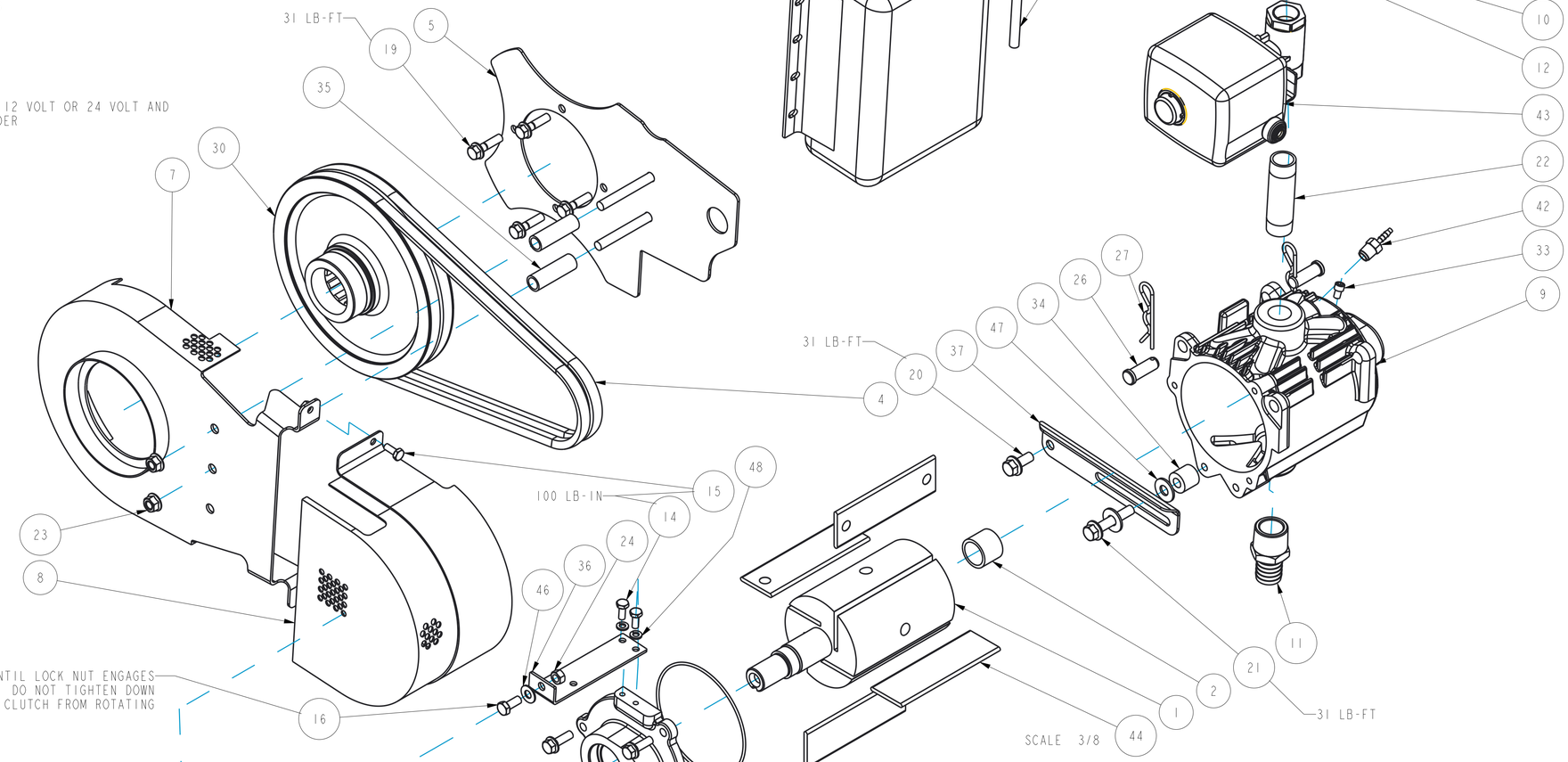
CONTACT DARLEY CUSTOMER SERVICE IMMEDIATELY AT 1-800-634-7812 or 715-726-2650

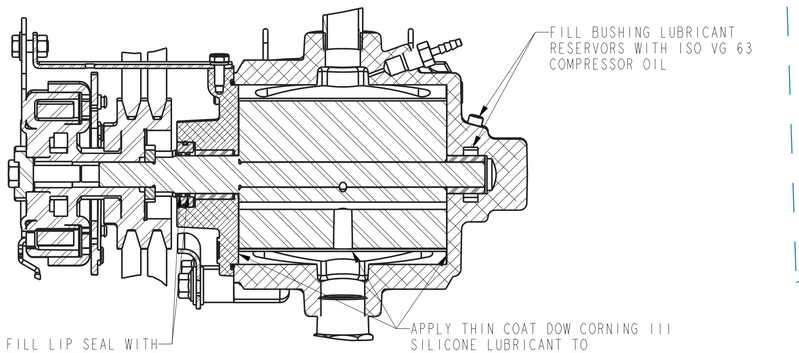
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSY - ROTOR, 25 CU IN VAC PUMP	-	1
2	BEARING - OILITE, 1.000 ID	-	1
3	BEARING - OILITE, 1.250 ID	-	1
4	BELT - PRIMER DRIVE	-	2
5	BRACKET - BELT COVER	-	1
6	CLUTCH - VAC PUMP, 24VDC	-	1
7	COVER - BELT	-	1
8	COVER - BELT	-	1
9	CYLINDER - VACUUM PUMP, 25 CU IN	-	1
10	FITTING-.75NPTMx.75JICM	-	1
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	-	1
12	FTG-.75NPTMX1 1/16-12JICM RIGD	-	1
13	HEAD - CYL, VAC PUMP, 25 CU IN	-	1
14	HHCS - .25-20 X .63, GR 5 SST	-	2
15	HHCS - .250-20 x 0.63, GR5	-	2
16	HHCS - .313-18 x 0.75, SST	-	1
17	HHCS - .438-20 x 2.75, GR5	-	1
18	HHCS - FLANGED, .313-18 X 1.00	-	3
19	HHCS - FLANGED, .313-18 X 1.25	-	4
20	HHCS - FLANGED, .375-16 X .88	-	1
21	HHCS - FLANGED, .375-16 X 2.00	-	1
22	NIPPLE - PIPE, .75 X 3.50, BR	-	1
23	NUT - FLANGED TOP LOCK	-	2
24	NUT - HEX, .313-18, NYLOC, SST	-	1
25	O-RING - 4.75 x 4.94 x 0.09	-	1
26	PIN - CLEVIS, .5"	-	2
27	PIN - COTTER, .125 SST HAIRPIN	-	2
28	PLATE - PRIMER, PUSH BUTTON	-	1
29	PLATE - PRIMER LUBRICANT TANK	-	1
30	PULLEY - PRIMER DRIVE, ZSE	-	1
31	RETAINER - BEARING, PRIMER CLUTCH	-	1
32	SEAL - FURON MECHANICAL, 1.250	-	1
33	SHCS - .250-20 x 0.37 SST	-	1
34	SPACER - .406 X .88 X .800	-	1
35	SPACER - 0.49 x 0.68 x 2.12	-	2
36	STRAP - CLUTCH ANTI-ROTATION	-	1
37	STRAP - PRIMER SUPPORT, ZSE	-	1
38	SWITCH - C7H, PUSH-BTN	-	1
39	TANK - PRIMER, 4 QUART, W/CAP	-	1
40	TUBE - PRIMER CONNECT	-	1
41	TUBE - ROUND, 0.19 X 6', NEO	-	1
42	TUBE FITTING - STR, .25 X .19	-	1
43	VALVE - ACTUATED, 12/24VDC, .75NPT FE	-	1
44	VANE - ROTOR, 25 CU IN, .1905 THICK	-	4
45	WASHER - 1.00 x 1.50 x .273 SS	-	1
46	WASHER - FLAT, 0.31 ID, SST	-	1
47	WASHER - FLAT, 3/8, STEEL	-	2
48	WASHER - LOCK, 0.250 ID, SST	-	2
49	SWITCH - PRESS, NC/NO,15 PSI,1	-	1



NOTE:
1) PRIMER ASSEMBLY IS EITHER 12 VOLT OR 24 VOLT AND MUST BE SPECIFIED UPON ORDER







REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226900 WAS 4226905 ADDED PRESS. SWITCH	14FEB2017	11956	SMS

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION:

MATERIAL NO.

PATTERN NO.

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

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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

DR'N SMS

CHKD WAH

TRCD

MODEL NAME AP02147 | MDL CREATED 14FEB2014 | SHEET 1/1 | D

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

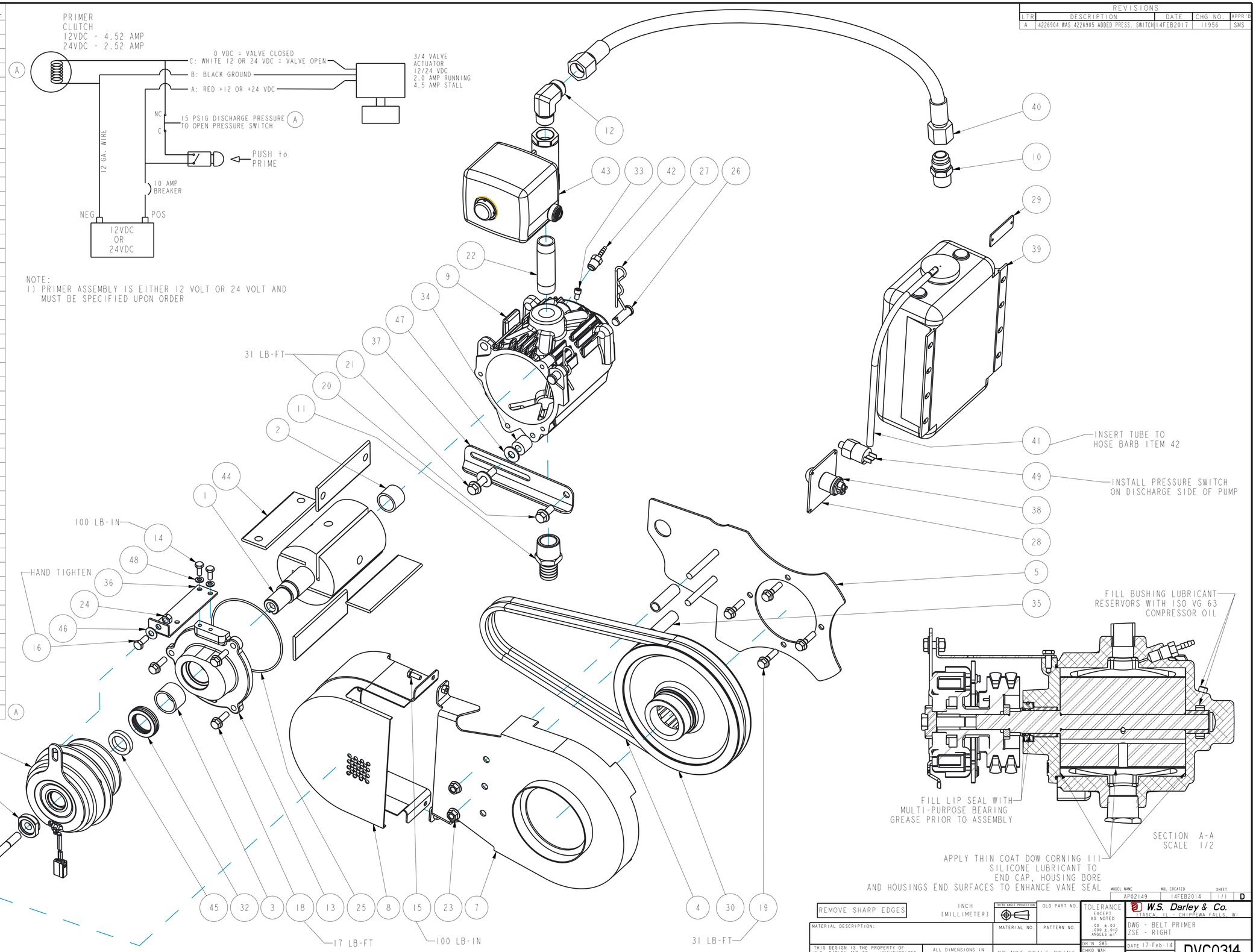
DWG - BELT PRIMER
ZSE, INPUT STANDARD, ABOVE, LEFT

DATE 13-Feb-14

SCALE 3/8

DVC0313

NO.	DESCRIPTION	PART NO.	QTY.
1	ASSY - ROTOR, 25 CU IN VAC PUMP	-	1
2	BEARING - OILITE, 1.000 ID	-	1
3	BEARING - OILITE, 1.250 ID	-	1
4	BELT - PRIMER DRIVE	-	2
5	BRACKET - BELT COVER	-	1
6	CLUTCH - VAC PUMP, 12VDC	-	1
7	COVER - BELT	-	1
8	COVER - BELT	-	1
9	CYLINDER - VACUUM PUMP, 25 CU IN	-	1
10	FITTING-.75NPTMx.75JICM	-	1
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	-	1
12	FTG-.75NPTMX1 1/16-12JICM RIGD	-	1
13	HEAD - CYL, VAC PUMP, 25 CU IN	-	1
14	HHCS - .25-20 X .63, GR 5 SST	-	2
15	HHCS - .250-20 x 0.63, GR5	-	2
16	HHCS - .313-18 x 0.75, SST	-	1
17	HHCS - .438-20 x 2.75, GR5	-	1
18	HHCS - FLANGED, .313-18 X 1.00	-	3
19	HHCS - FLANGED, .313-18 X 1.25	-	4
20	HHCS - FLANGED, .375-16 X .88	-	1
21	HHCS - FLANGED, .375-16 X 2.00	-	1
22	NIPPLE - PIPE, .75 X 3.50, BR	-	1
23	NUT - FLANGED TOP LOCK	-	2
24	NUT - HEX, .313-18, NYLOC, SST	-	1
25	O-RING - 4.75 x 4.94 x 0.09	-	1
26	PIN - CLEVIS, .5"	-	2
27	PIN - COTTER, .125 SST HAIRPIN	-	2
28	PLATE - PRIMER, PUSH BUTTON	-	1
29	PLATE - PRIMER LUBRICANT TANK	-	1
30	PULLEY - PRIMER DRIVE, ZSE	-	1
31	RETAINER - BEARING, PRIMER CLUTCH	-	1
32	SEAL - FURON MECHANICAL, 1.250	-	1
33	SHCS - .250-20 x 0.37 SST	-	1
34	SPACER - .406 X .88 X .800	-	1
35	SPACER - 0.49 x 0.68 x 2.12	-	2
36	STRAP - CLUTCH ANTI-ROTATION	-	1
37	STRAP - PRIMER SUPPORT, ZSE	-	1
38	SWITCH - C7H, PUSH-BTN	-	1
39	TANK - PRIMER, 4 QUART, W/CAP	-	1
40	TUBE - PRIMER CONNECT	--	1
41	TUBE - ROUND, 0.19 X 6', NEO	-	1
42	TUBE FITTING - STR, .25 X .19	-	1
43	VALVE - ACTUATED, 12/24VDC, .75NPT FE	-	1
44	VANE - ROTOR, 25 CU IN, .1905 THICK	-	4
45	WASHER - 1.00 x 1.50 x .273 SS	-	1
46	WASHER - FLAT, 0.31 ID, SST	-	1
47	WASHER - FLAT, 3/8, STEEL	-	2
48	WASHER - LOCK, 0.250 ID, SST	-	2
49	SWITCH - PRESS, NC/NO,15 PSI,1	-	1



REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226904 WAS 4226905 ADDED PRESS. SWITCH	14FEB2017	11956	SMS

REMOVE SHARP EDGES	INCH [MILLIMETER]	THIRD ANGLE PROJECTION	OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°
MATERIAL DESCRIPTION:			MATERIAL NO.	PATTERN NO.
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	DR'N SMS CHKD WAH TRCD	DATE 17-Feb-14 SCALE 3/8

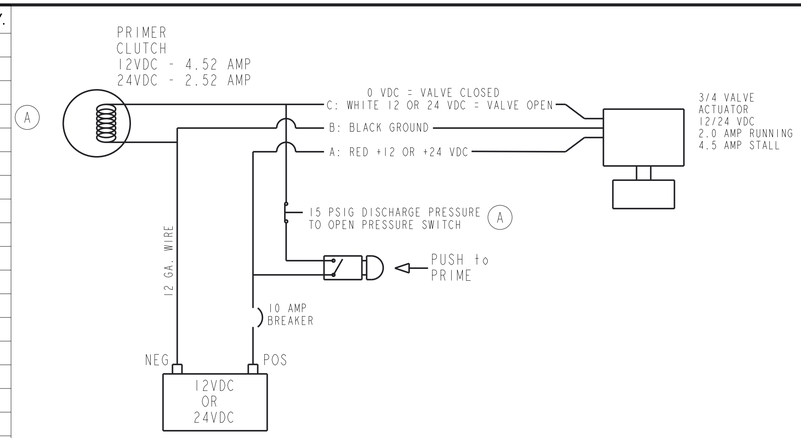
MODEL NAME	MDL CREATED	SHEET	
AP02149	14FEB2014	1/1	D

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

DWG - BELT PRIMER
ZSE - RIGHT

DVC0314

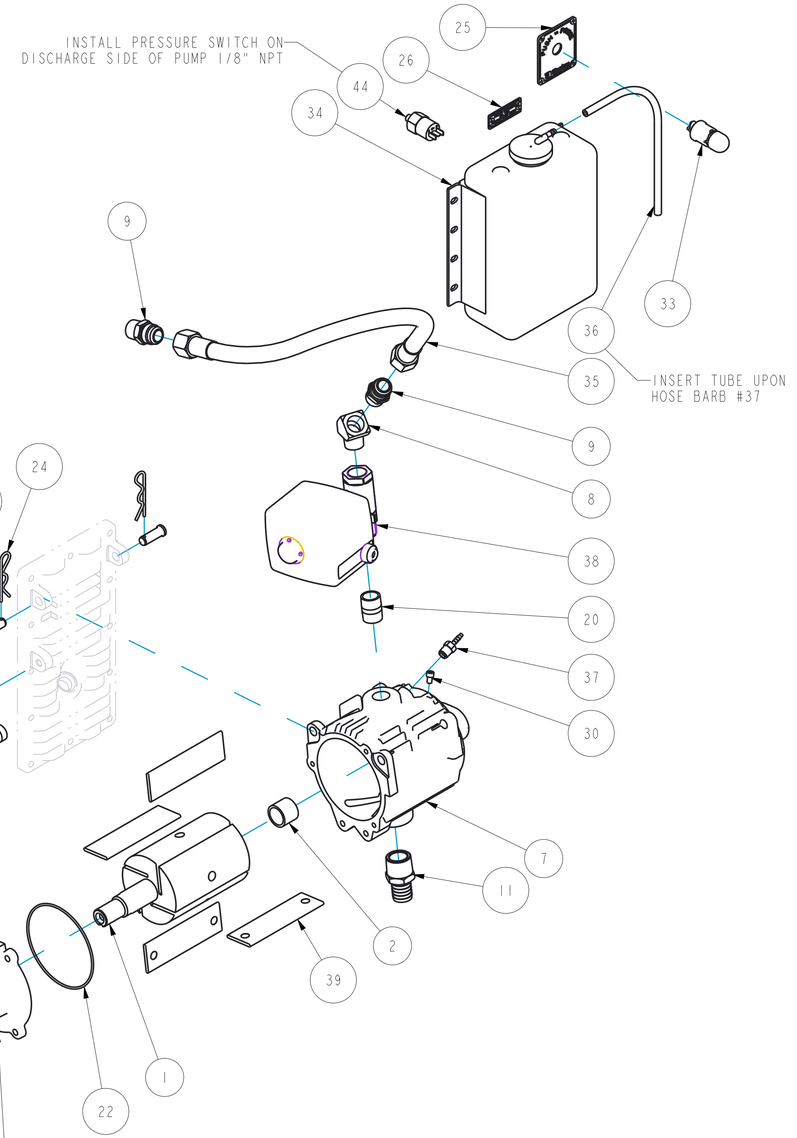
NO.	DESCRIPTION	PART NO.	QTY.	
1	ASSY - ROTOR, 25 CU IN VAC PUMP	4434313	1	
2	BEARING - OILITE, 1.000 ID	1760006	1	
3	BEARING - OILITE, 1.250 ID	1760033	1	
4	BELT - PRIMER DRIVE	4226900	2	
5	BRACKET - SUPPORT, PRIMER	4038000	1	
6	CLUTCH - VAC PUMP, 24VDC	4227011	1	
7	CYLINDER - VACUUM PUMP, 25 CU IN	1021201	1	
8	ELBOW - .75 M X .75 F	3500543	1	
9	FITTING-.75NPTMx.75JICM	3501553	2	
10	FLANGE - COMP., 1810/1710/1610	4822400	1	
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	3502031	1	
12	HEAD - CYL, VAC PUMP, 25 CU IN	2813801	1	
13	HHCS - .25-20 X .63, GR 5 SST	5400603	2	
14	HHCS - .313-18 x 0.75, SST	5400641	1	
15	HHCS - .438-20 x 2.75, GR5	5400118	1	
16	HHCS - FLANGED, .313-18 X .750	5402833	6	
17	HHCS - FLANGED, .313-18 X 1.00	5402843	3	
18	HHCS - FLANGED, .375-16 X .88	5402835	1	
19	HHCS - FLANGED, .375-16 X 1.25	5402856	1	
20	NIPPLE - PIPE, .75 X CLOSE, BR	1081048	1	
21	NUT - HEX, .313-18, NYLOC, SST	5403400	1	
22	O-RING - 4.75 x 4.94 x 0.09	3601114	1	
23	PIN - CLEVIS, .5"	4401501	2	
24	PIN - COTTER, .125 SST HAIRPIN	3605213	2	
25	PLATE - PRIMER, PUSH BUTTON	1978500	1	
26	PLATE - PRIMER LUBRICANT TANK	1963400	1	
27	PULLEY - PRIMER DRIVE	4822600	1	
28	RETAINER - BEARING, PRIMER CLUTCH	2314400	1	
29	SEAL - FURON MECHANICAL, 1.250	1843403	1	
30	SHCS - .250-20 x 0.37 SST	5401400	1	
31	SPACER - .406 X .88 X .38	3309000	1	
32	STRAP - CLUTCH ANTI-ROTATION	4038110	1	
33	SWITCH - C7H, PUSH-BTN	2600008	1	
34	TANK - PRIMER, 4 QUART, W/CAP	4403703	1	
35	TUBE - PRIMER CONNECT	4434800_ZSM2	1	
36	TUBE - ROUND, 0.19 X 6', NEO	1101937	1	
37	TUBE FITTING - STR, .25 X .19	3500021	1	
38	VALVE - ACTUATED, 12/24VDC, .75NPT FE	5209404	1	
39	VANE - ROTOR, 25 CU IN, .1905 THICK	4434200	4	
40	WASHER - 1.00 x 1.50 x .273 SS	3603342	1	
41	WASHER - FLAT, .375 ID	3603820	1	
42	WASHER - FLAT, 0.31 ID, SST	3603812	1	
43	WASHER - LOCK, 0.250 ID, SST	3603532	2	
44	SWITCH - PRESS, NC/NO,15 PSI,1	2600167	1	A

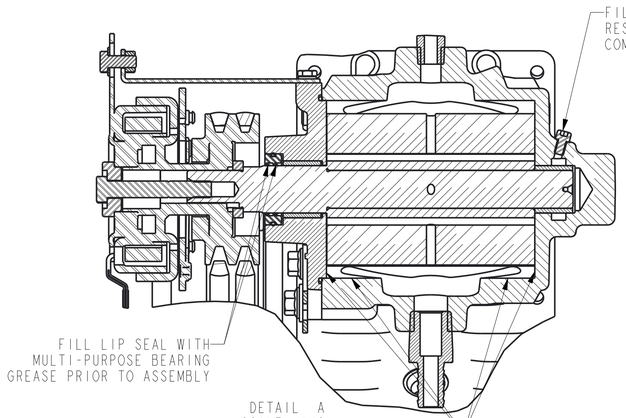


NOTES:
1) PRIMER ASSEMBLY IS EITHER 12 VDC OR 24 VDC AND MUST BE SPECIFIED UPON ORDER.
2) BELTS MUST BE INSTALLED IN THE ORIENTATION SHOWN.
3) TIGHTEN A NEW BELT UNTIL THERE IS 30 TO 60 LBF STATIC TENSION PER BELT. THIS CORRESPONDS TO A 2.2 TO 4.1 LBF DEFLECTION FORCE RESULTING IN A .16 INCH DEFLECTION AT THE BELT MIDSPAN.
4) IF A SONIC TENSION METER IS USED FOR INITIAL BELT TIGHTENING, 68 HZ WOULD BE THE RECOMMENDED MINIMUM FREQUENCY.
5) PRIME GREEN IS OUR RECOMMENDED PRIMER LUBRICANT.
6) PRIMING MUST BE DONE WITH A DRIVELINE SPEED OF 1000 RPM OR LESS.

REFERENCE NOTES:
1) THERE IS A 2.1998:1 SPEED INCREASE BETWEEN THE DRIVELINE AND THE PRIMER.
2) A 1550 SERIES JOINT REQUIRES A 4-2-689 FLANGE YOKE.
3) A 1610 SERIES JOINT REQUIRES A 5-2-379 FLANGE YOKE.
4) A 1710 SERIES JOINT REQUIRES A 4819900 (6-2-739-1) FLANGE YOKE.
5) A 1760 SERIES JOINT REQUIRES A 4820000 (6.3-2-19-1) FLANGE YOKE.
6) A 1810 SERIES JOINT REQUIRES A 4820100 (6.5-2-329-1) FLANGE YOKE.
7) PRIMER EVACUATES A THEORETICAL 51.28 CUBIC INCHES PER REVOLUTION.

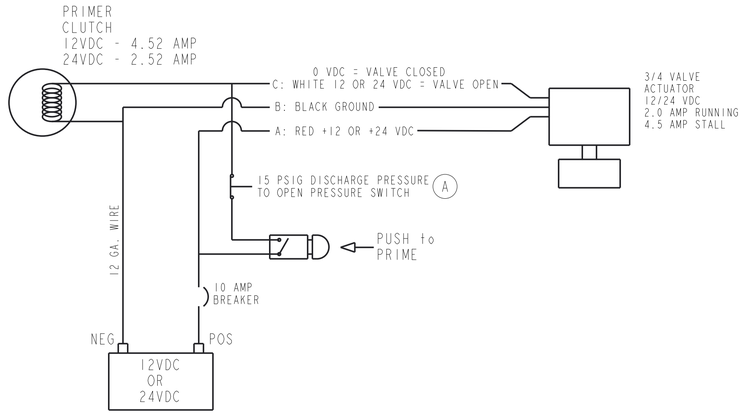
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226900 WAS 4226905 ADDED PRESS. SWITCH	09FEB2017	11592	SMS





MODEL NAME	MDL CREATED	SHEET			
AP02603	06JUN2015	1/1	D		
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: AS LISTED		MATERIAL NO. -	PATTERN NO. -		DWG - BELT PRIMER ZSM, 24V, BRONZE, ER, ENGLISH
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 WAH CHK'D - TRC'D	DATE 06JUL2015 SCALE 1/4	DVC0324

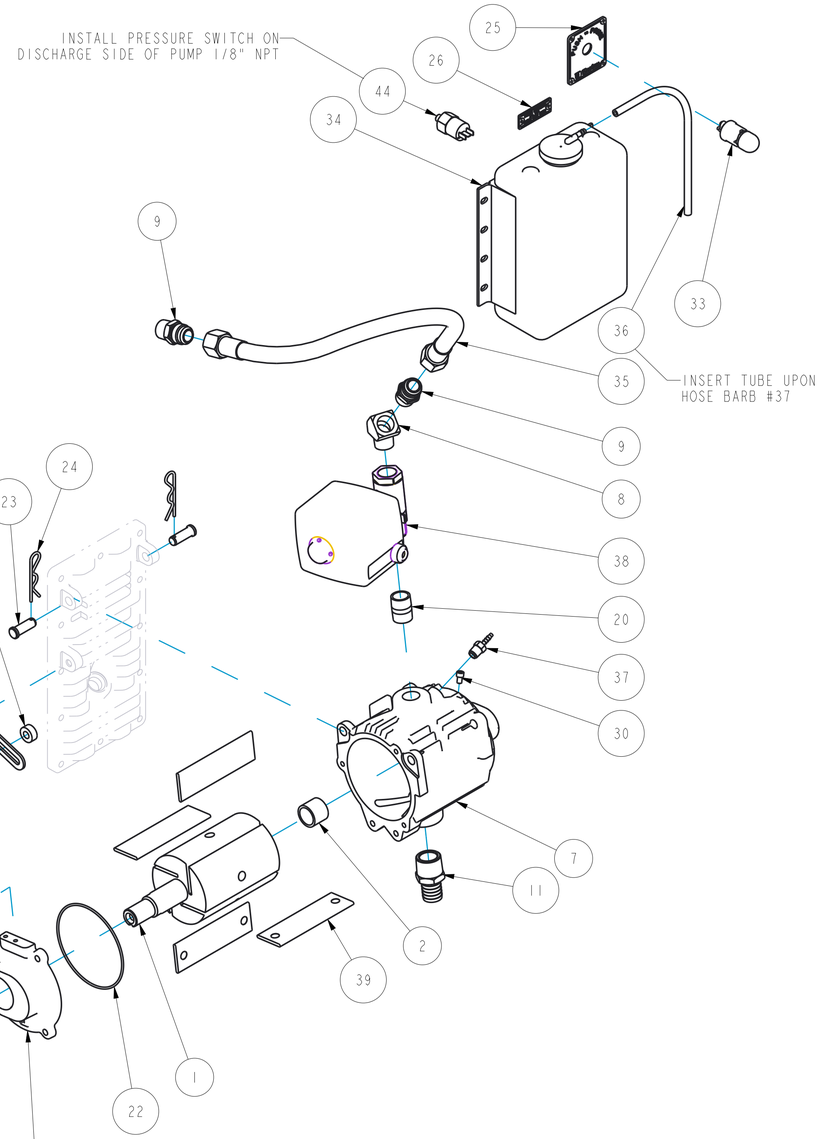
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSY - ROTOR, 25 CU IN VAC PUMP	4434313	1
2	BEARING - OILITE, 1.000 ID	1760006	1
3	BEARING - OILITE, 1.250 ID	1760033	1
4	BELT - PRIMER DRIVE	4226900	2
5	BRACKET - SUPPORT, PRIMER	4038000	1
6	CLUTCH - VAC PUMP, 12VDC	4227001	1
7	CYLINDER - VACUUM PUMP, 25 CU IN	1021201	1
8	ELBOW - .75 M X .75 F	3500543	1
9	FITTING-.75NPTMx.75JICM	3501553	2
10	FLANGE - COMP., 1810/1710/1610	4822400	1
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	3502031	1
12	HEAD - CYL, VAC PUMP, 25 CU IN	2813801	1
13	HHCS - .25-20 X .63, GR 5 SST	5400603	2
14	HHCS - .313-18 x 0.75, SST	5400641	1
15	HHCS - .438-20 x 2.75, GR5	5400118	1
16	HHCS - FLANGED, .313-18 X .750	5402833	6
17	HHCS - FLANGED, .313-18 X 1.00	5402843	3
18	HHCS - FLANGED, .375-16 X .88	5402835	1
19	HHCS - FLANGED, .375-16 X 1.25	5402856	1
20	NIPPLE - PIPE, .75 X CLOSE, BR	1081048	1
21	NUT - HEX, .313-18, NYLOC, SST	5403400	1
22	O-RING - 4.75 x 4.94 x 0.09	3601114	1
23	PIN - CLEVIS, .5"	4401501	2
24	PIN - COTTER, .125 SST HAIRPIN	3605213	2
25	PLATE - PRIMER, PUSH BUTTON	1978500	1
26	PLATE - PRIMER LUBRICANT TANK	1963400	1
27	PULLEY - PRIMER DRIVE	4822600	1
28	RETAINER - BEARING, PRIMER CLUTCH	2314400	1
29	SEAL - FURON MECHANICAL, 1.250	1843403	1
30	SHCS - .250-20 x 0.37 SST	5401400	1
31	SPACER - .406 X .88 X .38	3309000	1
32	STRAP - CLUTCH ANTI-ROTATION	4038110	1
33	SWITCH - C7H, PUSH-BTN	2600008	1
34	TANK - PRIMER, 4 QUART, W/CAP	4403703	1
35	TUBE - PRIMER CONNECT	4434800_ZSM2	1
36	TUBE - ROUND, 0.19 X 6', NEO	1101937	1
37	TUBE FITTING - STR, .25 X .19	3500021	1
38	VALVE - ACTUATED, 12/24VDC, .75NPT FE	5209404	1
39	VANE - ROTOR, 25 CU IN, .1905 THICK	4434200	4
40	WASHER - 1.00 x 1.50 x .273 SS	3603342	1
41	WASHER - FLAT, .375 ID	3603820	1
42	WASHER - FLAT, 0.31 ID, SST	3603812	1
43	WASHER - LOCK, 0.250 ID, SST	3603532	2
44	SWITCH - PRESS, NC/NO,15 PSI,1	2600167	1 (A)

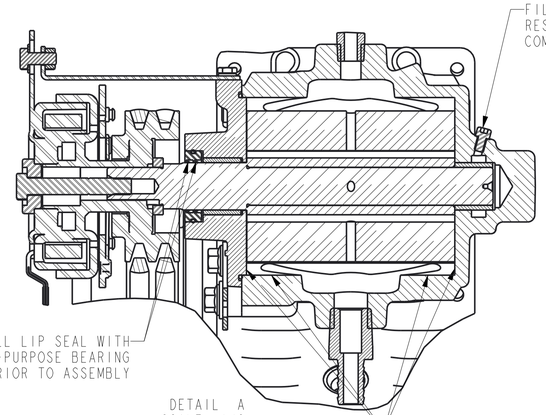


NOTES:
1) PRIMER ASSEMBLY IS EITHER 12 VDC OR 24 VDC AND MUST BE SPECIFIED UPON ORDER.
2) BELTS MUST BE INSTALLED IN THE ORIENTATION SHOWN.
3) TIGHTEN A NEW BELT UNTIL THERE IS 30 TO 60 LBF STATIC TENSION PER BELT. THIS CORRESPONDS TO A 2.2 TO 4.1 LBF DEFLECTION FORCE RESULTING IN A .16 INCH DEFLECTION AT THE BELT MIDSPAN.
4) IF A SONIC TENSION METER IS USED FOR INITIAL BELT TIGHTENING, 68 HZ WOULD BE THE RECOMMENDED MINIMUM FREQUENCY.
5) PRIME GREEN IS OUR RECOMMENDED PRIMER LUBRICANT.
6) PRIMING MUST BE DONE WITH A DRIVELINE SPEED OF 1000 RPM OR LESS.

REFERENCE NOTES:
1) THERE IS A 2.1998:1 SPEED INCREASE BETWEEN THE DRIVELINE AND THE PRIMER.
2) A 1550 SERIES JOINT REQUIRES A 4-2-689 FLANGE YOKE.
3) A 1610 SERIES JOINT REQUIRES A 5-2-379 FLANGE YOKE.
4) A 1710 SERIES JOINT REQUIRES A 4819900 (6-2-739-1) FLANGE YOKE.
5) A 1760 SERIES JOINT REQUIRES A 4820000 (6.3-2-19-1) FLANGE YOKE.
6) A 1810 SERIES JOINT REQUIRES A 4820100 (6.5-2-329-1) FLANGE YOKE.
7) PRIMER EVACUATES A THEORETICAL 51.28 CUBIC INCHES PER REVOLUTION.

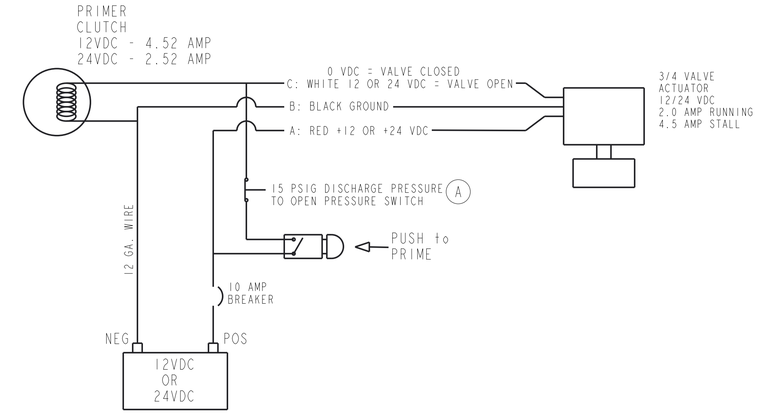
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226900 WAS 4226905 ADDED PRESS. SWITCH	09FEB2017	11592	SMS





MODEL NAME	MDL CREATED	SHEET			
AP02602	30JUN2015	1/1	D		
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: AS LISTED		MATERIAL NO. -	PATTERN NO. -		DWG - BELT PRIMER ZSM, 12V, BRONZE, ER, ENGLISH
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 WAH CHK'D - TRC'D	DATE 02JUL2015 SCALE 1/4	DVC0323

NO.	DESCRIPTION	PART NO.	QTY.
1	ASSY - ROTOR, 25 CU IN VAC PUMP	4434310	1
2	BEARING - OILITE, 1.000 ID	1760006	1
3	BEARING - OILITE, 1.250 ID	1760033	1
4	BELT - PRIMER DRIVE	4226900	2
5	BRACKET - SUPPORT, PRIMER	4038000	1
6	CLUTCH - VAC PUMP, 24VDC	4227011	1
7	CYLINDER - VACUUM PUMP, 25 CU IN	1021203	1
8	ELBOW - .75 M X .75 F	3500543	1
9	FITTING-.75NPTMx.75JICM	3501553	2
10	FLANGE - COMP., 1810/1710/1610	4822400	1
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	3502031	1
12	HEAD - CYL, VAC PUMP, 25 CU IN	2813803	1
13	HHCS - .25-20 X .63, GR 5 SST	5400603	2
14	HHCS - .313-18 x 0.75, SST	5400641	1
15	HHCS - .438-20 x 2.75, GR5	5400118	1
16	HHCS - FLANGED, .313-18 X .750	5402833	6
17	HHCS - FLANGED, .313-18 X 1.00	5402843	3
18	HHCS - FLANGED, .375-16 X .88	5402835	1
19	HHCS - FLANGED, .375-16 X 1.25	5402856	1
20	NIPPLE - PIPE, .75 X CLOSE, BR	1081048	1
21	NUT - HEX, .313-18, NYLOC, SST	5403400	1
22	O-RING - 4.75 x 4.94 x 0.09	3601114	1
23	PIN - CLEVIS, .5"	4401501	2
24	PIN - COTTER, .125 SST HAIRPIN	3605213	2
25	PLATE - PRIMER, PUSH BUTTON	1978500	1
26	PLATE - PRIMER LUBRICANT TANK	1963400	1
27	PULLEY - PRIMER DRIVE	4822600	1
28	RETAINER - BEARING, PRIMER CLUTCH	2314400	1
29	SEAL - FURON MECHANICAL, 1.250	1843403	1
30	SHCS - .250-20 x 0.37 SST	5401400	1
31	SPACER - .406 X .88 X .38	3309000	1
32	STRAP - CLUTCH ANTI-ROTATION	4038110	1
33	SWITCH - C7H, PUSH-BTN	2600008	1
34	TANK - PRIMER, 4 QUART, W/CAP	4403703	1
35	TUBE - PRIMER CONNECT	4434800_ZSM2	1
36	TUBE - ROUND, 0.19 X 6', NEO	1101937	1
37	TUBE FITTING - STR, .25 X .19	3500021	1
38	VALVE - ACTUATED, 12/24VDC, .75NPT FE	5209404	1
39	VANE - ROTOR, 25 CU IN, .1905 THICK	4434200	4
40	WASHER - 1.00 x 1.50 x .19 SS	3603342	1
41	WASHER - FLAT, .375 ID	3603820	1
42	WASHER - FLAT, 0.31 ID, SST	3603812	1
43	WASHER - LOCK, 0.250 ID, SST	3603532	2
44	SWITCH - PRESS, NC/NO,15 PSI,1	2600167	1 (A)



NOTES:
1) PRIMER ASSEMBLY IS EITHER 12 VDC OR 24 VDC AND MUST BE SPECIFIED UPON ORDER.
2) BELTS MUST BE INSTALLED IN THE ORIENTATION SHOWN.
3) TIGHTEN A NEW BELT UNTIL THERE IS 30 TO 60 LBF STATIC TENSION PER BELT. THIS CORRESPONDS TO A 2.2 TO 4.1 LBF DEFLECTION FORCE RESULTING IN A .16 INCH DEFLECTION AT THE BELT MIDSPAN.
4) IF A SONIC TENSION METER IS USED FOR INITIAL BELT TIGHTENING, 68 HZ WOULD BE THE RECOMMENDED MINIMUM FREQUENCY.
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REFERENCE NOTES:
1) THERE IS A 2.1998:1 SPEED INCREASE BETWEEN THE DRIVELINE AND THE PRIMER.
2) A 1550 SERIES JOINT REQUIRES A 4-2-689 FLANGE YOKE.
3) A 1610 SERIES JOINT REQUIRES A 5-2-379 FLANGE YOKE.
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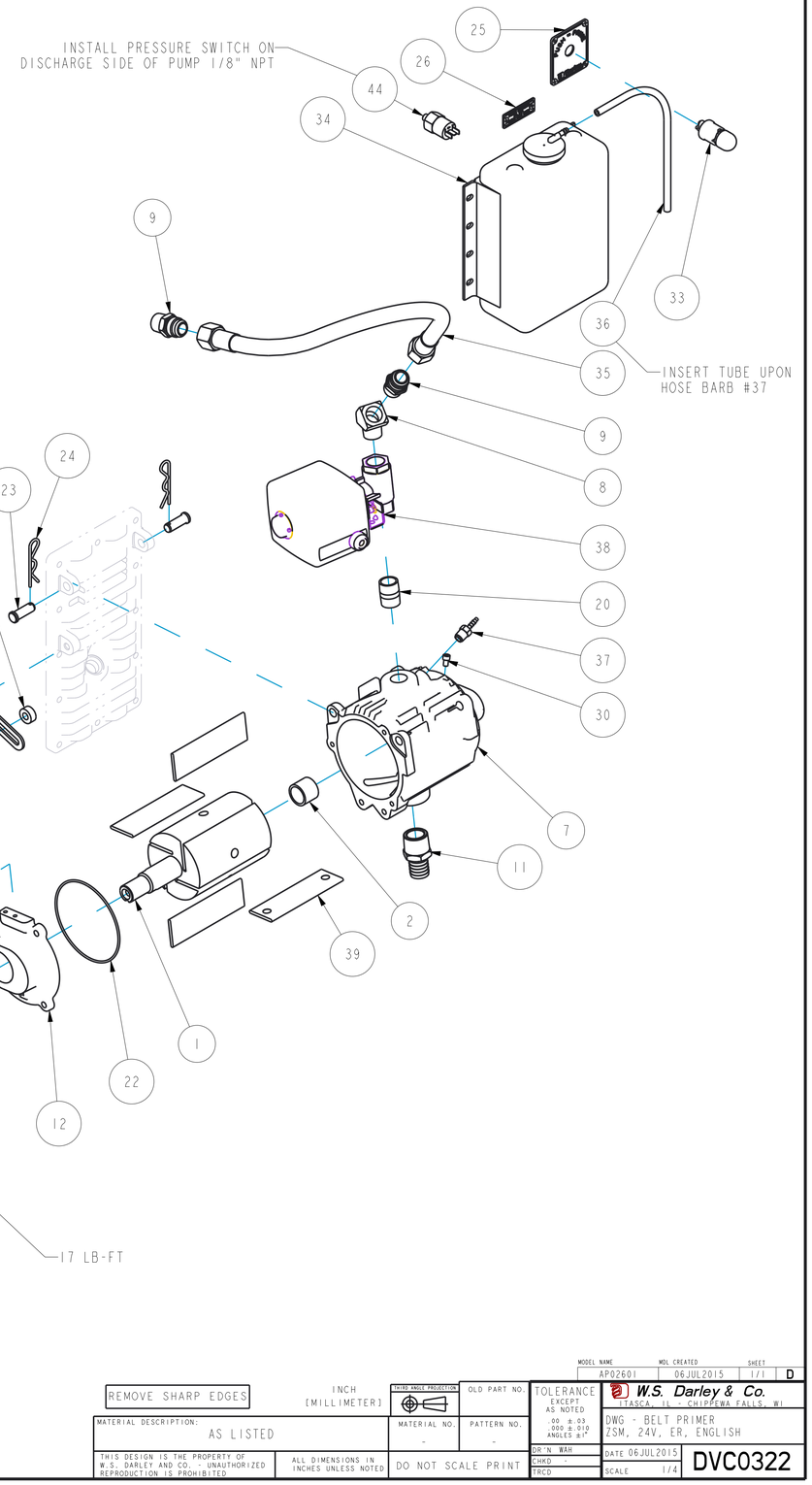
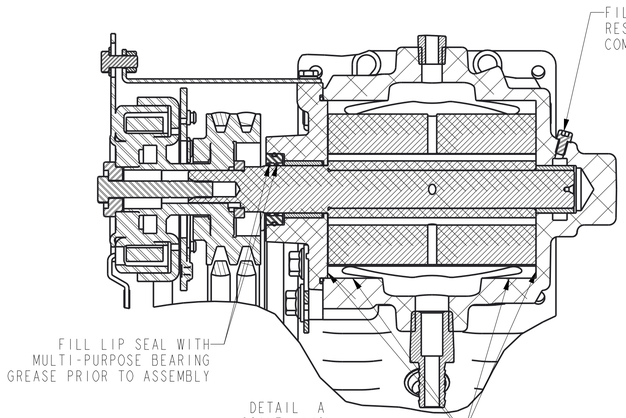
6) A 1810 SERIES JOINT REQUIRES A 4820100 (6.5-2-329-1) FLANGE YOKE.
7) PRIMER EVACUATES A THEORETICAL 51.28 CUBIC INCHES PER REVOLUTION.

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226900 WAS 4226905 ADDED PRESS. SWITCH	09FEB2017	11592	SMS

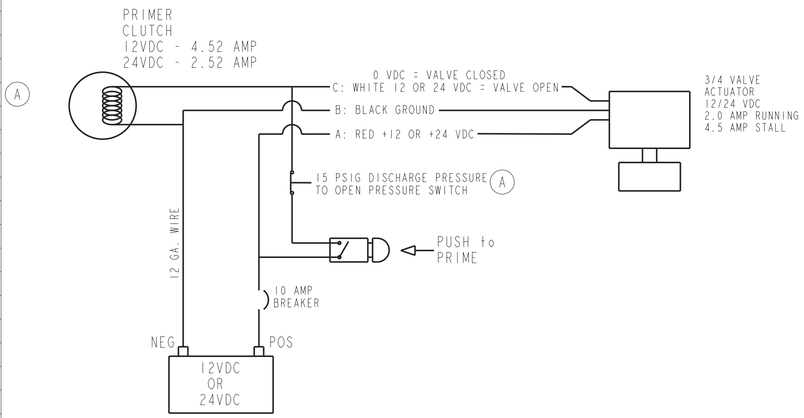




REMOVE SHARP EDGES	INCH [MILLIMETER]	THIRD ANGLE PROJECTION	OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI
MATERIAL DESCRIPTION: AS LISTED		MATERIAL NO. -	PATTERN NO. -	DR'N WAH	DWG - BELT PRIMER ZSM, 24V, ER, ENGLISH
THIS DESIGN 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 06JUL2015 SCALE 1/4 DVC0322

MODEL NAME	MDL CREATED	SHEET	
AP02601	06JUL2015	1/1	D

NO.	DESCRIPTION	PART NO.	QTY.	
1	ASSY - ROTOR, 25 CU IN VAC PUMP	4434310	1	
2	BEARING - OILITE, 1.000 ID	1760006	1	
3	BEARING - OILITE, 1.250 ID	1760033	1	
4	BELT - PRIMER DRIVE	4226900	2	
5	BRACKET - SUPPORT, PRIMER	4038000	1	
6	CLUTCH - VAC PUMP, 12VDC	4227001	1	
7	CYLINDER - VACUUM PUMP, 25 CU IN	1021203	1	
8	ELBOW - .75 M X .75 F	3500543	1	
9	FITTING-.75NPTMx.75JICM	3501553	2	
10	FLANGE - COMP., 1810/1710/1610	4822400	1	
11	FTG - BARB, 1.00 ID X 1.00 NPT MALE	3502031	1	
12	HEAD - CYL, VAC PUMP, 25 CU IN	2813803	1	
13	HHCS - .25-20 X .63, GR 5 SST	5400603	2	
14	HHCS - .313-18 x 0.75, SST	5400641	1	
15	HHCS - .438-20 x 2.75, GR5	5400118	1	
16	HHCS - FLANGED, .313-18 X .750	5402833	6	
17	HHCS - FLANGED, .313-18 X 1.00	5402843	3	
18	HHCS - FLANGED, .375-16 X .88	5402835	1	
19	HHCS - FLANGED, .375-16 X 1.25	5402856	1	
20	NIPPLE - PIPE, .75 X CLOSE, BR	1081048	1	
21	NUT - HEX, .313-18, NYLOC, SST	5403400	1	
22	O-RING - 4.75 x 4.94 x 0.09	3601114	1	
23	PIN - CLEVIS, .5"	4401501	2	
24	PIN - COTTER, .125 SST HAIRPIN	3605213	2	
25	PLATE - PRIMER, PUSH BUTTON	1978500	1	
26	PLATE - PRIMER LUBRICANT TANK	1963400	1	
27	PULLEY - PRIMER DRIVE	4822600	1	
28	RETAINER - BEARING, PRIMER CLUTCH	2314400	1	
29	SEAL - FURON MECHANICAL, 1.250	1843403	1	
30	SHCS - .250-20 x 0.37 SST	5401400	1	
31	SPACER - .406 X .88 X .38	3309000	1	
32	STRAP - CLUTCH ANTI-ROTATION	4038110	1	
33	SWITCH - C7H, PUSH-BTN	2600008	1	
34	TANK - PRIMER, 4 QUART, W/CAP	4403703	1	
35	TUBE - PRIMER CONNECT	4434800_ZSM2	1	
36	TUBE - ROUND, 0.19 X 6', NEO	1101937	1	
37	TUBE FITTING - STR, .25 X .19	3500021	1	
38	VALVE - ACTUATED, 12/24VDC, .75NPT FE	5209404	1	
39	VANE - ROTOR, 25 CU IN, .1905 THICK	4434200	4	
40	WASHER - 1.00 x 1.50 x .19 SS	3603342	1	
41	WASHER - FLAT, .375 ID	3603820	1	
42	WASHER - FLAT, 0.31 ID, SST	3603812	1	
43	WASHER - LOCK, 0.250 ID, SST	3603532	2	
44	SWITCH - PRESS, NC/NO,15 PSI,1	2600167	1	A



NOTES:
1) PRIMER ASSEMBLY IS EITHER 12 VDC OR 24 VDC AND MUST BE SPECIFIED UPON ORDER.
2) BELTS MUST BE INSTALLED IN THE ORIENTATION SHOWN.
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REFERENCE NOTES:
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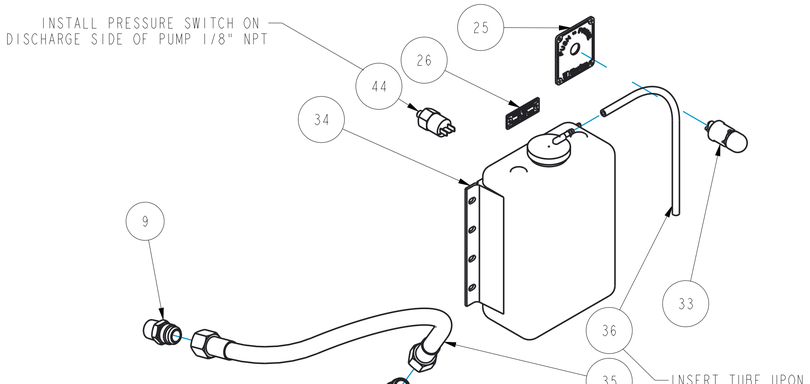
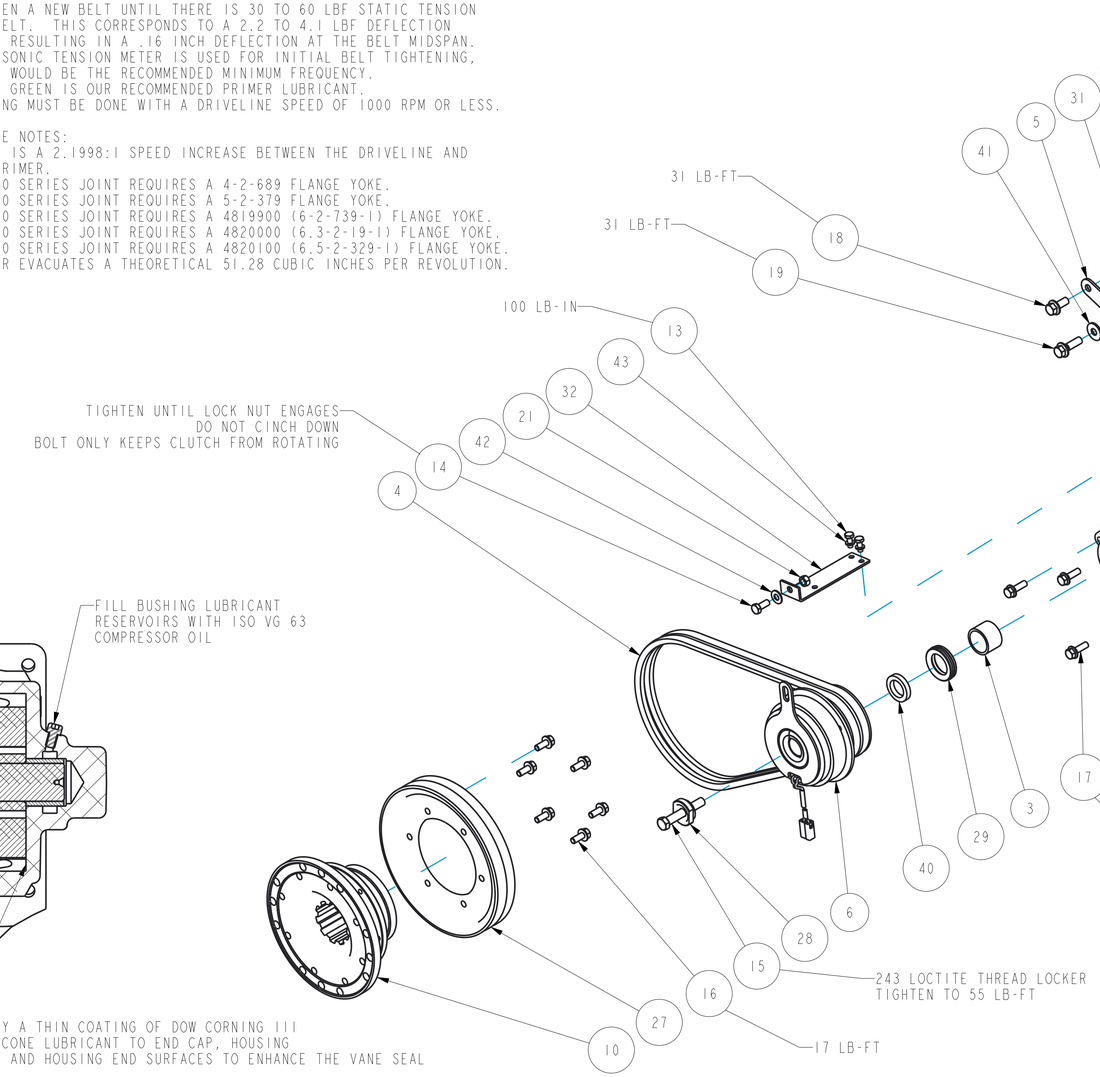
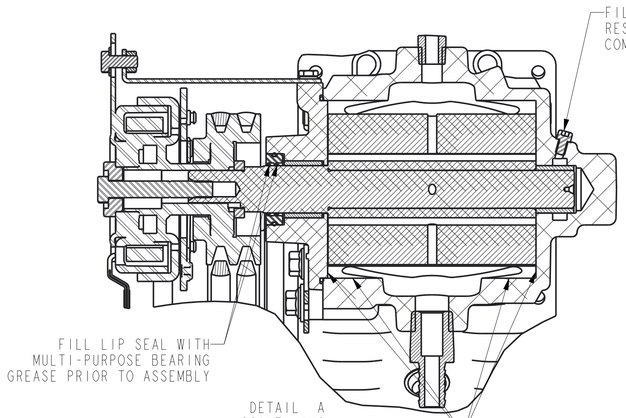
7) PRIMER EVACUATES A THEORETICAL 51.28 CUBIC INCHES PER REVOLUTION.

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	4226900 WAS 4226905 ADDED PRESS. SWITCH	09FEB2017	11592	SMS

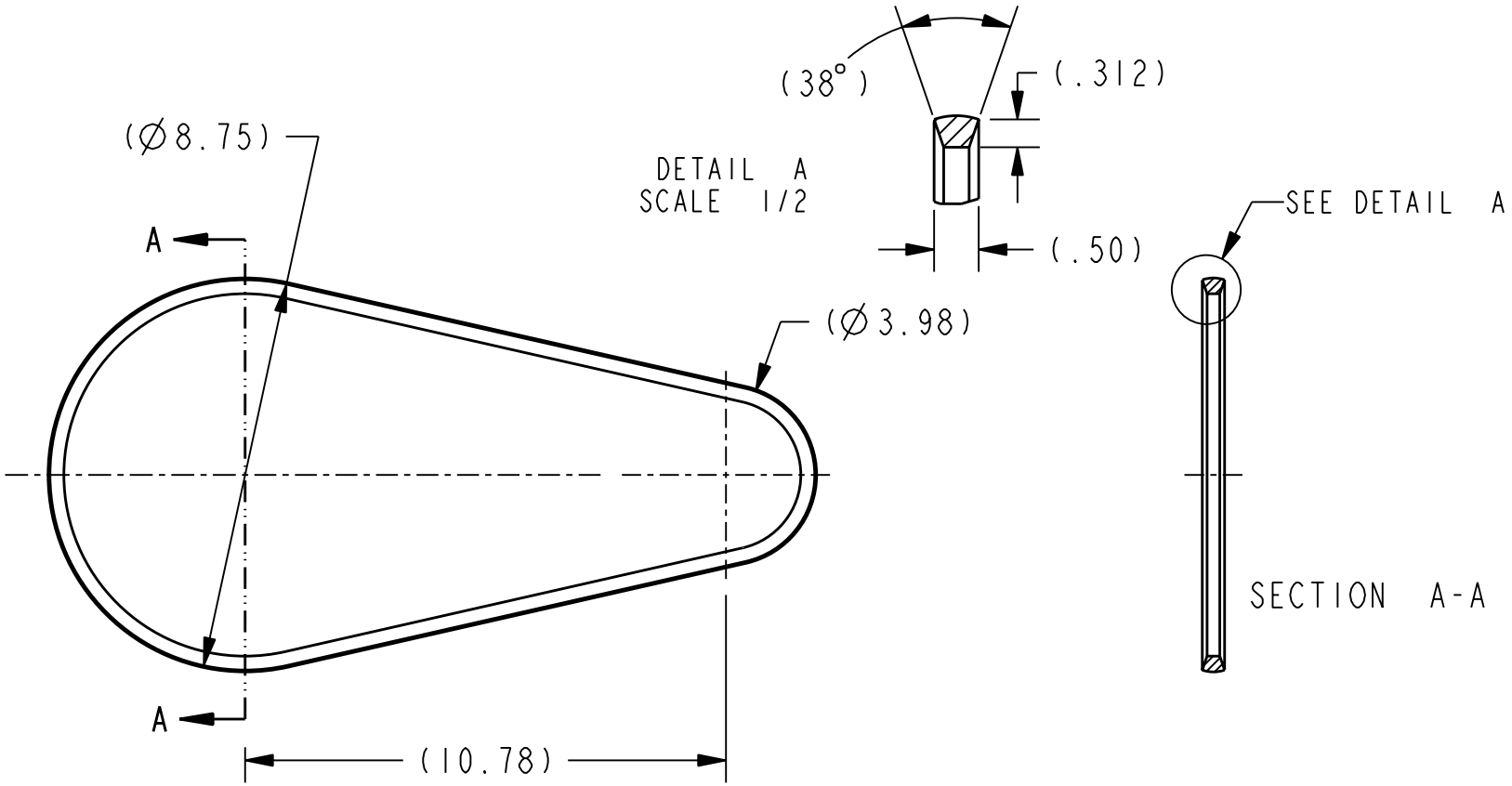






MODEL NAME	MDL CREATED	SHEET			
AP02600	06JUL2015	1/1	D		
REMOVE SHARP EDGES	INCH [MILLIMETER]	THIRD ANGLE PROJECTION	OLD PART NO.	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. Darley & Co. ITASCA, IL - CHIPPEWA FALLS, WI
MATERIAL DESCRIPTION: AS LISTED		MATERIAL NO. -	PATTERN NO. -		DWG - BELT PRIMER ZSM, 12V, ER, ENGLISH
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 WAH CHK'D - TRC'D	DATE 06JUL2015 SCALE 1/4	DVC0321

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL NAME	MDL CREATED	SHEET	
4226900	21-MAY-2010	1/1	A

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION:
GATES PREDATOR AP40 OR EQUIV BELT
(REF GATES PRODUCT NO. 9185-0040)

MATERIAL NO.

PATTERN NO.

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

DR'N DWS
CHKD TED
TRCD

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

BELT - PRIMER DRIVE

DATE 08-Jun-10

SCALE 1/4

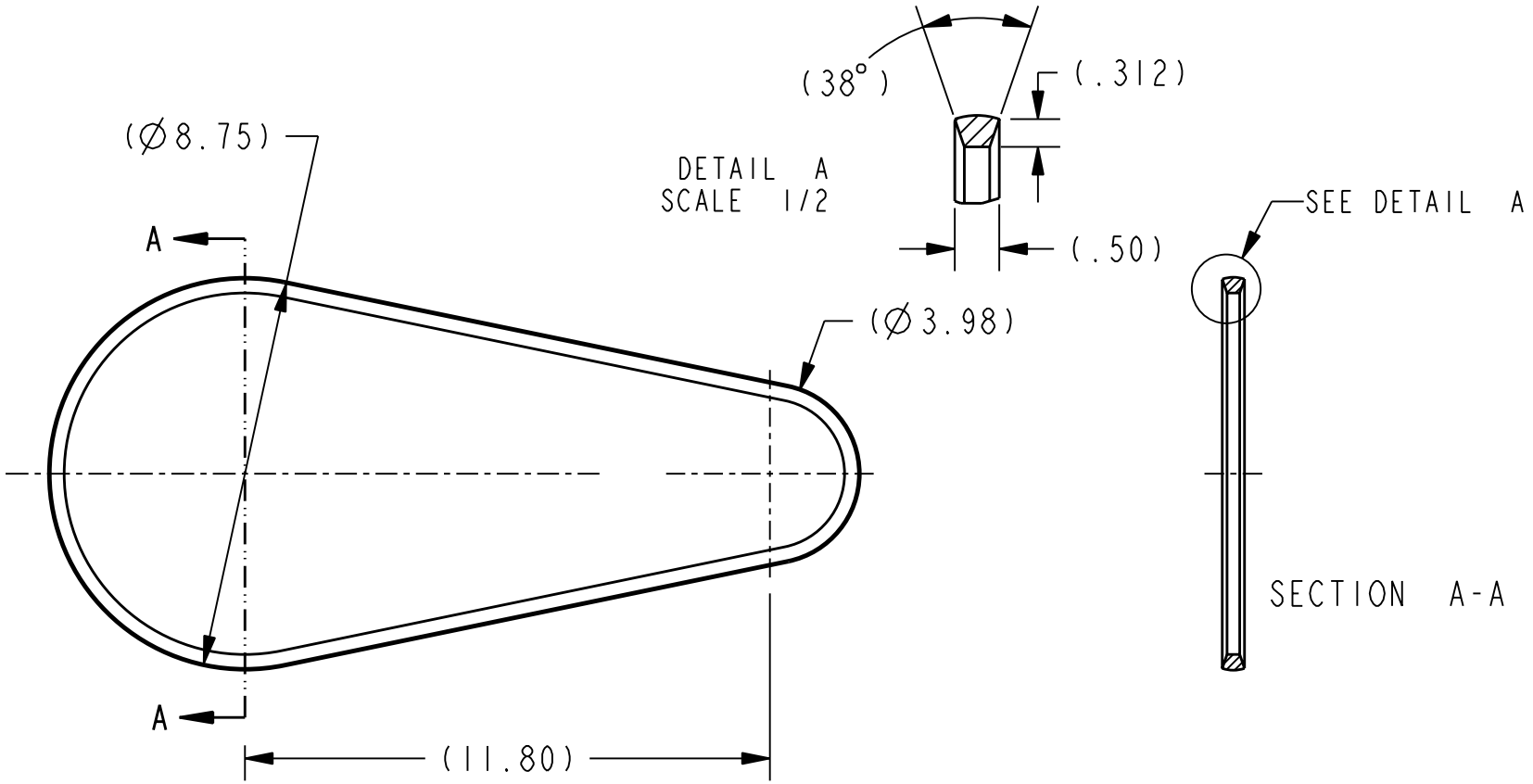
4226900

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

NAME:WAH OBJECT:4226904 DATE:03-Jan-17 14:43:37

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



MODEL NAME	MDL CREATED	SHEET	
4226904	13OCT2013	1/1	A

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION:
GATES PREDATOR AP42 OR EQUIV BELT
(REF GATES PRODUCT NO. 9185-0042)

MATERIAL NO.

PATTERN NO.

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

DR'N WAH
CHKD -
TRCD

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

BELT - PRIMER DRIVE
GATES AP42, GATES 9185-0042

DATE 13OCT2013

SCALE 1/4

4226904

ALL DIMENSIONS IN INCHES UNLESS NOTED

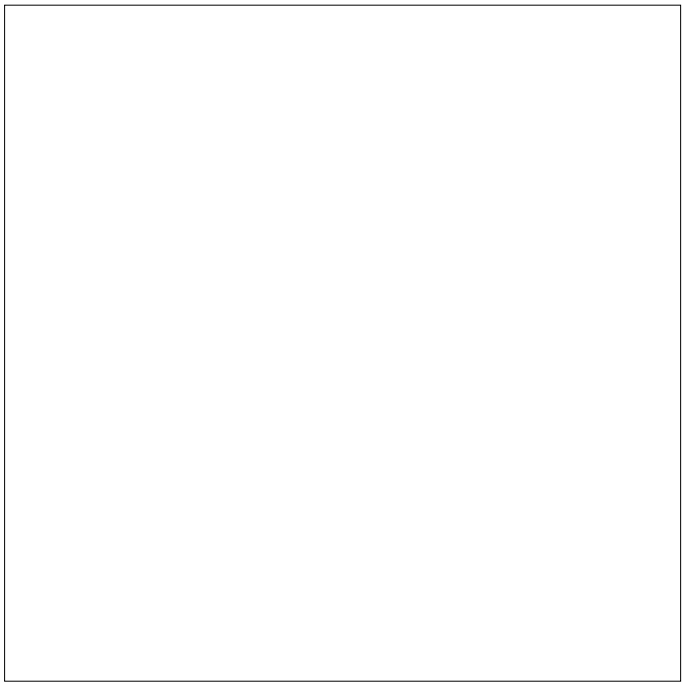
DO NOT SCALE PRINT

NASON
NEW THINKING

1307 S Highway 11
Walhalla, SC 29691
800.229.4955
nassales@nasonptc.com

Low Pressure Switch MM

Part Number: MM-2C-15F/QC/AT



Interactive 3D graphic, click to activate and rotate.

Part No.	MM-2C-15F/QC/AT
Type	MM
Media Connection Modifier	Standard (Brass)
Media Connection	2 (1/8 - 27 NPT Male)
Circuit Form	C (SPDT)
Fixed Set Point (PSI)	15
Set Point Direction	F (Falling)
Electrical Connection	QC (1/4" Male Spade Quick Connect)
Wire Lengths Settings	N/A
Diaphragms	Standard (Buna Nitrile 366y)
Contacts	AT (10 A @ 125/250 VAC / 5 A @ 30 VDC)
Other Options	None
Note	-

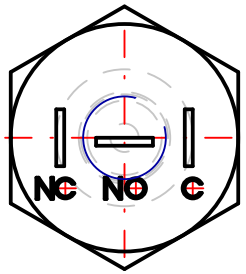
After more than 60 years, Nason has become a proven leader in space-efficient hydraulic and pneumatic components.

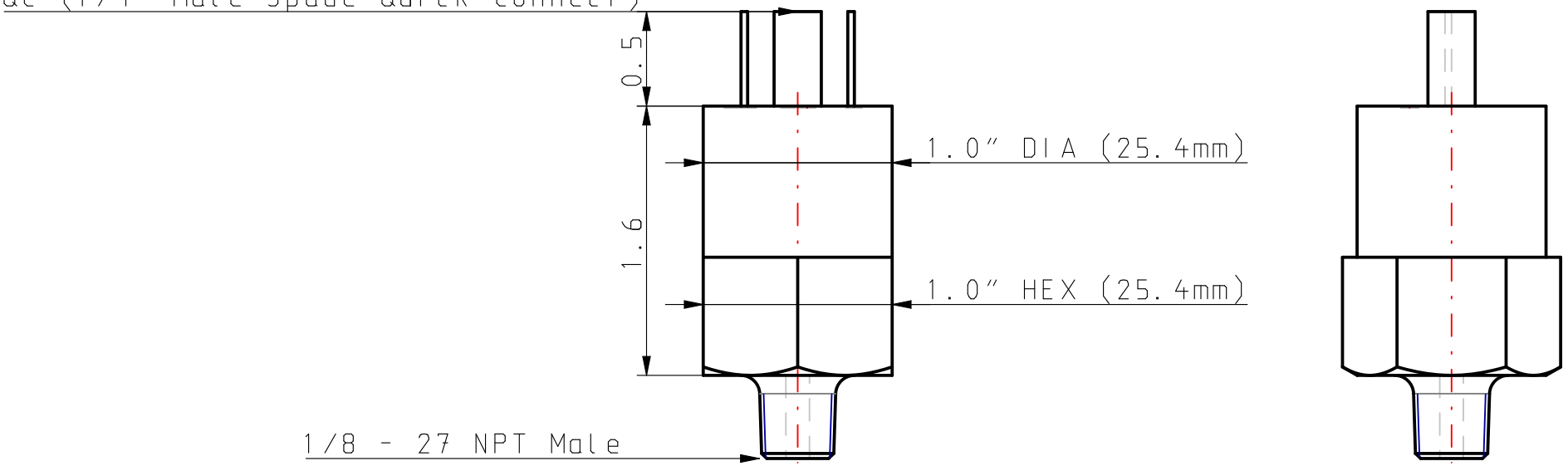
Whether for the military, foodservice, healthcare or industrial market, Nason manufactures space-saving components for today's most demanding applications - hydraulic and pneumatic cylinders, switches and transducers that deliver maximum power and durability in a smaller footprint than ever.

Our products have set a new industry standard for quality, efficiency and flexibility - yet our biggest point of pride is our commitment to taking on new challenges for our customers. We strive to be a flexible partner - always innovating, always customizing solutions, big and small.

It's at the core of what we do, and we believe it's the best way to serve our customers.

NASON



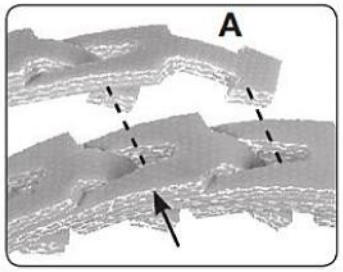


NASON

MM-2C-15F/QC/AT

English HOW TO MEASURE, ASSEMBLE & INSTALL

How to Measure



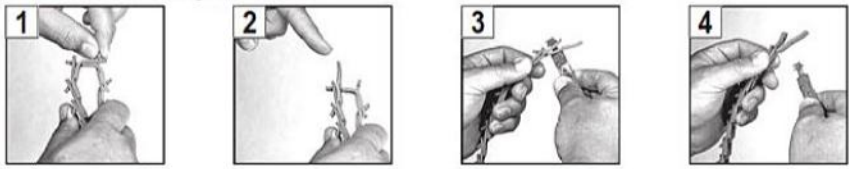
To determine the "hand-tight length," route the belt along its intended path (Note: tabs ride in the groove of the sheave). Overlap the last two tabs of end (A) with two corresponding holes when pulled snug. Mark the hole corresponding to the second tab. Eliminate the extra links by starting the disassembly process (see Disassembly, 1. below) with the tab currently going through the marked hole (as shown in figure to the right). Count the number of links that remain and remove one link for every 24 of 3L, Z/10, A/4L, and B/5L sections, and one link for every 20 of C and D sections. This gives the correct installed belt length and will ensure proper belt tension while running. For multiple belt drives, ensure each belt has the same number of links.

For 3L, Z/10, A/4L, and B/5L sections:	For C and D sections:
$\frac{\text{Hand-tight length of belt (\# of links)}}{24} = \text{\# of links to remove}$	$\frac{\text{Hand-tight length of belt (\# of links)}}{20} = \text{\# of links to remove}$
For all sections, round number of links to be removed to the nearest whole number.	

Note: Every tenth link is designated with an arrow (⟶) (3L, Z/10, A/4L and B/5L only).

Disassembly

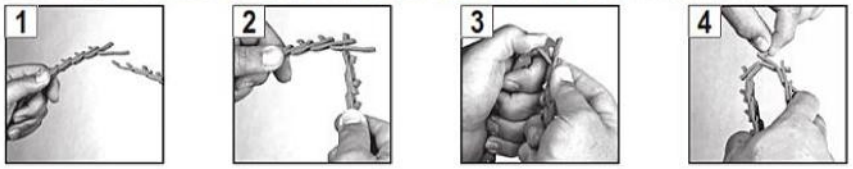
1. Hold belt as shown in figure. Bend back as far as possible; hold with one hand. Twist one tab 90° parallel with slot.
2. Pull end of link over tab.
3. Rotate belt end with tab 90° parallel with slot.
4. Pull belt end through two links.



View the PowerTwist Plus installation video at: www.fennerdrives.com/instructional-videos

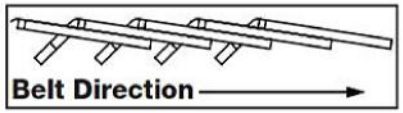
Assembly

1. Hold belt as shown in figure.
2. Place end tab through two links at once and twist tab into place.
3. Bend back and insert second tab through end link by twisting tab 90° with thumb.
4. Ensure tab returns to position across belt. Reverse belt so tabs run inside.



Installation

1. Turn belt with tabs to the inside before installing.
2. Determine direction of drive rotation.
3. Belt must travel following the belt direction arrow (⟶) with tabs trailing.
4. Fit belt in nearest groove of smaller pulley.
5. Roll belt onto larger pulley, turning the drive slowly. Belt may seem very tight; this is ok; DO NOT JOG MOTOR.
6. Check to see all tabs are still in their correct position and are not twisted out of alignment.
7. For multiple belt drives, work belt from groove to groove. On particularly wide drives, it may be easier to install half the belts from the inboard side and half from the outboard.



Note: With drive ratios around 1:1, it may be necessary to add back one link to allow belts to be rolled on. This does not apply if using the Alternative Installation Method.

Alternative Installation Method

1. Set motor to mid-position of adjustment range and mark base clearly.
2. Determine required belt length as in "How to Measure" Section.
3. Push motor forward to minimum center distance.
4. Install belts as in "Installation" Section above.
5. Pull motor back to previously marked mid-position.

Retensioning

Like all high performance V-belts, PowerTwist Plus V-Belts require the maintenance of correct drive tension to operate efficiently. Experience indicates that drive tension should be checked between 1/2 hour and 24 hours running at full load. A retension may be necessary depending on the application. Any initial belt stretch is then taken up. Subsequently, belt tension should be checked periodically and adjusted when necessary.

PART NUMBER
0408505

AMT
25' 428231

PROFILE
A/4L

COUNTRY OF ORIGIN
USA

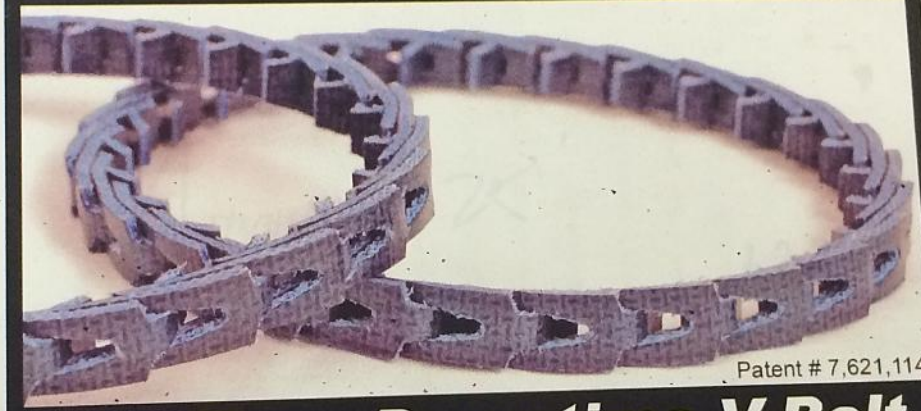
RoHS COMPLIANT

MADE WITH TOM PRIDE BY

6 62345 07824 5

PowerTwist Plus V-BELTS **Antistatic**

High Performance Composite V-Belts



Patent # 7,621,114

The Zero Downtime V-Belt

Fenner Drives
www.fennerdrives.com

Eagle® Polyurethane Belting

Eagle® Can Cable

Eagle® & PowerTwist® SGT Belting

Trantorque® Keyless Bushings

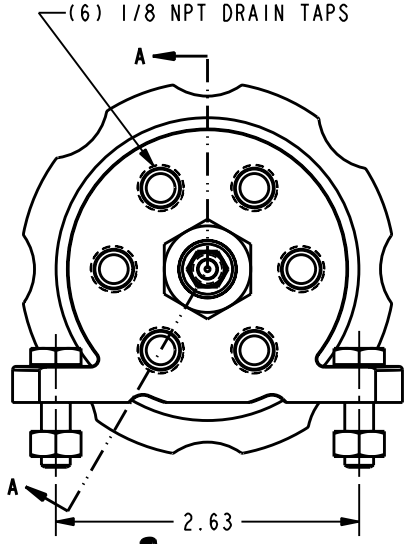
Section 5

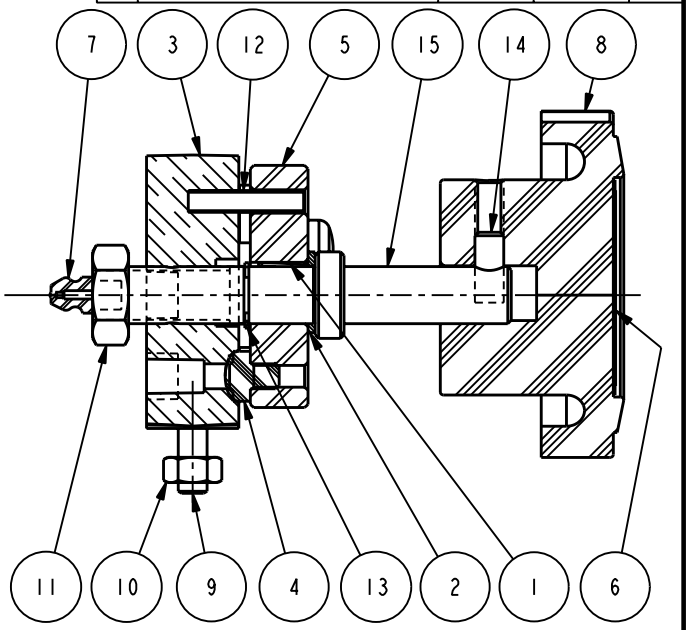
Optional Equipment

MULTIPLE DRAIN VALVE

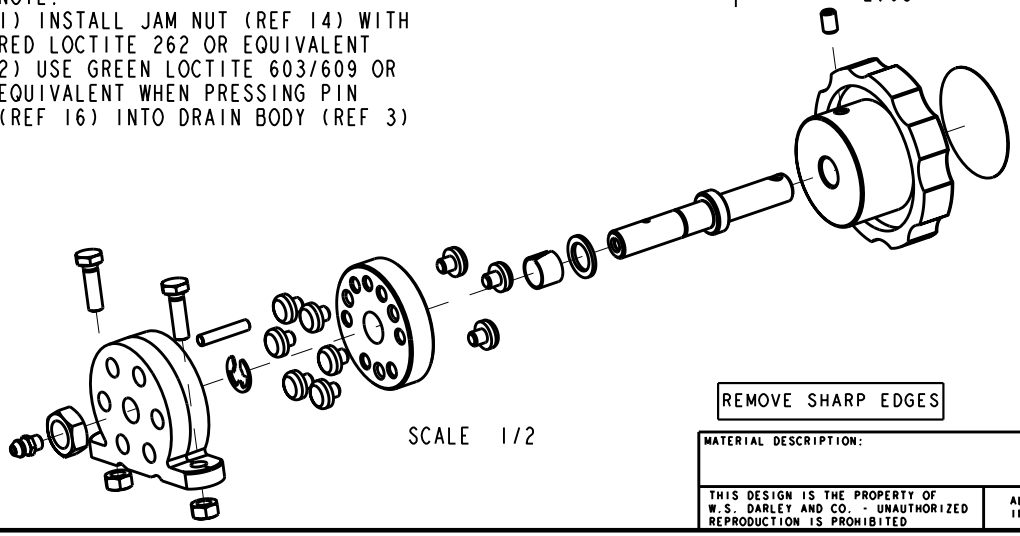
NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING - NYLINER, 0.50 ID	1760102	1
2	BEARING - OILITE, 0.500 ID	1760024	1
3	BODY - MULTIPLE DRAIN VALVE	5320602	1
4	BUMPER - DRAIN VALVE	4401727	9
5	CAP - MULTIPLE DRAIN VALVE	5323803	1
6	DECAL - DRAIN VALVE	1963200	1
7	GREASE ZERK - .25-28	4403200	1
8	HANDWHEEL	3001800	1
9	HHCS - .250-20 x 0.88, 18-8	5400658	2
10	NUT - HEX, .250-20, 18-8 SST	5403027	2
11	NUT - JAM, .500-20, 18-8 SST	5403219	1
12	PIN - SPRING, 0.19 X 1.00, SST	3605029	1
13	RING - RETAINER, 68011	3600435	1
14	SSS - 1/4-20 x 0.38, SST	5402603	1
15	STEM - MULTIPLE DRAIN VALVE	5241303	1

NOTE:
1) INSTALL JAM NUT (REF 14) WITH RED LOCTITE 262 OR EQUIVALENT
2) USE GREEN LOCTITE 603/609 OR EQUIVALENT WHEN PRESSING PIN (REF 16) INTO DRAIN BODY (REF 3)

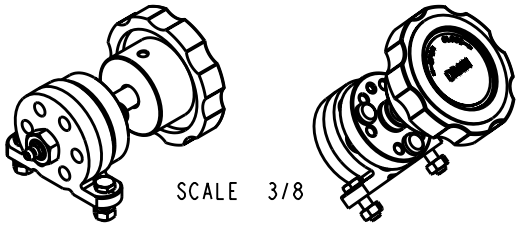




SECTION A-A



SCALE 1/2



SCALE 3/8

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

MODEL NAME	MDL CREATED	SHEET	
VD00600	12JUN2009	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 - MULTIPLE DRAIN VALVE BUMPER

DR'N SMS

CHKD MCR

TRCD

DATE 16-Jul-09

SCALE 1/1

DGC0904

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NAME:SMS OBJECT:DGC0904 DATE:13-May-10 13:22:00

BALL VALVE

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.

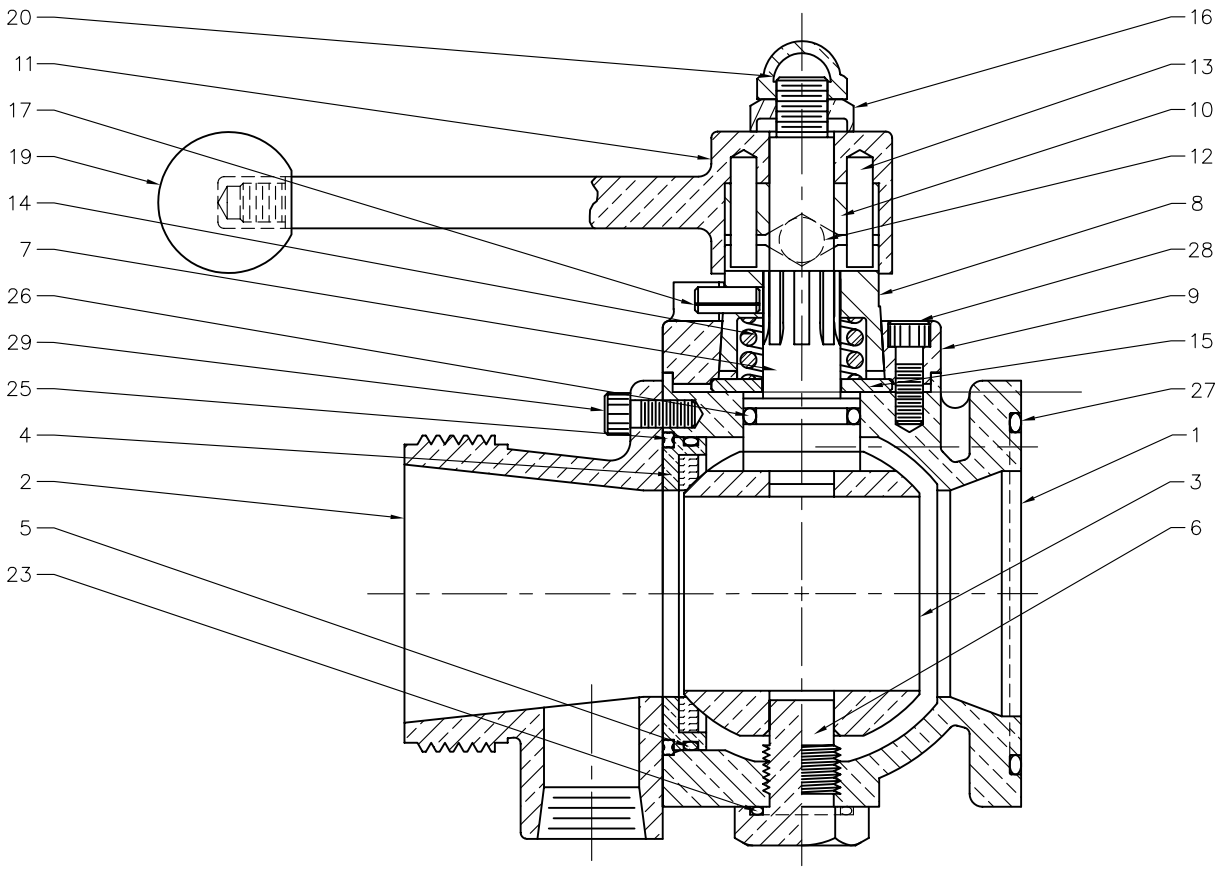
5. Place seat assembly (4), seat o-ring (5), and quad ring (25) into position.

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

DO NOT SCALE PRINT

PRESSURE RELIEF VALVE

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.

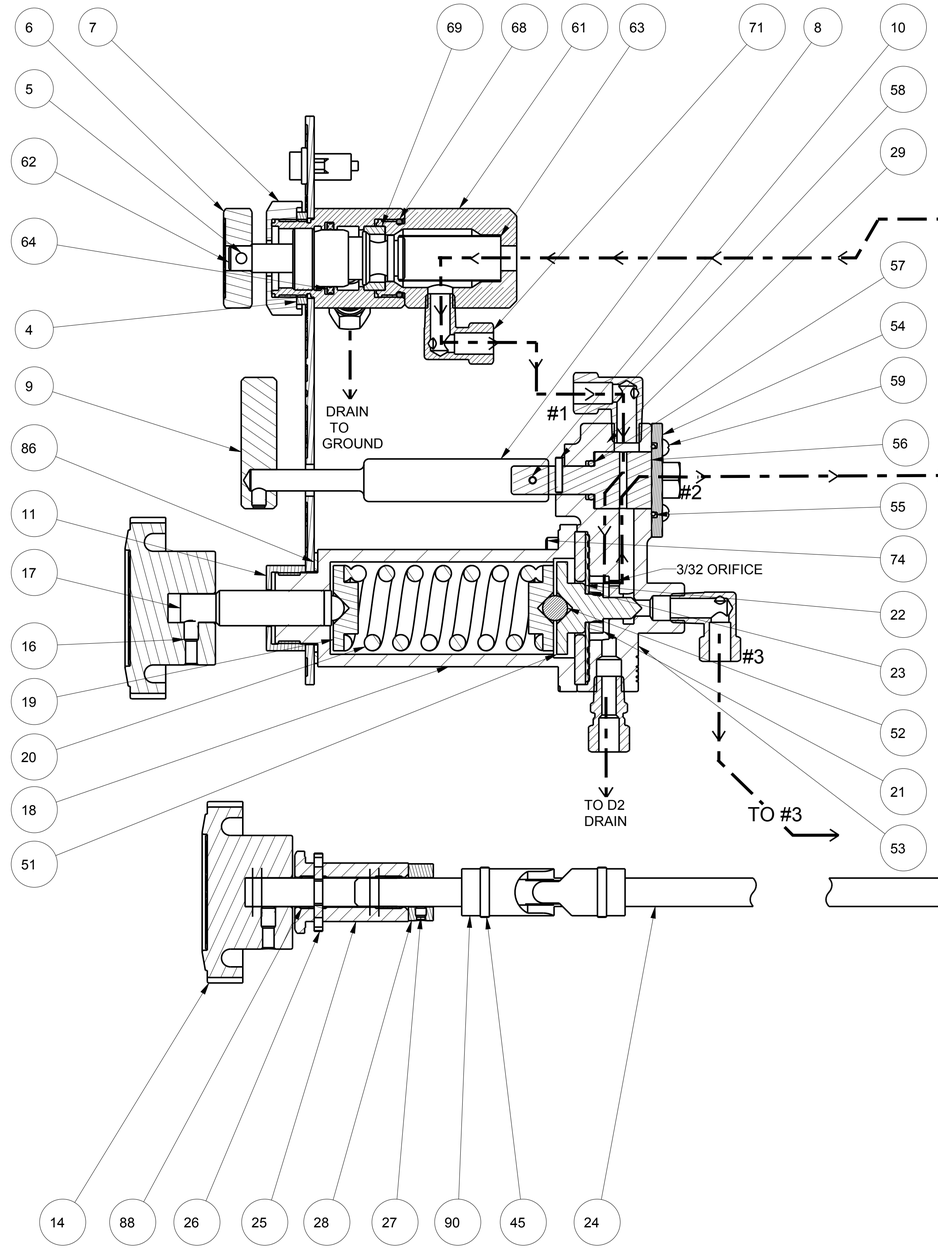
To replace flush valve seat (69), remove stem/screen assembly, disconnect tubing lines attached to (61) body half and unscrew (61) body half from (70) body half. Replace (69) valve seat. Reverse procedure to reassemble valve.

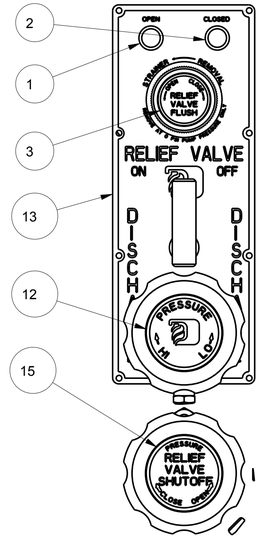
All Darley relief valves can be provided with a micro switch and either one or two pilot lights to indicate when the valve is open or closed.

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

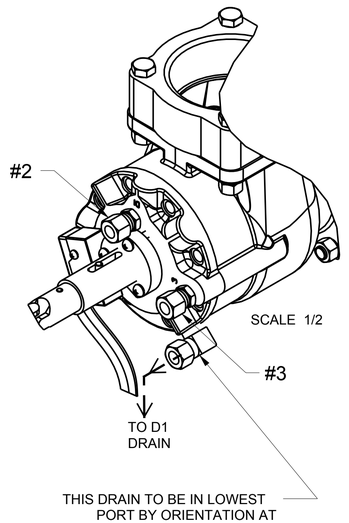
NO.	DESCRIPTION	PART NO.	QTY.
1	LIGHT - AMBER	-	1
2	LIGHT - GREEN	-	1
3	DECAL - FLUSH SCREEN	-	1
4	NUT - PANEL, FLUSH VALVE	-	1
5	SSS - NO.10-32 x 0.38, GR5	-	1
6	KNOB - FLUSH VALVE	-	1
7	NUT - PANEL, 1.38-12	-	1
8	COUPLING - RELEIF VALVE STEM	-	1
9	LEVER - R.V. ON/OFF	-	1
10	PIN - DRIVE LOK, 0.125 X 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 NPTM	-	3
73	TUBE FITTING - STR, .38 cf x .12 NPTM	-	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

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REVERSED LIGHT POSITIONS	12JUL07	2007-285	RJG
B	ADDED FLOW PATH VIEW	21NOV2007	2007-451	SMS



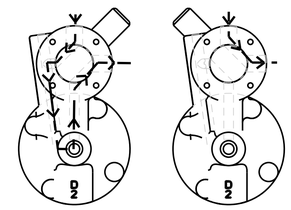


SCALE 1/2



SCALE 1/2

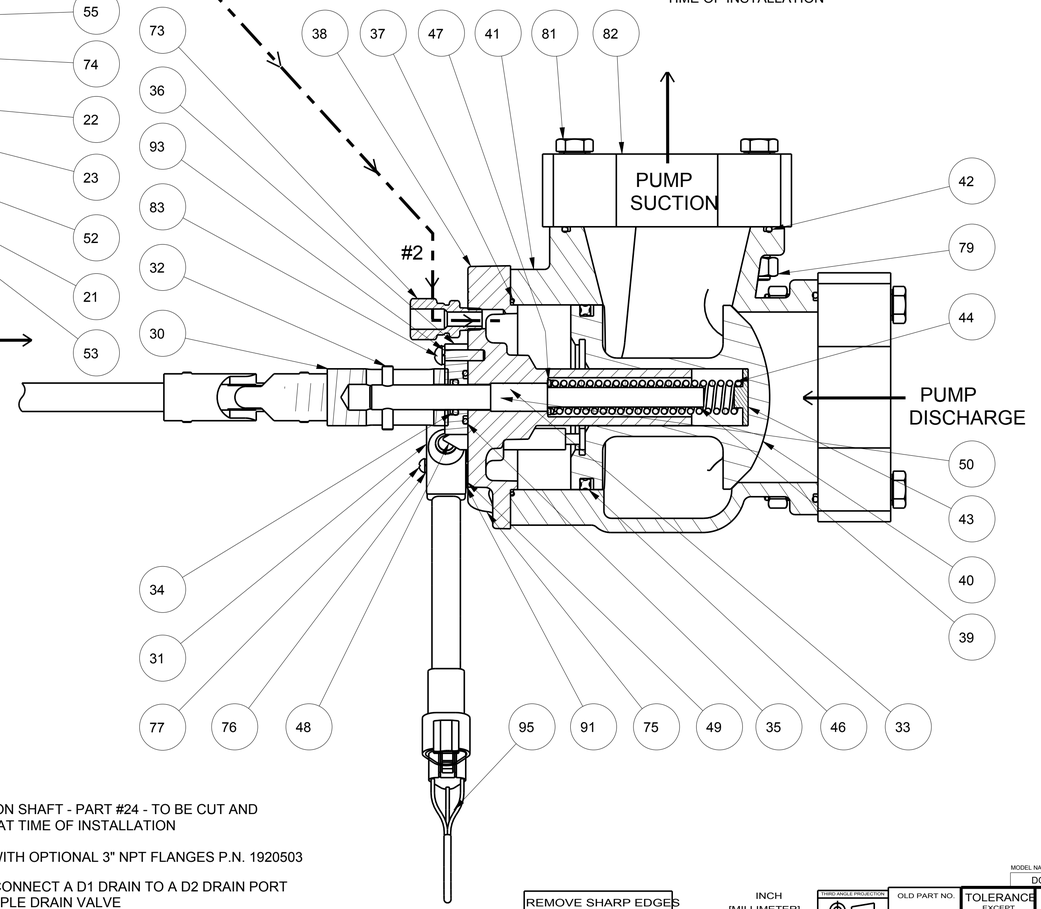
THIS DRAIN TO BE IN LOWEST PORT BY ORIENTATION AT TIME OF INSTALLATION

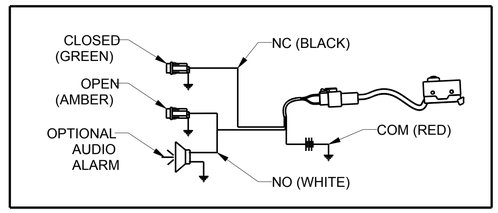


SCALE 1/2

VALVE ON VALVE OFF

(B) FLOW PATH THRU PILOT CONTROL VALVE





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

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

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

SEE DRAWING #DGC0112 FOR DETAILED LOCATION

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

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

MATERIAL DESCRIPTION: | MATERIAL NO. | PATTERN NO.

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

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

DRN HAL
CHKD SJL
TRCD

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

RELIEF VALVE

DATE 13-Jun-05
SCALE 3/4

DGC0141

NO.	DESCRIPTION	PART NO.	QTY.
1	LIGHT - AMBER	-	1
2	LIGHT - GREEN	-	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 NPTM	-	3
73	TUBE FITTING - STR, .38 cf x .12 NPTM	-	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

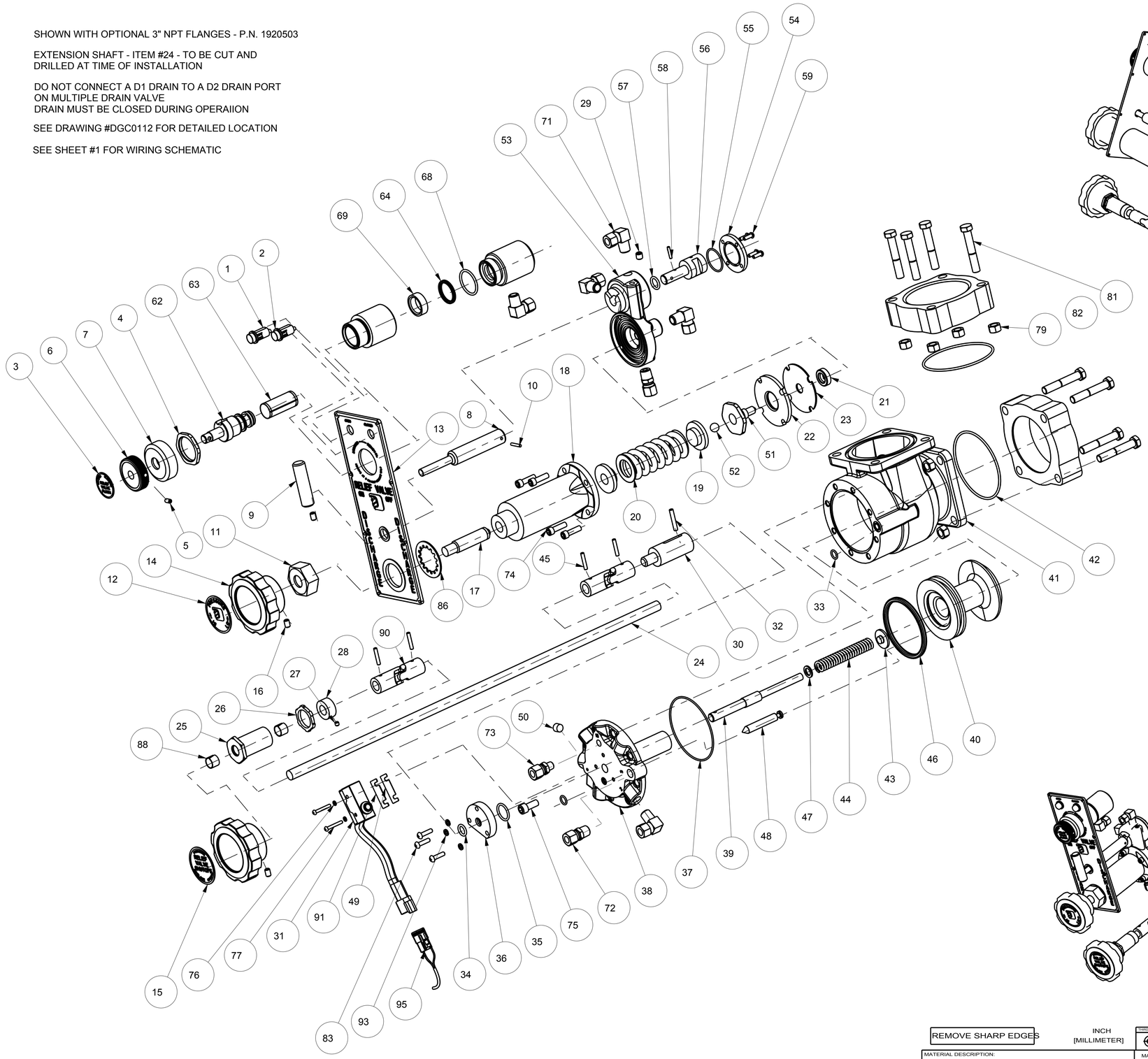
SHOWN WITH OPTIONAL 3" NPT FLANGES - P.N. 1920503

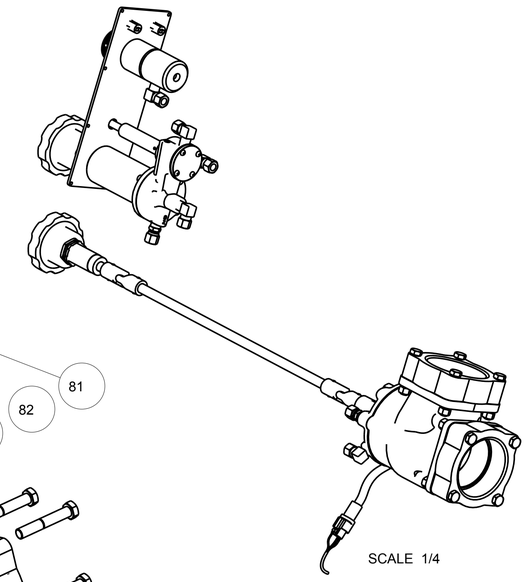
EXTENSION SHAFT - ITEM #24 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION

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

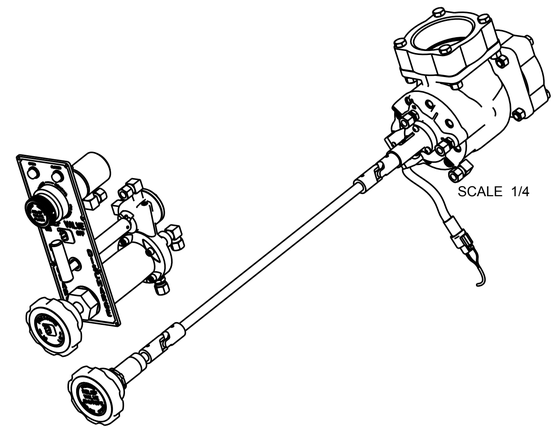
SEE DRAWING #DGC0112 FOR DETAILED LOCATION

SEE SHEET #1 FOR WIRING SCHEMATIC





SCALE 1/4



SCALE 1/4

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

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

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

RELIEF VALVE

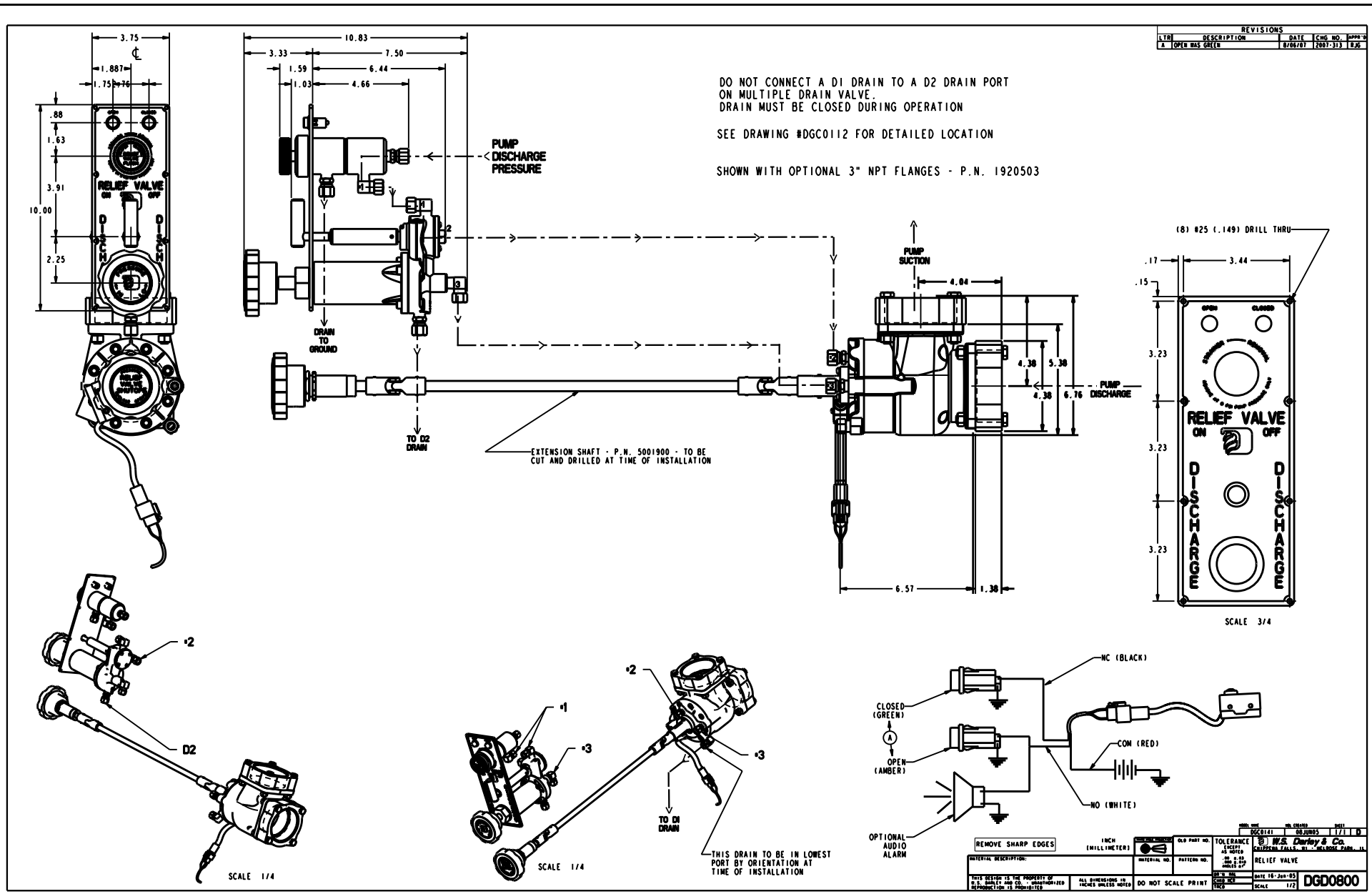
DRN HAL
CHKD SJL
TRCD

DATE 15-Jun-05
SCALE 3/4

DGC0141

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT



NAME:RG OBJECT:DGD0800 DATE:06-Aug-07 09:18:21

W.S. DARLEY & CO.

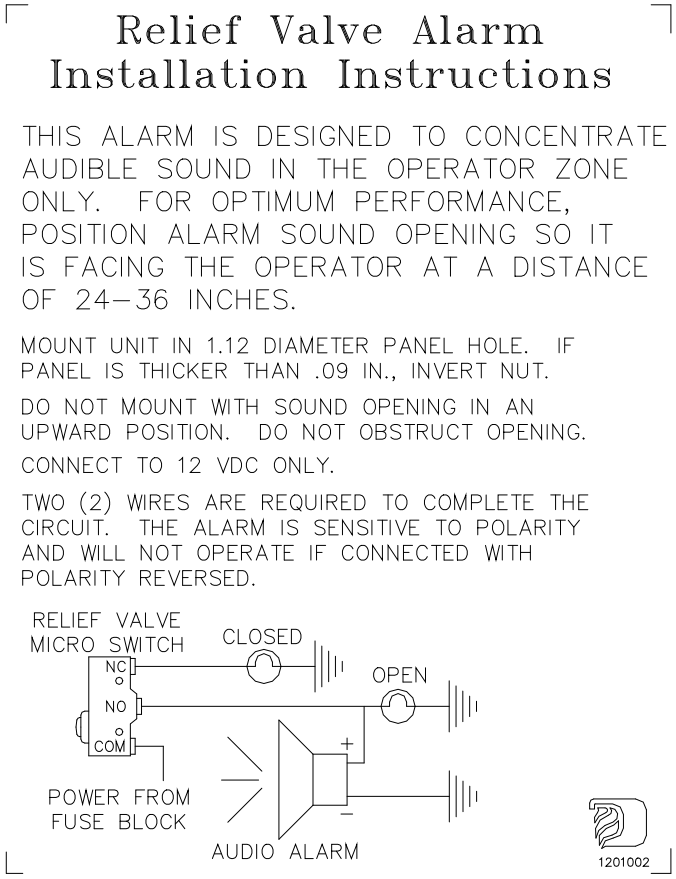
Relief Valve Alarm
Installation Instruction

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.

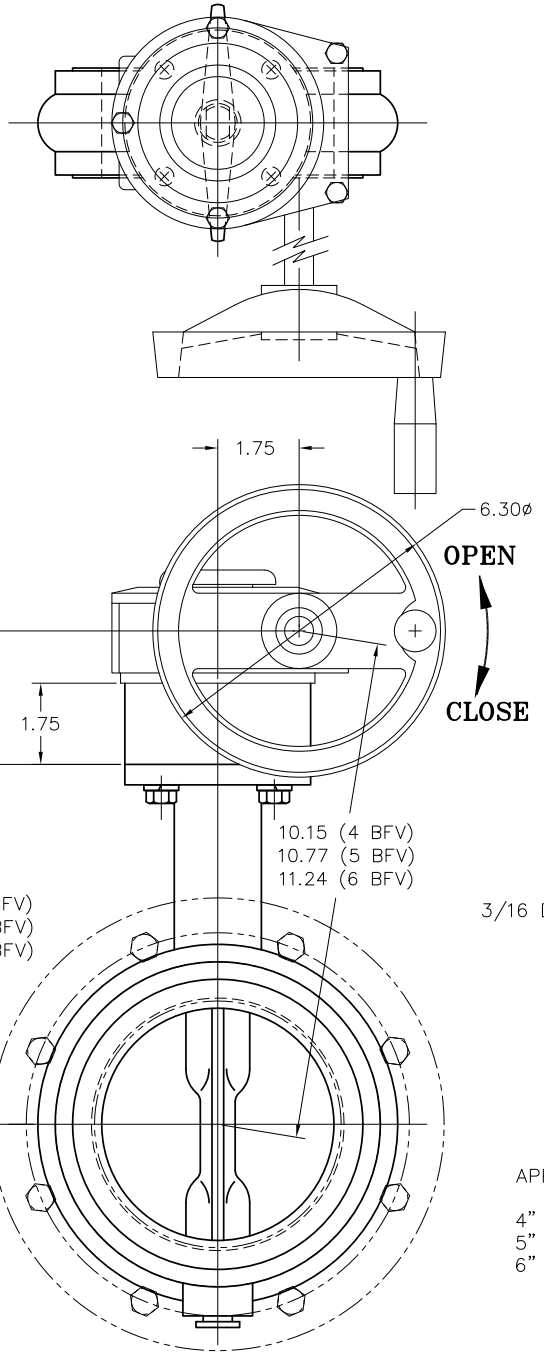
Do not mount with sound opening in an upward position. Do not obstruct opening.

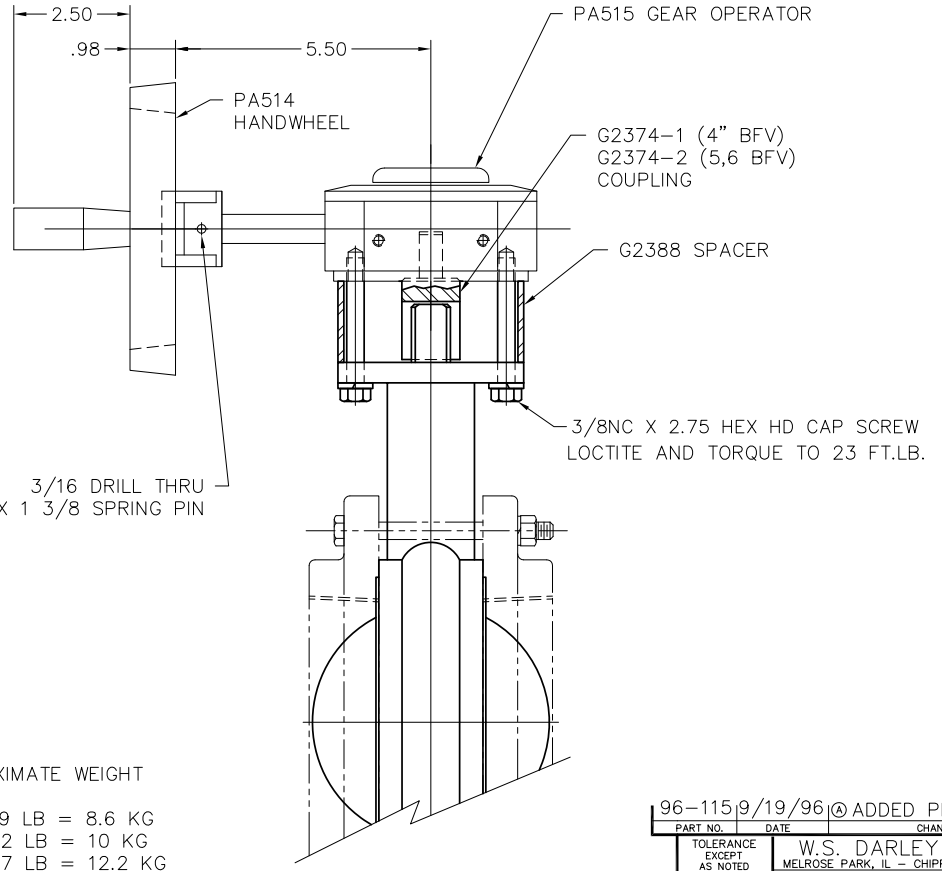
Connect to 12 VDC only.
Two (2) wires are required to complete the circuit. The alarm is sensitive to polarity and will not operate if connected with polarity reversed.



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

BUTTERFLY VALVE





ATTACH WARNING PLATE
(ASSY AM00700) TO
CONTROL PANEL VIA
REV. NO. 96-115 (REF). Ⓐ

APPROXIMATE WEIGHT

4" - 19 LB = 8.6 KG
5" - 22 LB = 10 KG
6" - 27 LB = 12.2 KG

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

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

OLD PART NO. G2420

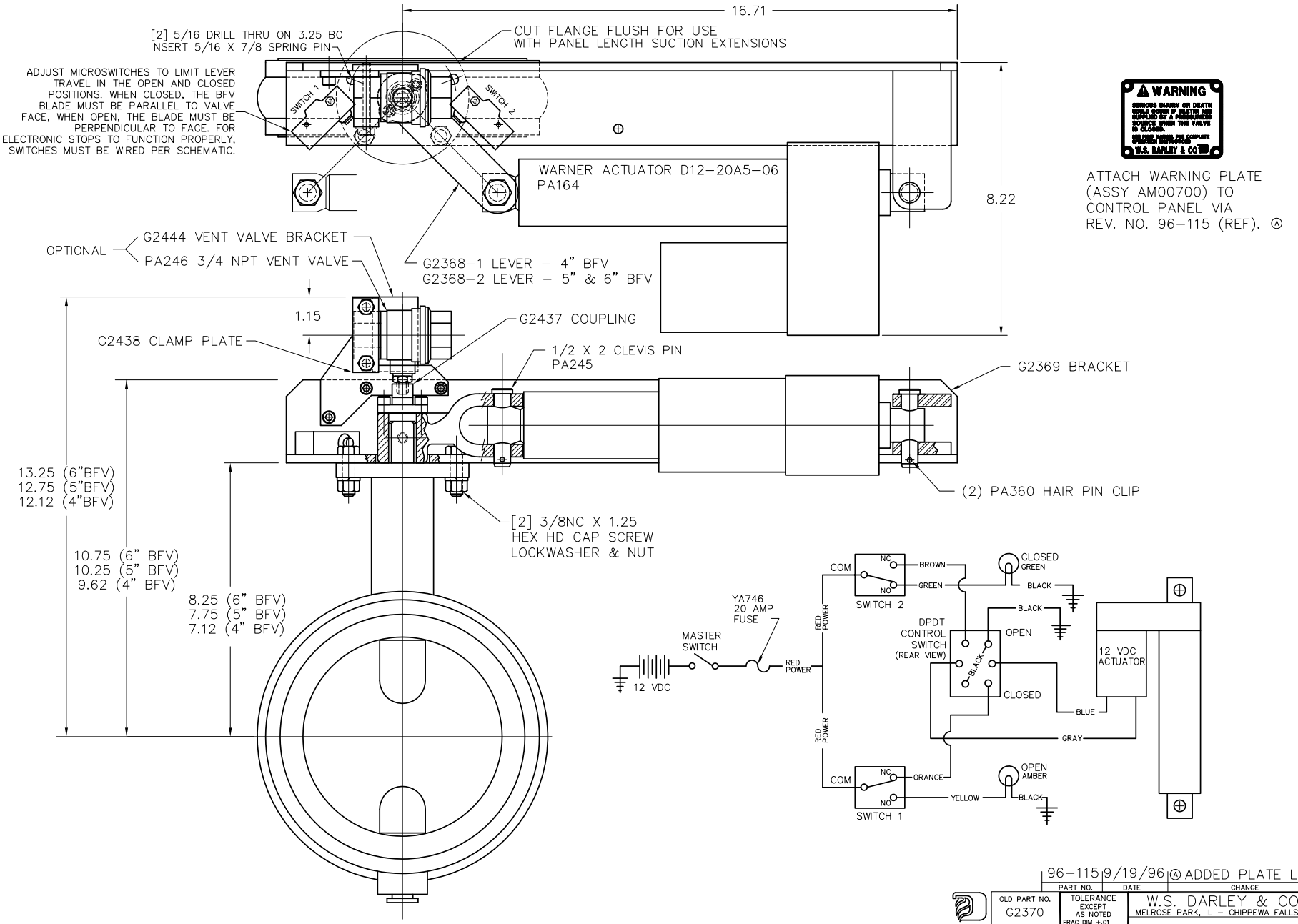
DR'N DWS
CHKD
TRCD

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. –	PATTERN NO.	OLD PART NO. G2370	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°
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

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

DWG – BUTTERFLY VALVE ASSEMBLY
ELECTRIC ACTUATED

DGD0101

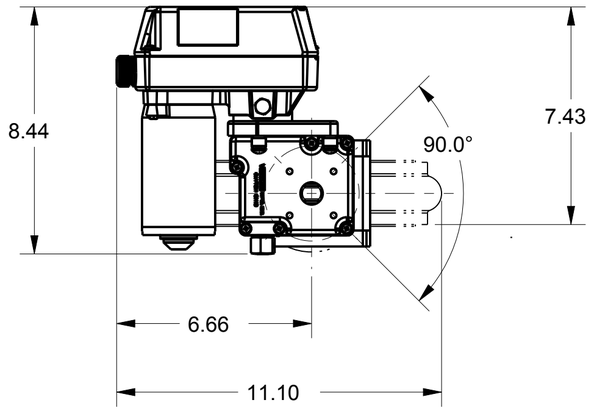
NO.	DESCRIPTION	PART NO.	QTY.
1	ACTUATOR - THUEMLING, MECH OVERRIDE	2603214	1
2	BRACKET - THUEMLING ACTUATOR	4034120	1
3	COUPLER - THUEMLING ACTUATOR	3006710	1
4	COVER - TOGGLE SWITCH	2605001	1
5	HHCS - .250-20 x 0.63, GR5	5400001	4
6	HHCS - .375-16 x 1.25, GR5	5400037	4
7	LIGHT - INDICATOR, AMBER, 12V	2602302	1
8	LIGHT - INDICATOR, GREEN, 12V	2602301	1
9	NUT - HEX, .375-16, GR2	5403002	4
10	PLATE - SWITCH	1960201	1
11	SSS - .250 x 0.25, GR5	5402602	2
12	SWITCH - TOGGLE, MOMENTARY	2600003	1
13	WASHER - LOCK, 0.250 ID	3603501	4
14	WASHER - LOCK, 0.375 ID	3603503	4
15	MISC - VALVE, WARNING PLATE	AM00700	1

A

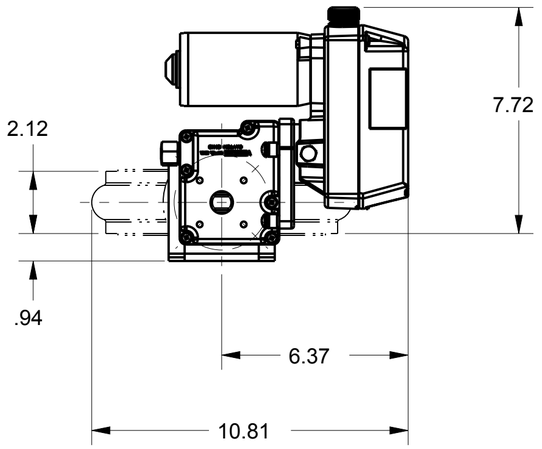
*ACTUATOR CAN BE INVERTED

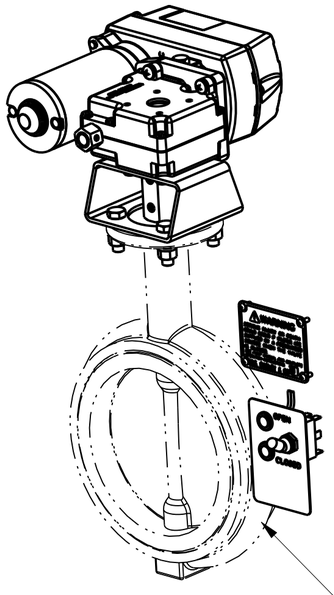
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	WAS B SIZE, REFERENCE HISTORICAL COPY FOR BOM CHANGES	12-AUG-13	10273	JAF
B	ADDED TABLE	12-AUG-13	10273	JAF

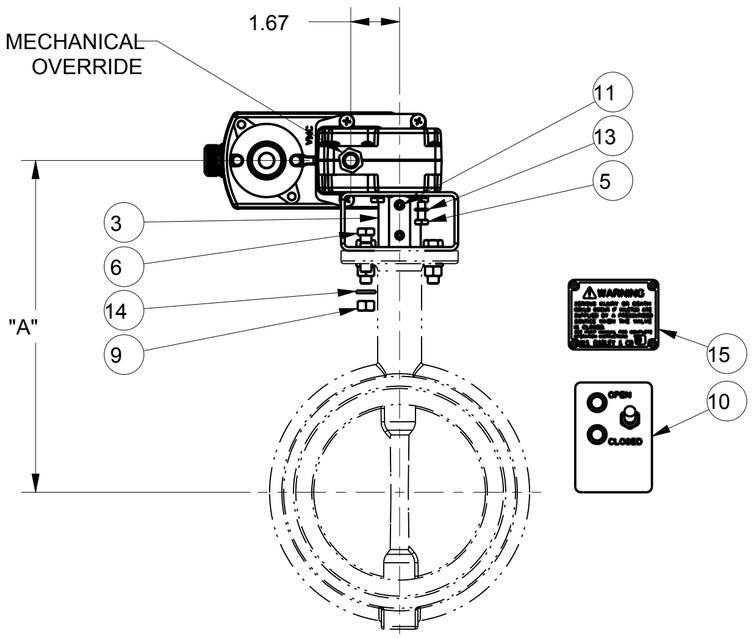
STANDARD ORIENTATION*

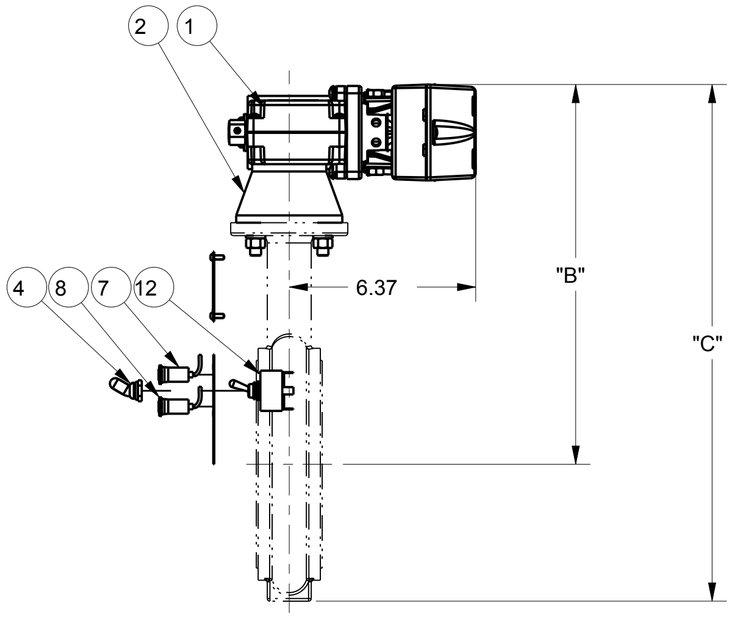


90° ORIENTATION*









SIZE	PART #	A	B	C
5	5206000	10.20	11.84	16.52
5	5206001	10.20	11.84	16.52
6	5206100	11.33	12.97	17.65
6	5206101	11.33	12.97	17.65
6	5206110	9.96	11.60	16.28
6	5206111	9.96	11.60	16.28

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°

DR'N JAF

CHKD RJG

TRCD

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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

ACTUATOR - ASSY, ELEC THUEMLING 5"-6" BFV W/MECH OERRIDE

DATE 12-Aug-13

SCALE 1/4

DGD0109

A

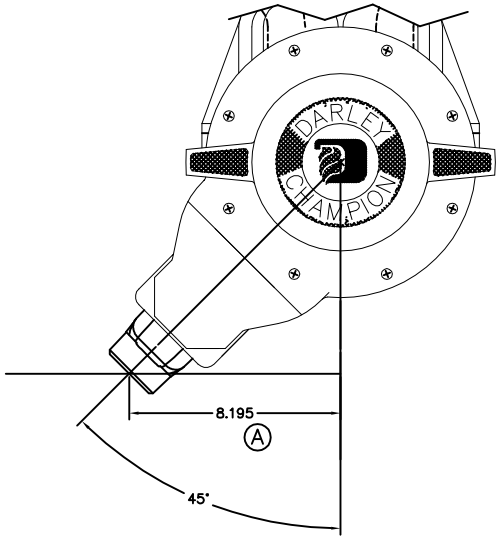
MODEL NAME	MDL CREATED	SHEET	
AA00621	10-JUN-13	1/1	C

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

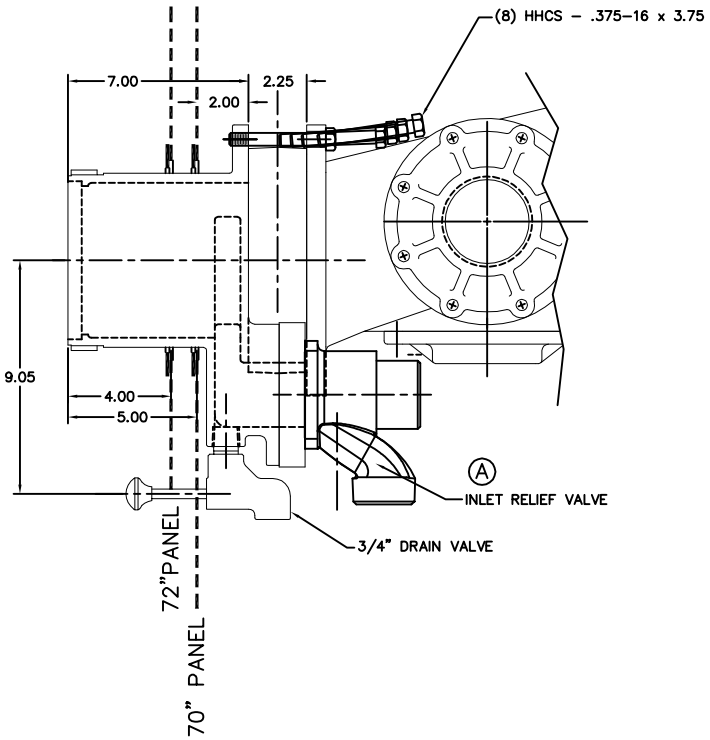
ADJUSTMENT INSTRUCTIONS (IF REQUIRED): Ⓐ

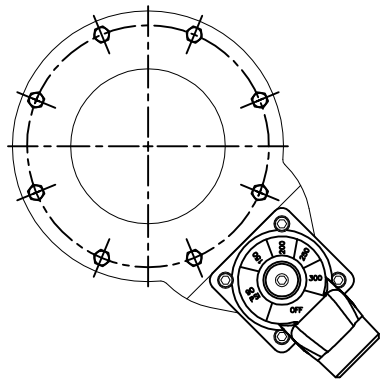
ADJUST CENTER HEX COUNTERSUNK HEX HEAD PRESSURE ADJUSTING BOLT WITH A 1/4" ALLEN WRENCH, 9/16" OR 14 MM SOCKET.
TO SET AT THE DESIRED RELIEF PRESSURE, ADJUST THE ADJUSTING BOLT HEAD SO THE TOP OF THE BOLT HEAD IS EVEN WITH THE DESIRED PRESSURE.



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

PUMP OVERHEAT PROTECTION

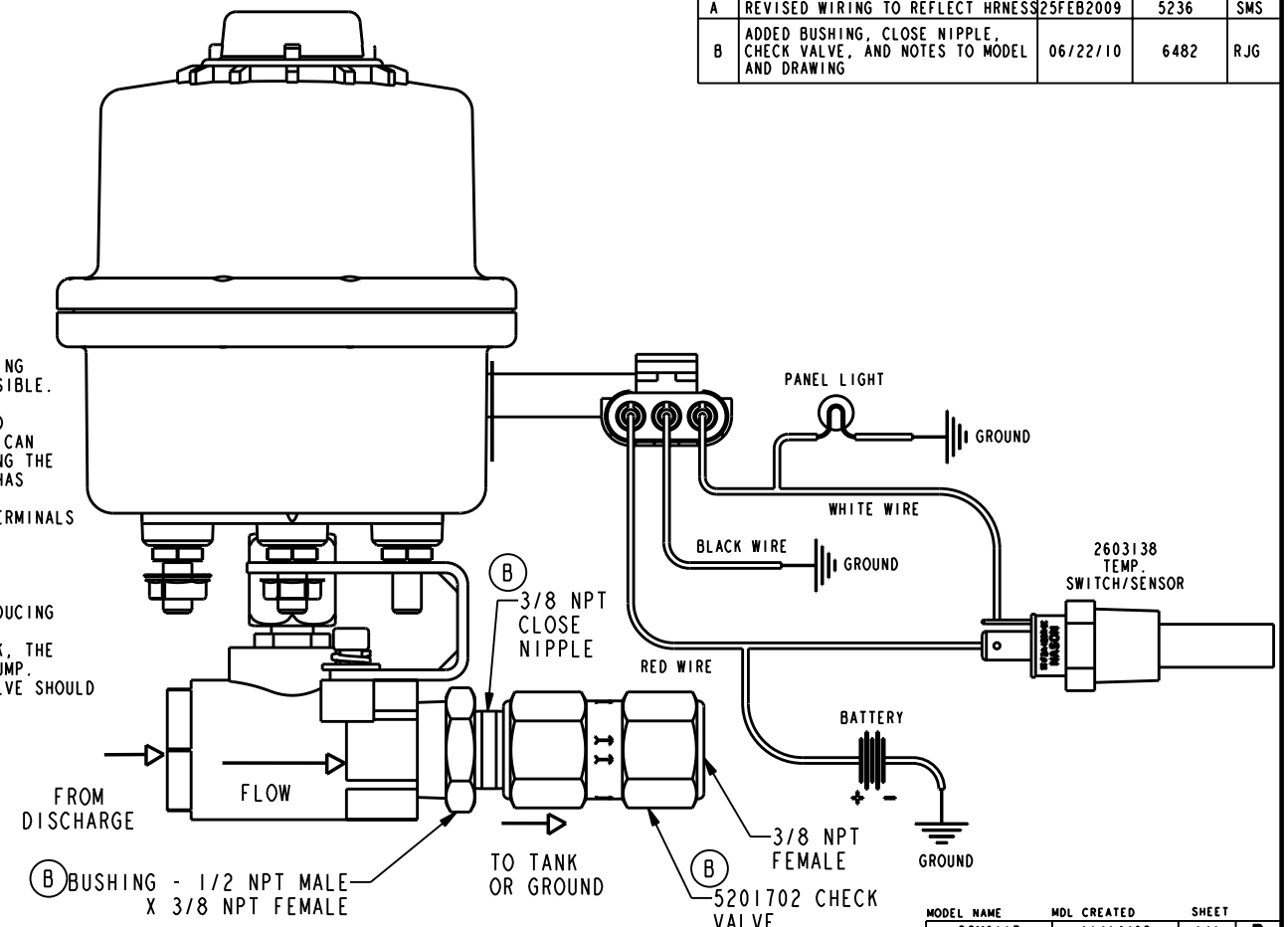
NAME:RJG OBJECT:DGM0117 DATE:22-Jun-10 14:41:12

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

INSTALLATION INSTRUCTIONS:

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

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



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

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: -

MATERIAL NO. -

PATTERN NO. -

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

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

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

DR'N RJG
CHKD DWS
TRCD

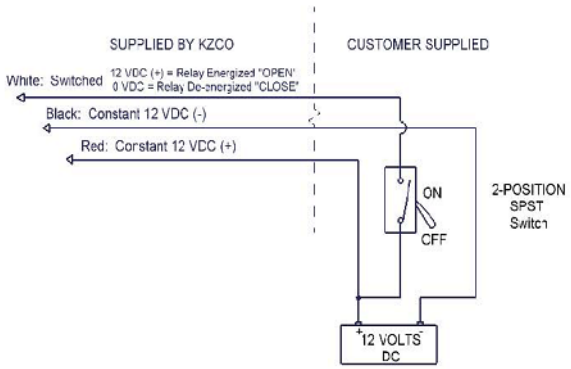
DATE 14-Nov-08
SCALE 1/1

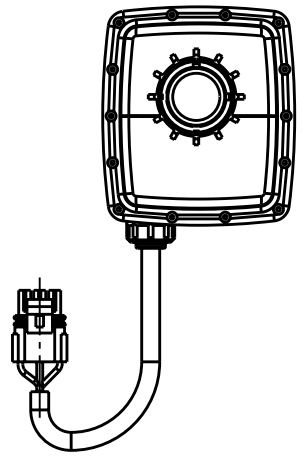
DGM0117

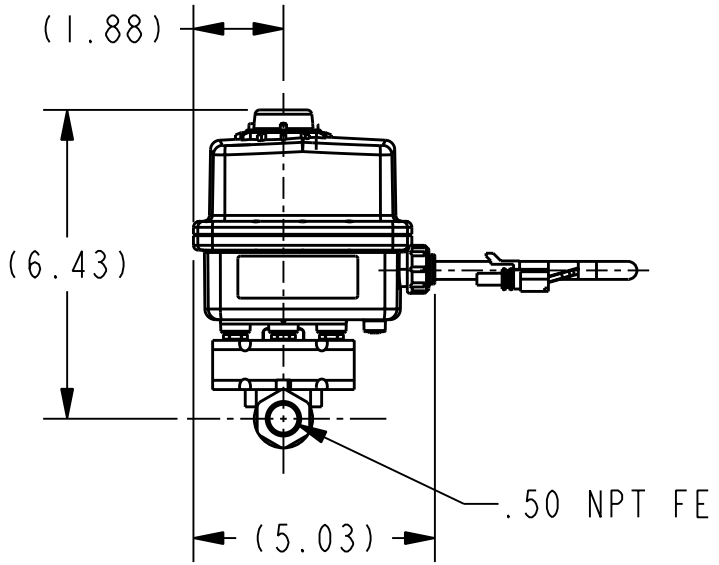
ALL DIMENSIONS IN INCHES UNLESS NOTED

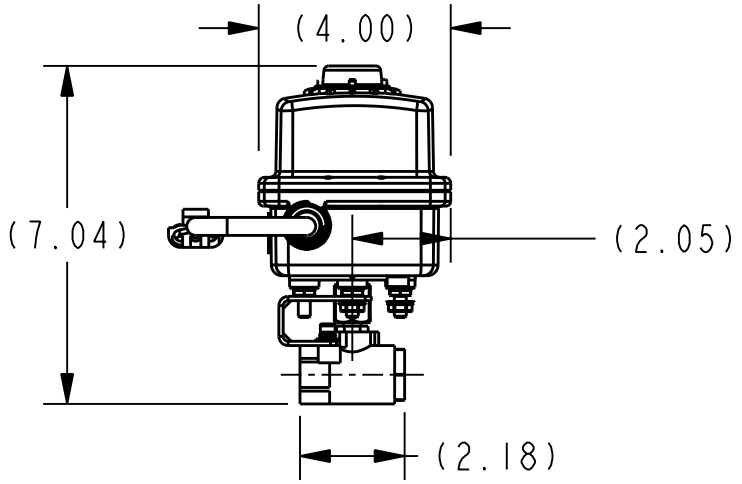
DO NOT SCALE PRINT

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D









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

REMOVE SHARP EDGES

INCH [MILLIMETER]

THIRD ANGLE PROJECTION

OLD PART NO.

MATERIAL DESCRIPTION: KZCO 84D23-10D20-P01

MATERIAL NO. -

PATTERN NO. -

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

DR'N RJG
CHKD DWS
TRCD

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

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

DATE 13-Nov-08

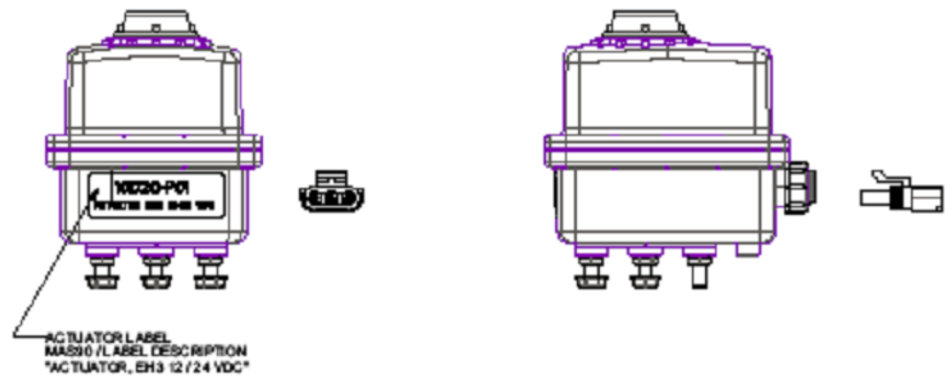
SCALE 1/4

5209401

ALL DIMENSIONS IN INCHES UNLESS NOTED

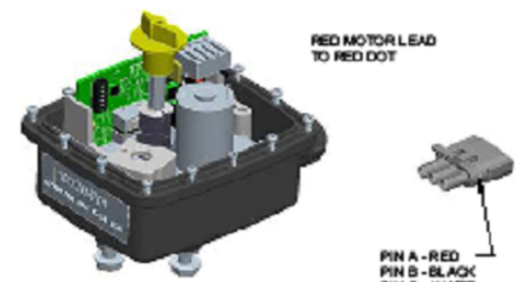
DO NOT SCALE PRINT

REV/VER	REVIEWED	REVISION/VERSION DATE	REVISION/VERSION 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, 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 EH2/5 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, 6-20 X .562	STAINLESS_STEEL_TYPE_410
8	1	EH3-1001-N	LID, CASE, EH3, DOME	NYLON_DPC_6N33-L_BLACK
7	4	EH3-139	SCREW, 8-32 X 1.25 PPHMS SS	STAINLESS_STEEL_TYPE_18-8
6	1	EH-157	SCREW, 8-18 x 3/8" TSB PPH SS	STAINLESS_STEEL_TYPE_18-8
5	1	EH3-1030	O-RING, EH3, CASE I.D., #120	SILICONE_RED_55_DUROMETER
4	1	EH-139	O-RING, #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)

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

KZCO Inc.

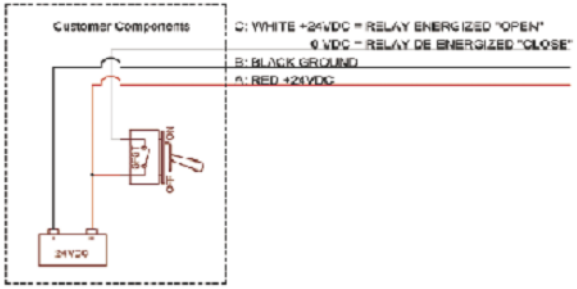
TITLE: ACTUATOR, EH3, SOLID STATE

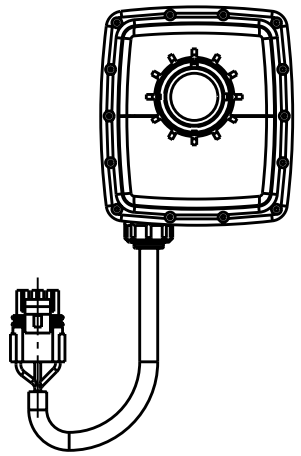
PART NO.	10020-P01
REVISION	-2+
DRAWING NO.	10020-P01
SHEET	1 of 1

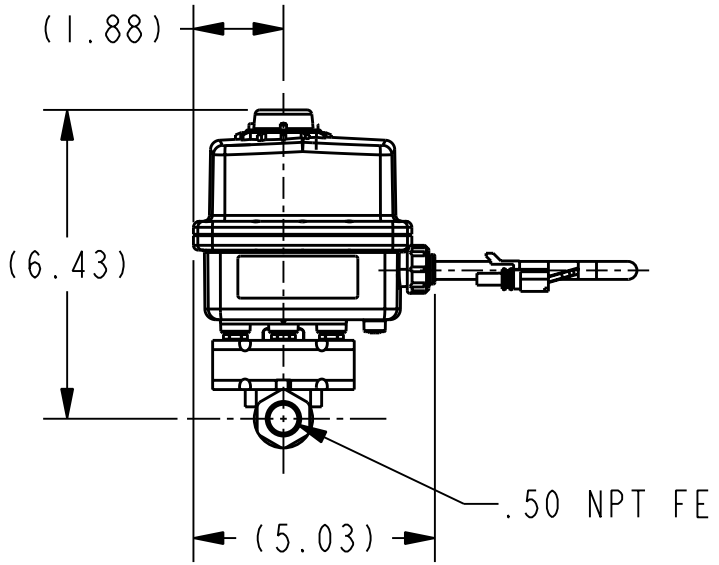
NAME:RJG OBJECT:5209401_2 DATE:17-Nov-08 11:49:19

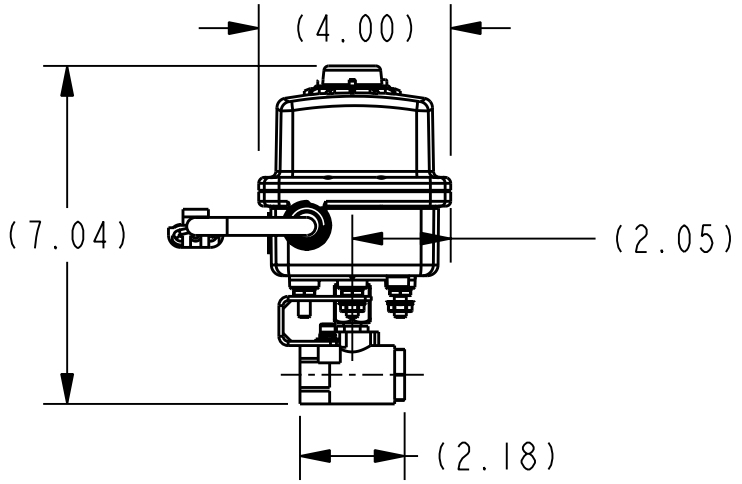
60AD WIRING
Standard On/Off applications, SPST Switch
24 VDC

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

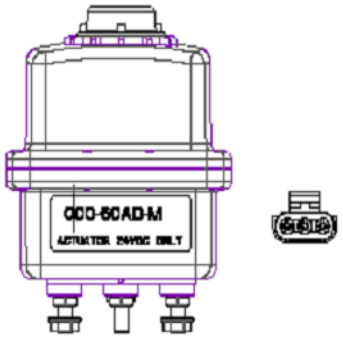
ALL DIMENSIONS IN INCHES UNLESS NOTED

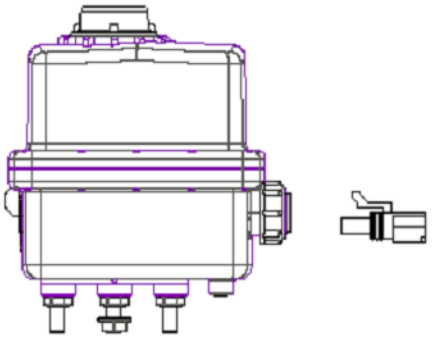
DO NOT SCALE PRINT

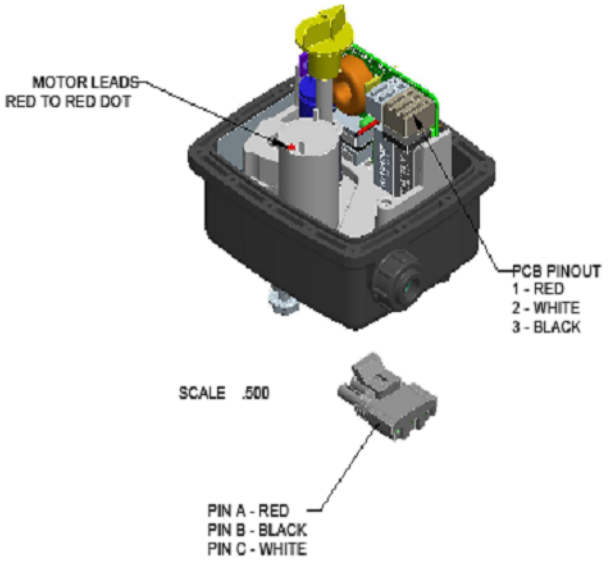
NAME:RJG OBJECT:5209402_2 DATE:19-Nov-08 13:40:13

CREATED BY: wfedde CREATED ON: 3/28/2008 1:49:38 PM REV: *** VER: .1 REL: -- LOCATION: Rod Fabs\Engineering\Parts BRANCH: --

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







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

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

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

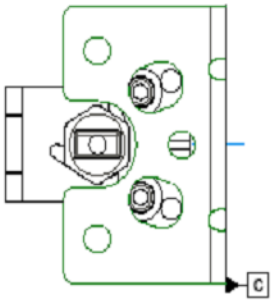
DENSITY: .047 LBM/CU IN
MASS: .592 LBM
SURF AREA: 163.793 SQ IN
VOLUME: 12.043 CU IN

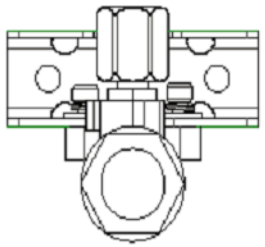
DATE: 2007-04-16
DESIGNED: L. ERDKAMP
DRAWN: W. FEDDE
APPROVED: A. KOTTAS
SCALE: .500 SIZE: B
MATERIAL:

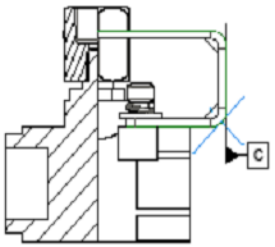
KZCO inc.
23660 KZ PARKWAY
GREENWOOD, NE 68366 USA
PHONE: +1.402.944.2767
FAX: +1.402.944.2402

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

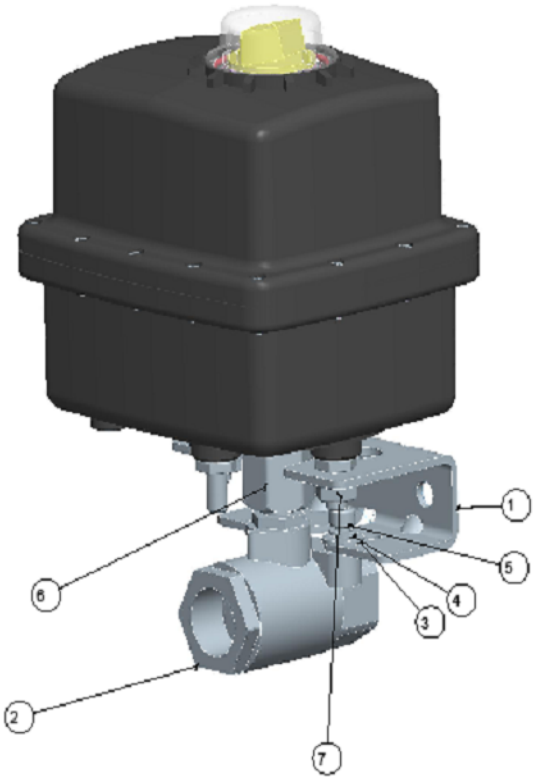
REVISER	REVISION ECO	REVISION/VERSION DATE	REVISION/VERSION BY
-.6+		8/12/2008 9:18:50 AM	bgotschall







SECTION A-A



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

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

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

X±.1
.XX±.01
.XXX±.005
XX°±1°

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

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

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

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

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

Appendix

Detailed Specification
Darley ZSE 2000-3000

A Darley model ZSE 2000-3000 GPM single stage shaft driven fire pump shall be provided and installed.

The pump shall be driven by engine that is directly connected to the pump's integral transmission. The engine, transmission and driveline components shall provide sufficient horsepower and RPM to enable the pump to meet and exceed its rated performance.

The pump casing shall be manufactured from Class 40 Cast Iron with a minimum tensile strength of 40,000 PSI. The casing shall be vertically split allowing for access to the impeller and impeller drive shaft without removing the pump from the vehicle in the event maintenance is ever required.

The pump shall contain a cored heating jacket feature that, if selected, can be connected into the vehicle cooling system to protect the pump from freezing in cold climates, and to help reject engine heat from engine coolant, providing longer life for the engine.

Pump Shaft

The pump shaft shall be precision ground stainless steel. The shaft shall be splined to receive shaped impeller hubs, for greater resistance to wear, torsional vibration, and torque imposed by engine, as well as ease of maintenance and repair.

Impeller

The impeller shall be a high strength bronze alloy of mixed flow design, splined to the pump shaft for precision fit, durability, and ease of maintenance. Impeller shall be vacuum cast designed for maximum lift and highest capacity. The seal rings shall be renewable, double labyrinth, wrap around bronze type.

Impeller shaft oil seals shall be constructed to be free from steel components except for the internal lip spring. The impeller shaft oil seals shall carry a lifetime warranty against damage from corrosion from water and other fire-fighting fluids.

Impeller shaft mechanical seal primary ring shall be constructed of Silicone Carbide material with a mating rating material of Carbon. Due to the superior performance and resistance to failure in the event of "running dry," tungsten carbide or ni-resist face materials shall not meet the requirements of the specification. No Exceptions shall be made to this portion of the specification.

Pump Engine Driven 2 Gear Transmission

The transmission case shall be heavy duty 356T6 cast aluminum. Transmission case shall be vacuum resin impregnated to seal casting microstructure. A magnetic drain plug shall be provided. Transmission case shall include a readily accessible lubricant fill port with combination plug/dipstick for checking and maintaining oil level. Transmission case shall be equipped with a removable access plate for quick inspection of gears, shafts, and bearings inside the transmission.

The pump drive shaft shall be precision ground, heat treated alloy steel, with a minimum 2"-10 spline. Gears shall be helical design and shall be precision ground for quiet operation and extended life. The gears shall be manufactured from alloy steel, carburized, and heat treated for surface hardness and strength.

The bearings provided shall be heavy duty, deep groove, radial and spherical roller type bearings. Sleeve bearings on any portion of the pump or transmission shall be prohibited due to wear, deflection, and alignment concerns. The bearings shall be protected at all openings from road dirt and water splash with oil seals and water slingers.

The pump transmission shall include an integrated, positive displacement lubrication system providing pressurized lubrication to transmission gears and bearings. The pressurized lubricant system shall include a closed loop, heat exchanger providing low operating temperatures thus extending lubricant life and change intervals. The lubrication circuit shall include a 100 mesh, stainless steel, oil pickup screen.

The transmission shall include a secondary, splash lubrication system which will provide continued bearing and gear lubrication in the event of primary lubrication system malfunction.

High Capacity Vacuum Primer

When specified, the pump shall include an integrated, belt-driven, clutch-actuated, high capacity vacuum primer. The high capacity primer will be capable of evacuating 40' of 8" suction hose within 45 seconds with a pump input speed of 1000 rpm. The primer shall be actuated by a panel mounted, manual operated, 'PUSH to PRIME' momentary switch.

The primer control shall include an indicator lamp to indicate when the primer is engaged.

Manuals

One manual covering the fire pump transmission and selected options of the fire pump shall be provided with the apparatus in either printed copies or on CD.

Corporate Darley Office

325 Spring Lake Drive
Itasca, Illinois 60143-2072
Toll Free Phone: 800-323-0244
Phone: 630-735-3500
Fax: (708) 345-8993

Apparatus Division

920 Kurth Rd.
Chippewa Falls, WI 54729
Toll Free Phone: 800-527-0068
Phone: 715-726-2645
Fax: (715) 726-2648

Pump Manufacturing

1051 Palmer St.
Chippewa Falls, WI 54729
Toll Free Phone: 800-634-7812
Phone: 715-726-2650
Fax: (715) 726-2656