W.S. Darley & Co.

INSTALLATION OF TYPE FRONT MOUNT TYPE PUMPS

READ COMPLETELY BEFORE PROCEEDING

WARNING!

Rotating shafts can be dangerous. Clothes, skin, hair, hands, etc. can become snagged or tangled, causing serious injury or death. DO NOT work on a drive shaft or pump when the engine is running and without the wheels chocked.

When determining the best location for the pump, allow adequate room for pump maintenance.

Many drawings have been supplied to aid you in the mounting of your front mount pump.

Universal joints must always be installed in pairs to transmit uniform rotary motion. The operating angles of each universal joint in the pair should be as close to equal as possible. The input and output shafts of each universal joint pair may be either parallel, or so located that the centerline of each shaft intersects the midpoint of the shaft connecting each universal joint (intersecting angles-see DGM1303). The intersecting angle arrangement will allow the pump to be mounted level with the chassis, and may be required if the coupling shaft between pump and engine is relatively short. Refer to attached drawing DGM1303 for examples of parallel shafts and intersecting angle installations.

Remove the bumper, apron, grill and radiator (as necessary) from the truck chassis.

Measure the vertical angle between the truck engine crankshaft centerline and chassis frame (often 4^{o}).

Install the drive attachment to the front of the crankshaft pulley.

Affix the frame extensions to the side members of the truck frame to provide rigid support for the pump.

Set the pump in position in front of the chassis.

Keep the following points in mind when positioning the pump and constructing the driveline.

- Do not exceed recommended universal joint operating angles. Complimentary shaft angles should be equal and as low as possible.
- Do not exceed universal joint torque limitations.
- Do not exceed drive shaft speed/length limitations.
- Yokes on each end of the drive shaft must be in phase. When in phase the yoke lugs (ears) at each end are in line.
- Use balanced driveline components to help prevent vibration and to extend the life of drive yokes and other components related to the driveline.

Fasten mounting brackets to the bosses on each side of the pump assembly with a single cap screw through the center of each bracket at the correct height and angle to bring the mounting lugs to bear on the top of the truck frame extensions. The mounting lugs are reversible to permit locating the pump at the most advantageous level. Final adjustment of correction of the pump & drive shaft alignment may be made by the use of shims between the mounting lugs and the frame extensions.

Realign the pump shaft with the engine shaft. The pump shaft, and engine crankshaft should now be aligned to allow appropriate operating angles for the drive yokes.

Drill and tap four holes in the pump's mounting casting through each mounting bracket, and secure the pump in correct position with 3/8" cap screws and lock washers. Tighten the setscrews in the mounting brackets to secure the mounting lugs in position.

Clamp the pump support to frame extensions and drill for fastening bolts. Bolt the pump support to the frame extensions using lock washers under the nuts.

Support the suction of the pump. Some pumps use jack studs between the suction head and a cross member, while other pumps such as the PSF and KSF will require a bracket like the one shown on drawing DGM0106 fastened to the suction head and welded to a cross member. With either type of support, the cross member must be able to pivot in relation to the frame extensions to allow for flexing of the frame when the vehicle is being driven.

Install the drive shaft between the electric clutch and the engine crankshaft adapter.

Torque the universal joint bearing cap-retaining bolts to the following Dana Spicer Recommendations.

U-BOLT	
SERIES	***RECOMMENDED NUT TORQUE***
1280	14-17 LB. FT
1310	14-17 LB. FT
1330	14-17 LB. FT
1350	20-24 LB. FT
1410	20-24 LB. FT
1480	32-37 LB. FT
1550	32-37 LB. FT

BEARING STRAP	
SERIES	***RECOMMENDED BOLT TORQUE***
SPL90	45-60 LB. FT
1210	13-18 LB. FT
1280	13-18 LB. FT
1310	13-18 LB. FT
1330	13-18 LB. FT
1350	30-35 LB. FT
1410	30-35 LB. FT
1480	55-60 LB.FT
1550	55-60 LB.FT
1610	55-60 LB.FT
1710	130-135 LB. FT
1760	130-135 LB. FT
1810	130-135 LB. FT

CAP & BOLT	
SERIES	***RECOMMENDED BOLT TORQUE***
1650	77-103 LB. FT
1850	110-147 LB. FT
1850	110-147 LB. FT
1910	110-147 LB. FT
1950	271-362 LB. FT
2010	102-118 LB. FT
2050	744- 844 LB. FT
2110	171-197 LB. FT
2150	744- 844 LB. FT
2210	260- 298 LB. FT

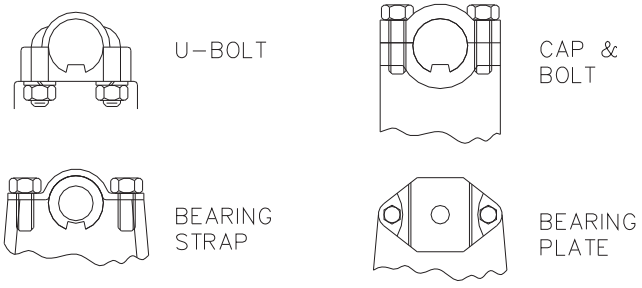
BEARING PLATE	
SERIES	***RECOMMENDED BOLT TORQUE***
1610	26-35 LB. FT
1710	38-48 LB. FT
1760	38-48 LB. FT
1810	38-48 LB. FT
1880	60-70 LB.FT

New part kits with lock straps available from Spicer after Spring 1994

SERIES	***RECOMMEND BOLT TORQUE***
1610	17-24 LB. FT
1710	32-42 LB. FT
1760	32-42 LB. FT
1810	32-42 LB. FT
1880	50-66 LB. FT

WARNING: Bearing strap retaining bolts must **NOT** be reused!
WARNING: Self-locking bolts must **NOT** be reused!

Note: The Dana Spicer fastener torque recommendations are per Dana Spicer's literature # 3119-5 DSD 4/94.



Lubricate universal joint cross using a good quality E.P. (extreme pressure) grease meeting N.L.G.I. E.P. Grade 2 specifications. (Consult your local lubricant source for greases that meet this specification.)

Cut out portions of the apron and grill that interfere with the pump and mounting. Provide suitable reinforcement around the openings.

In some installations it is necessary to raise or remodel the radiator to provide clearance for the drive shaft. An opening through the tube section of the radiator requires spreading the tubes or cutting and resealing some of them. An opening through the bottom radiator tank may require adding a bypass to prevent obstructing the lateral flow of coolant. A cored radiator must be installed before the final engagement of the drive shaft.

WIRING THE ELECTRIC CLUTCH

It is recommended that the electric clutch be wired to an interlock that prevents the clutch from being engaged when the engine speed is in excess of 900-1000 rpm. (It is intended that the pump clutch is engaged at a low idle speed, and then after the clutch is fully engaged, the throttle is advanced to an engine speed of over 1000 rpm.)

It is also recommended that a neutral interlock be wired in to prevent engagement of the electric clutch without the truck transmission first being in neutral. An over ride button can be installed for pump & roll application.

See the electric clutch instructions that are supplied from the clutch manufacturer for more detailed instructions. Also see drawings DGS0000 and DGS0100 for examples of wiring installations. Wiring installations will very due to the many variables in building a fire suppression vehicle.

INSTRUCTIONS FOR INITIAL BREAK-IN OF A NEW CLUTCH

NOTE: Pump must be full of water at all times during this procedure to avoid damaging it.

NOTE: This procedure is performed on new pumps shipped with the clutch installed.

To break in a new electric clutch, the clutch should be run through a short burnishing period. This is a process of cycling the clutch to slightly wear the friction surfaces. This allows full contact, and maximum magnetic attraction. To avoid burning or heat distortion, perform the following break in procedure:

Install the clutch and run the engine at about 1000 rpm. Cycle the clutch on and off at a rate of 10 to 15 cycles per minute for a total of 50 to 100 cycles.

PRIMER CONNECTION

For 12 and 24 volt electric priming pump installation, see drawing DVC0106. See DVC0107 for oilless primer.

ENGINE COOLING/PUMP HEATER

On most pumps, two tapped openings in the pump suction head are provided for circulating engine coolant through the heater jacket/heat exchanger to prevent pump freezing in cold weather, and to aid in engine cooling in warm weather. Use no smaller than a 1/2” heater hose for this connection. See drawing DGS0400. An external heat exchanger should be added to aid in cooling the engine on units that do not have an internal heater jacket/heat exchanger in the suction head.

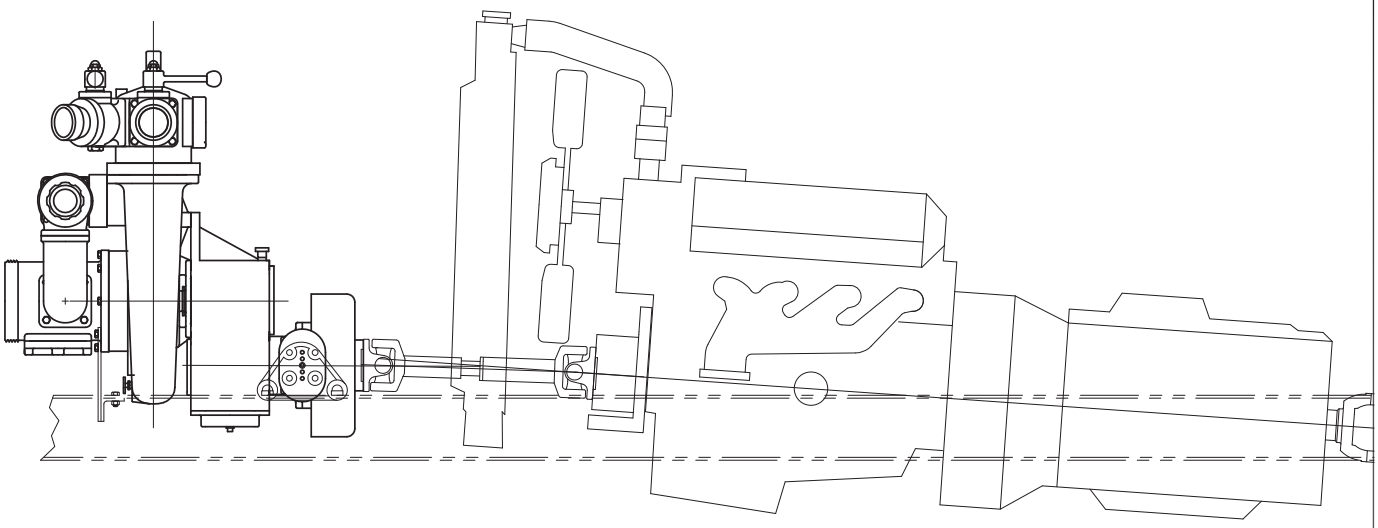
Related Drawings & Documents

The following drawings and documents have been supplied as examples to aid you during your mounting design:

DGM1303 – Driveline recommendation
DGM0600 – Drawing of electric clutch
DGM0106 – Drawing of front support bracket
DGS0000 – Sample wiring schematic for electric clutch
DGS0100 – Sample wiring schematic for electric clutch
DVC0108 – Drawing of electric primer – including schematics for hookup
DVC0109 – Drawing of electric oilless primer – including schematics for hookup.
DGS0400 – Sample pluming schematic for built-in heat exchanger
DHD0200 – HF pump drawing
DKD0103 – KSF pump drawing
DKD0600 – KSFH pump drawing
DPD0300 – PSF (Low Profile) pump drawing
DPD0301 – PSF (Standard) pump drawing
1201007 – Driveline info

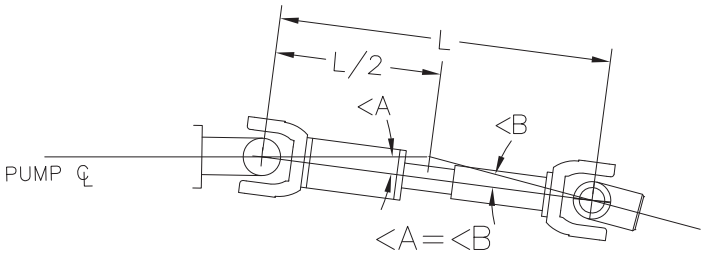
W.S. Darley & Co., PO Box 577, 200 E. Walnut Street, Chippewa Falls, WI 54729
1-800-634-7812 or (715) 726-2650 Fax: (715) 726-2656

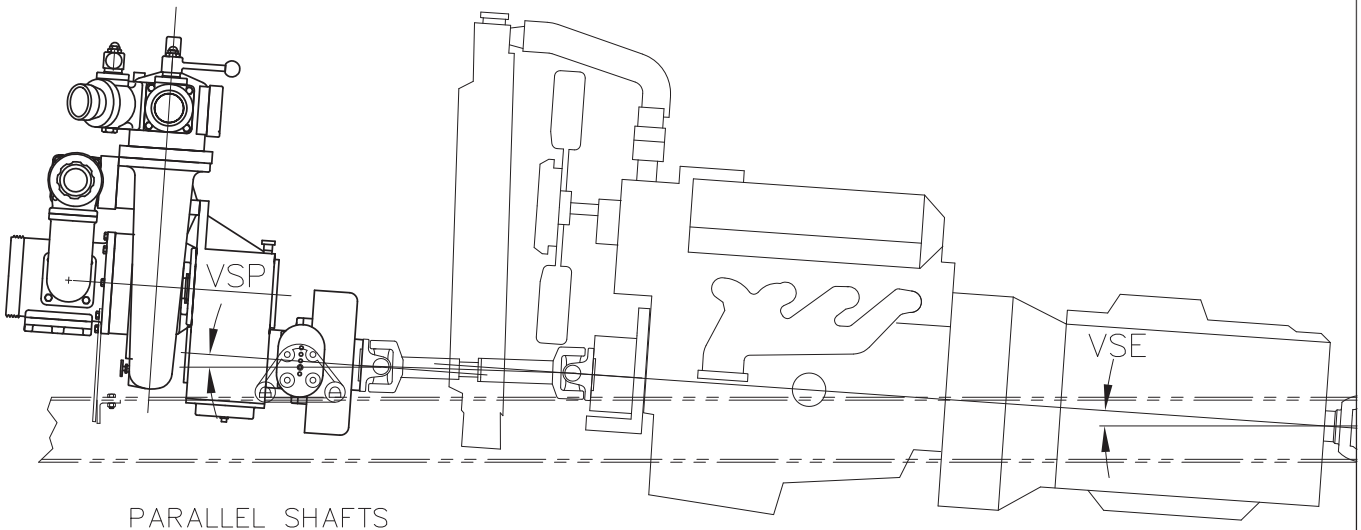
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



INTERSECTING ANGLES

ENGINE AND PUMP MUST
NOT BE OFFSET FROM
ONE ANOTHER



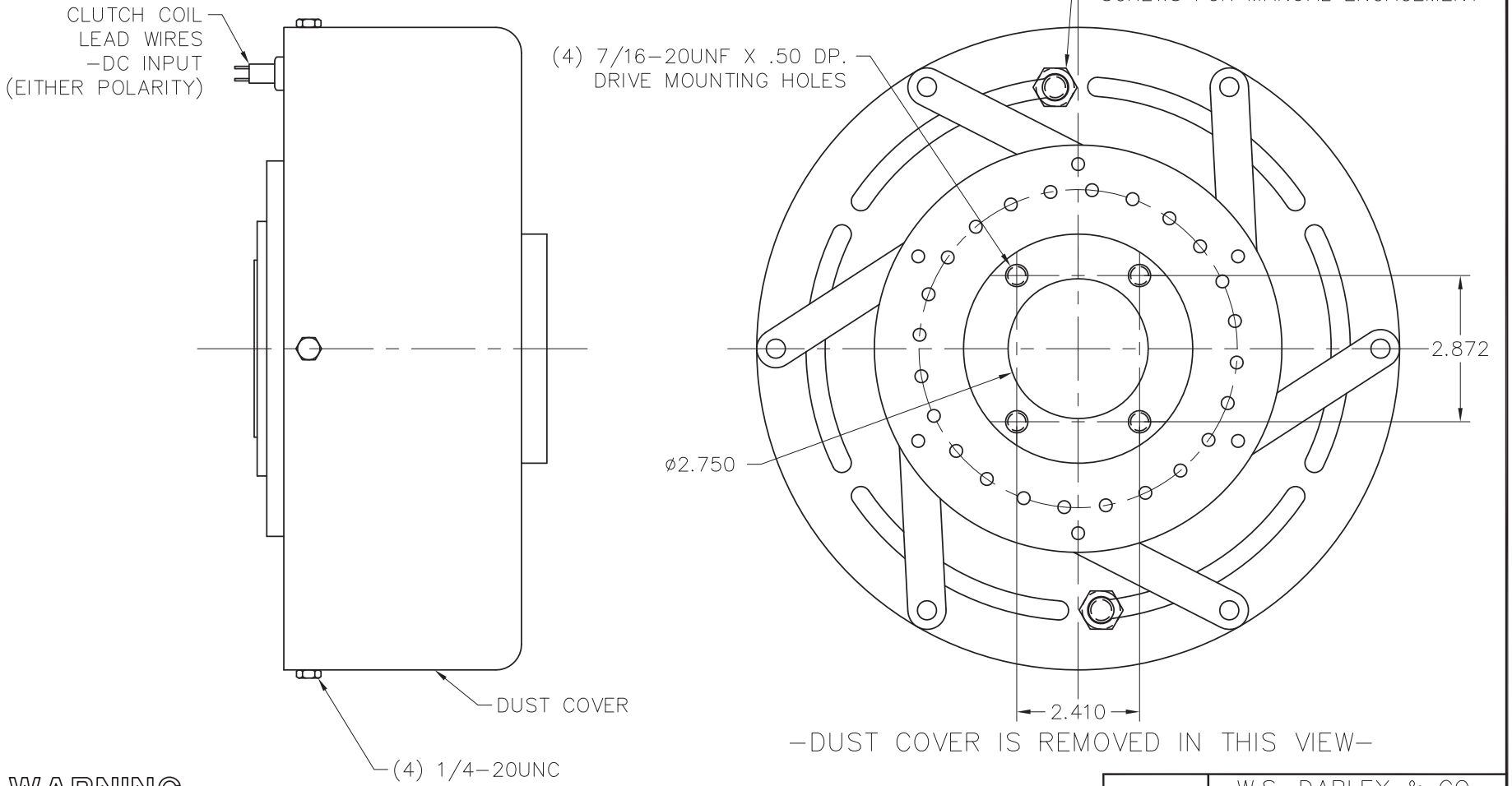


PARALLEL SHAFTS

VSE=VSP=SHAFT TO HORIZONTAL ANGLE
PUMP CAN BE OFFSET TO SIDE
WITHIN ANGLE LIMITS

INCH [MILLIMETER] — THIRD ANGLE PROJECTION

MATERIAL DESCRIPTION: –	MATERIAL NO. –	PATTERN NO. –	OLD PART NO. –	TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°	W.S. DARLEY & Co. MELROSE PARK, IL – CHIPPEWA FALLS, WI
					DWG – MOUNTING DRVLINE, FRONT FRONT MOUNT
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 TED CHKD DWS TRCD	DATE 10JAN2001 SCALE NTS
					DGMI303



WARNING:
–TO MANUALLY ENGAGE CLUTCH, ENGINE MUST BE OFF.
–DUST COVER MUST BE FASTENED IN POSITION DURING OPERATION.

OLD PART NO. P232

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

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

DWG – ELECTRIC CLUTCH ACCOMPANIES 1200516

DR'N TED
CHKD
TRCD

DATE MAY4,94

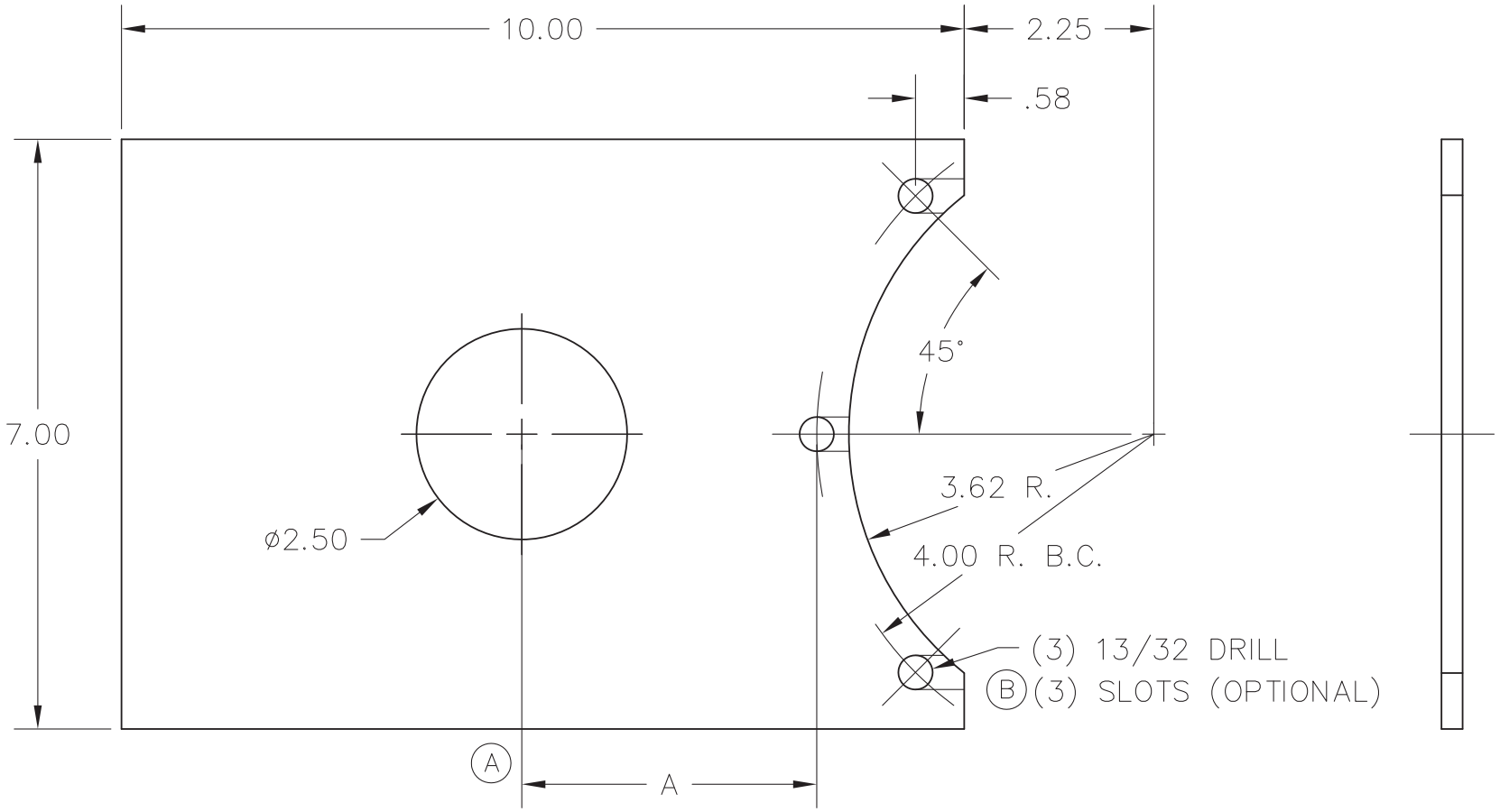
SCALE 1/2

DGM0600

Prepared By: EAP
Approved By: TED

PUMP TYPE	"A"
KSF/LSF	2.88
PSF	4.03

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	ADDED ø2.5 HOLE	25MAY01	01–149	DLW
B	ADDED OPTIONAL SLOTS	25MAY01	01–149	DLW



		OLD PART NO. G2492	TOLERANCE EXCEPT AS NOTED: FRAC DIM ±.01; .00 ±.01; .000 ±.005; ANGLES ±1°
MATERIAL DESCRIPTION: 1/4 X 7 X 10 FMS	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 TED; CHKD; TRCD

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

DWG – FRONT SUPPORT BRACKET KSF/PSF

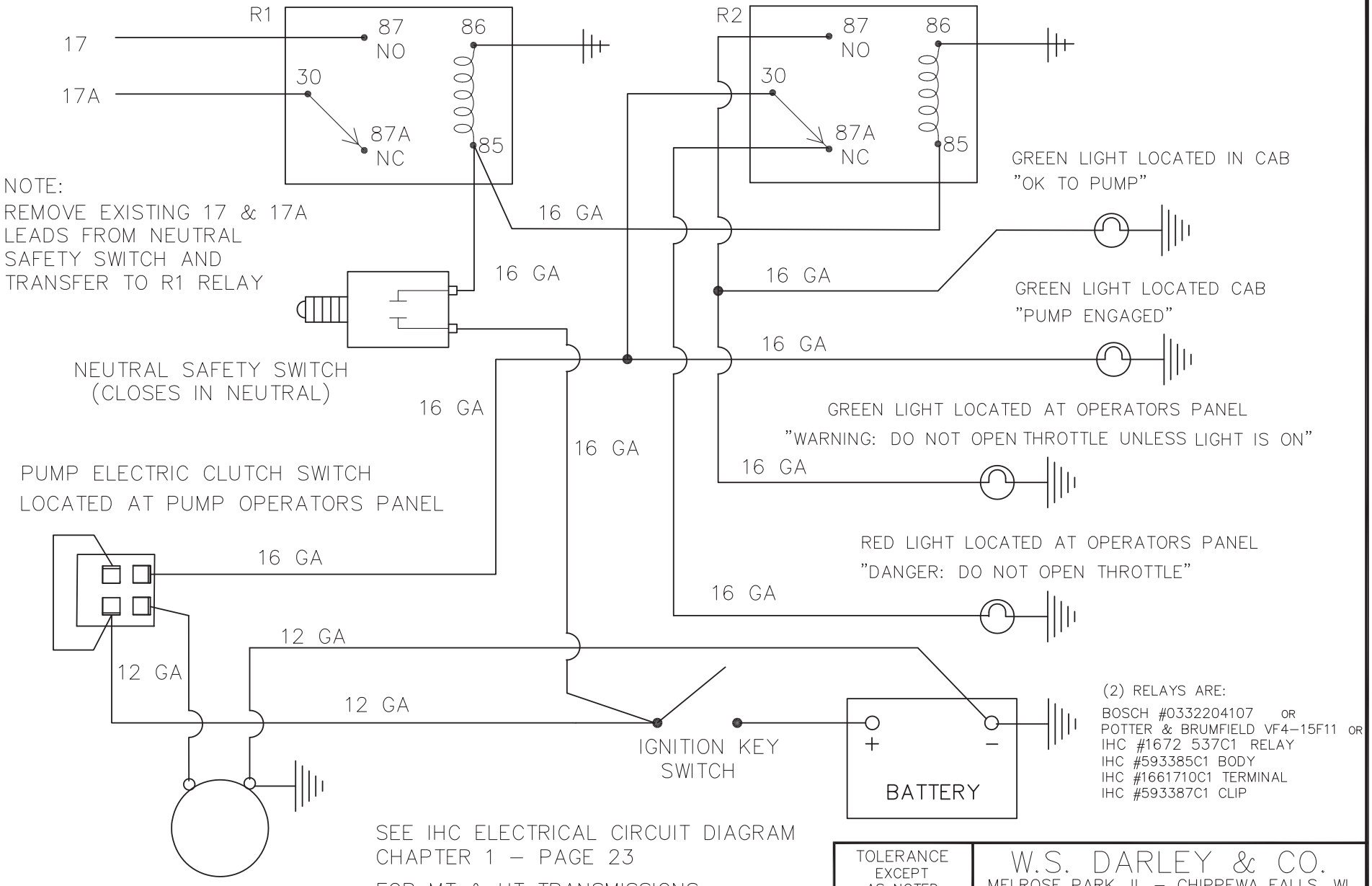
DATE OCT01,92

SCALE 1/2

DGM0106

Rev. 4
Date: 11/20/08
1201015.doc

Prepared By: EAP
Approved By: TED



SEE IHC ELECTRICAL CIRCUIT DIAGRAM
CHAPTER 1 – PAGE 23
FOR MT & HT TRANSMISSIONS

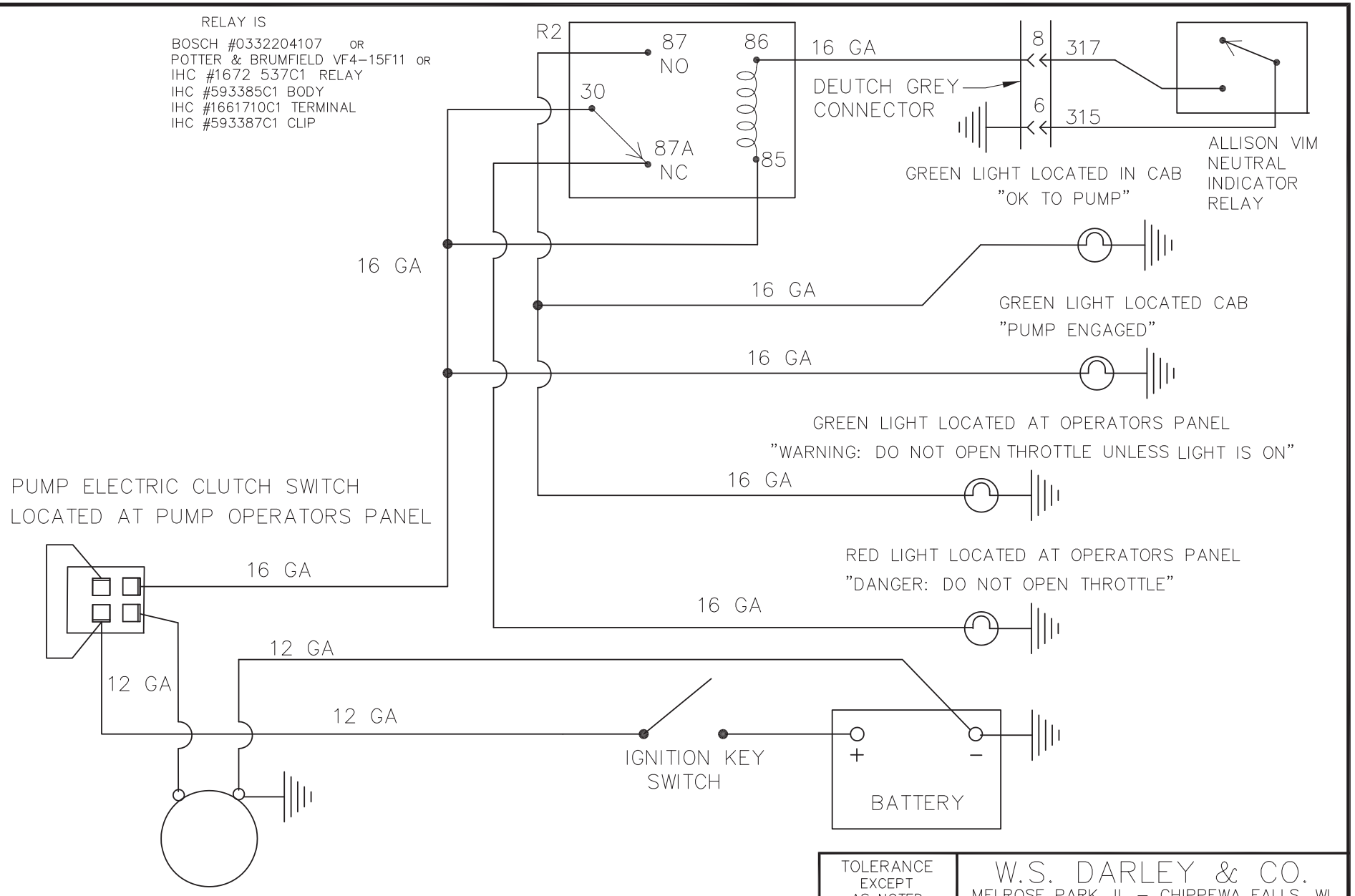
TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	OLD PART NO. AE002100	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
DR'N JCM CHKD TRCD		DWG – FRONT MT ELEC. CLUTCH FOR IHC CHASSIS
		DATE FEB18,94 SCALE NONE
		DGS0000

ALL DIMENSIONS IN INCHES UNLESS NOTED

DO NOT SCALE PRINT

Rev. 4
Date: 11/20/08
1201015.doc

Prepared By: EAP
Approved By: TED

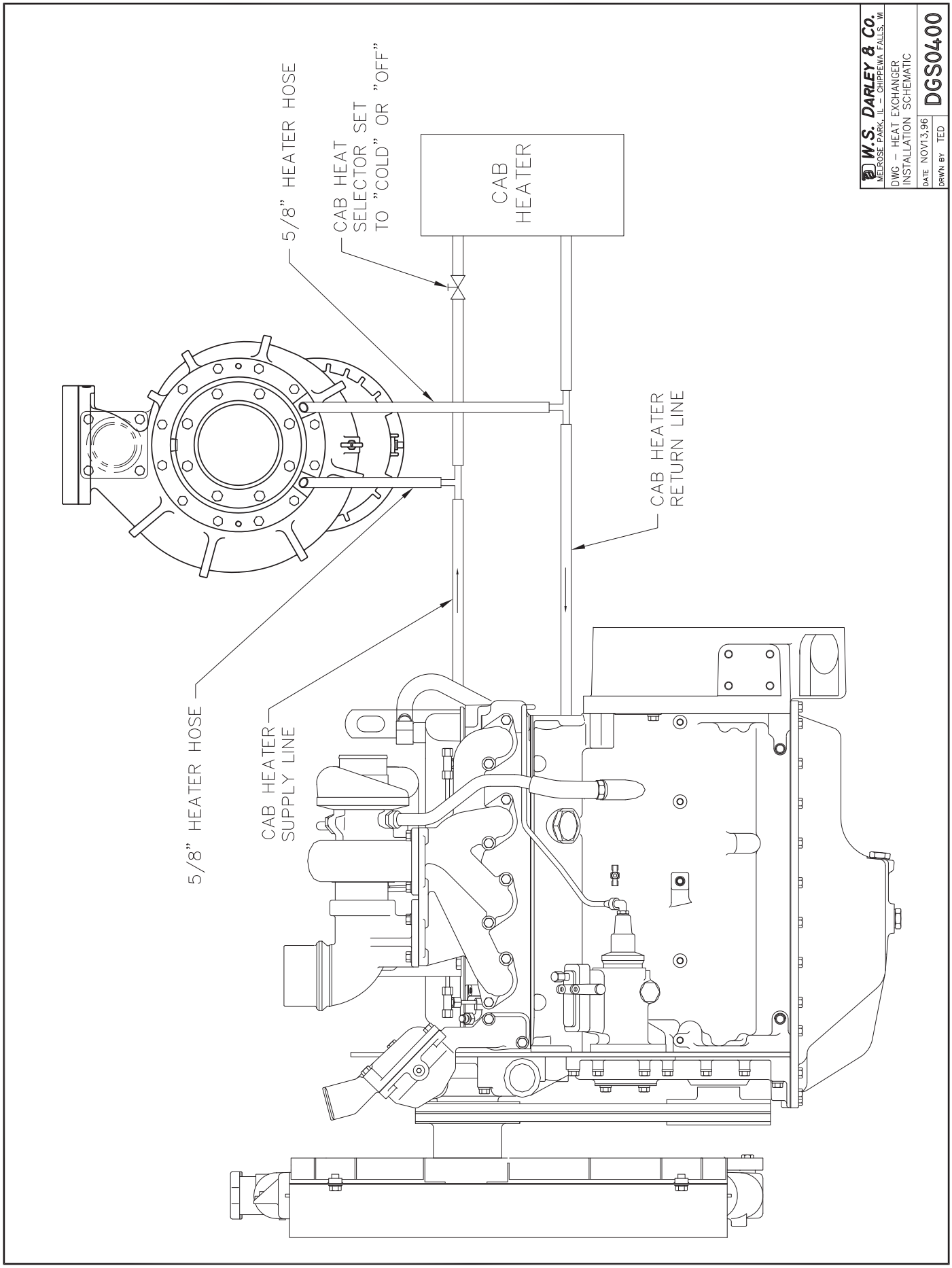


OLD PART NO. AE002200	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
	DR'N DWS	DWG – FRONT MT ELEC. CLUTCH FOR WORLD TRANS ECU
	CHKD	
	TRCD	DATE FEB21,94
		SCALE NONE
		DGS0100

ALL DIMENSIONS IN INCHES UNLESS NOTED

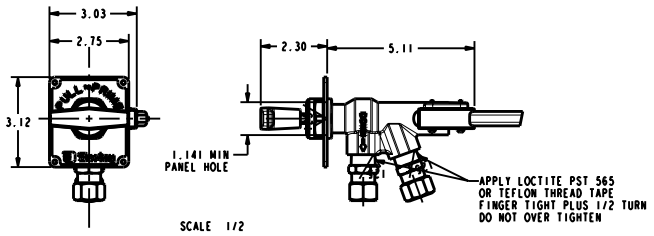
DO NOT SCALE PRINT

Rev. 4
Date: 11/20/08
1201015.doc


W.S. DARLEY & Co.
MELROSE PARK, IL – CHIPPEWA FALLS, WI
DWG – HEAT EXCHANGER INSTALLATION SCHEMATIC
DATE NOV13,96
DRWN BY TED
DGS0400
5/8" HEATER HOSE
CAB HEAT SELECTOR SET TO "COLD" OR "OFF"
CAB HEATER
CAB HEATER RETURN LINE
5/8" HEATER HOSE
CAB HEATER SUPPLY LINE

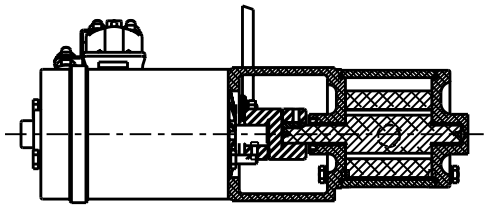
NAME:AAN OBJECT:DVC0207 DATE:17-Apr-09 09:42:43

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

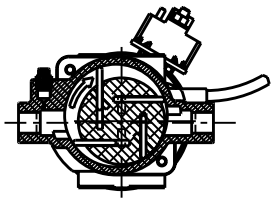


SCALE 1/2

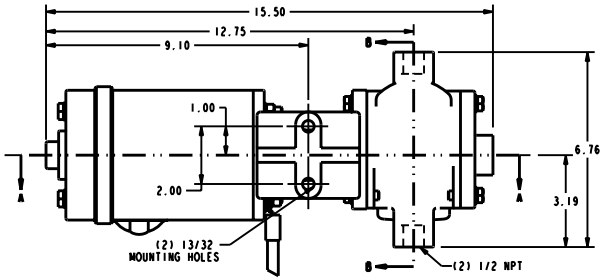
NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DVC0203, DVC0204 & DVC0205
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.

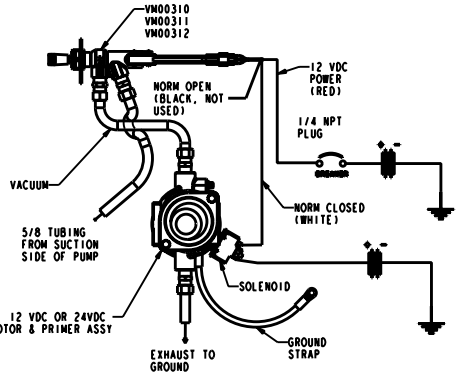


SECTION A-A
SCALE 1/2



SECTION B-B





NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

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

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

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

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

WEIGHT = 27 LB (12.1 KG)

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

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

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

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

DRN'D BJS | DATE 18-Apr-08 | CHK'D BDS | SCALE 1/2

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

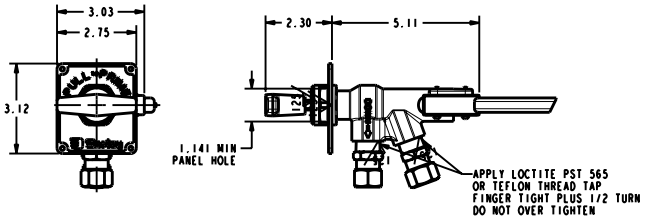
DWG - ELEC, PRIMER, VLV., 4 V NO TANK, CR. SECTION, EXPLODED

DVC0207

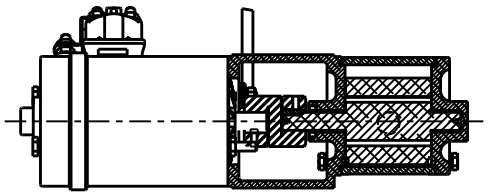
NAME:AAN OBJECT:DVC0209 DATE:29-Apr-09 10:21:45

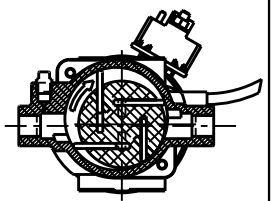
NO.	DESCRIPTION	PART NO.	QTY.
1	ASSEMBLY - PRIMER, ROTOR	4420105	1
2	BEARING - OILITE, 0.626 ID	1760023	2
3	COUPLING - 844093	2404500	1
4	CYLINDER - VACUUM PUMP	1020800	1
5	HEAD - CYLINDER INBOARD	2808904	1
6	HEAD - CYLINDER, OUTBOARD	2808800	1
7	HHCS - .313-18 x 1.00, SST	5400610	4
8	KEY - SQ., 0.19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

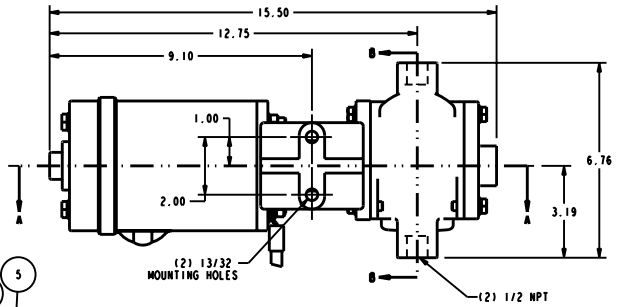
REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D
A	REMOVED FROST PLUG	4/15/09	5226	AAN

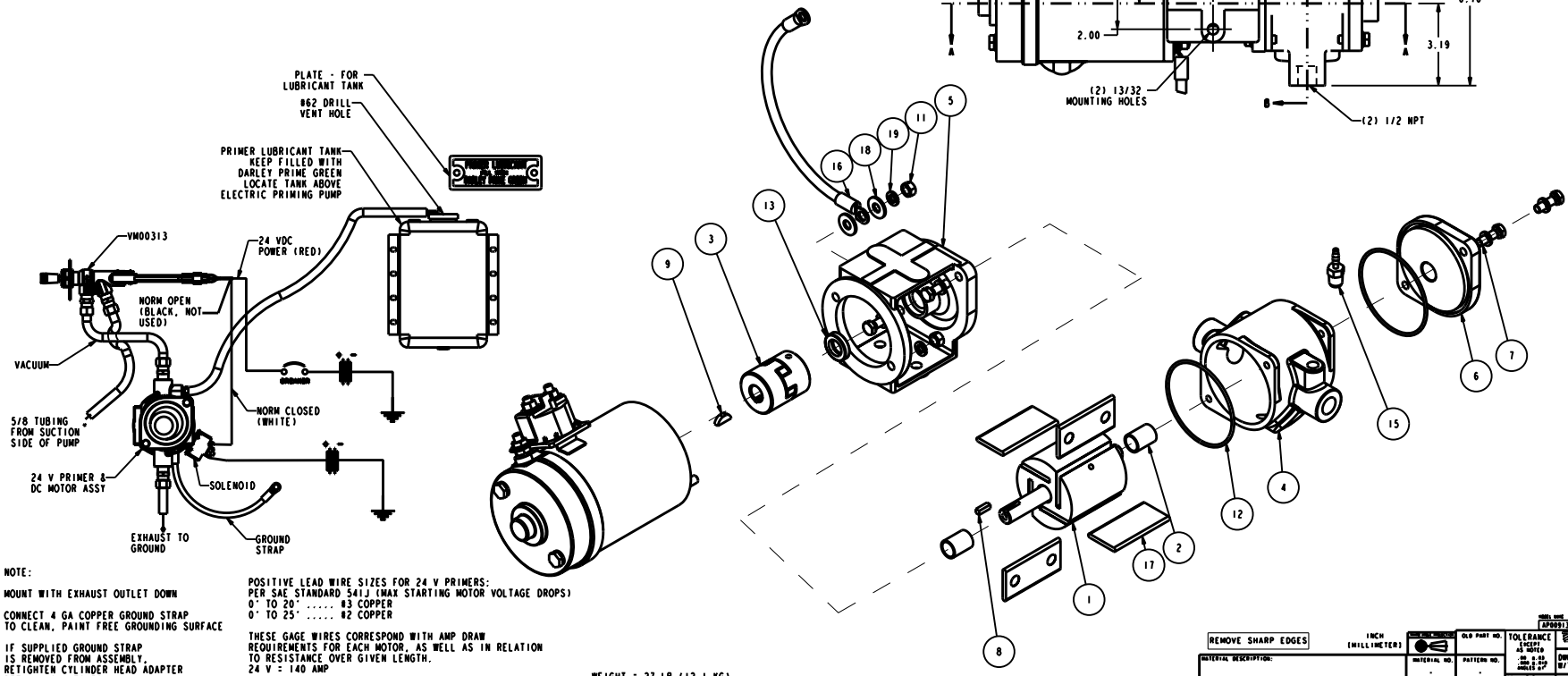


NOTE:
- FOR CROSS SECTION AND EXPLODED VIEW DRAWING SEE DRAWING DVC0203
- ALSO, WHEN REPLACING THE OLD VERSION OF THIS VALVE WITH THIS NEW VERSION; BUSHING 1762500 CAN BE USED TO RETROFIT IT TO THE EXISTING PANEL.









NOTE:

MOUNT WITH EXHAUST OUTLET DOWN

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

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

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

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

WEIGHT = 27 LB (12.1 KG)

REMOVE SHARP EDGES

INCH (MILLIMETER)

MATERIAL DESCRIPTION:

MATERIAL NO. -

PATTERN NO. -

OLD PART NO.

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

DO NOT SCALE PRINT

ALL DIMENSIONS IN INCHES UNLESS NOTED

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

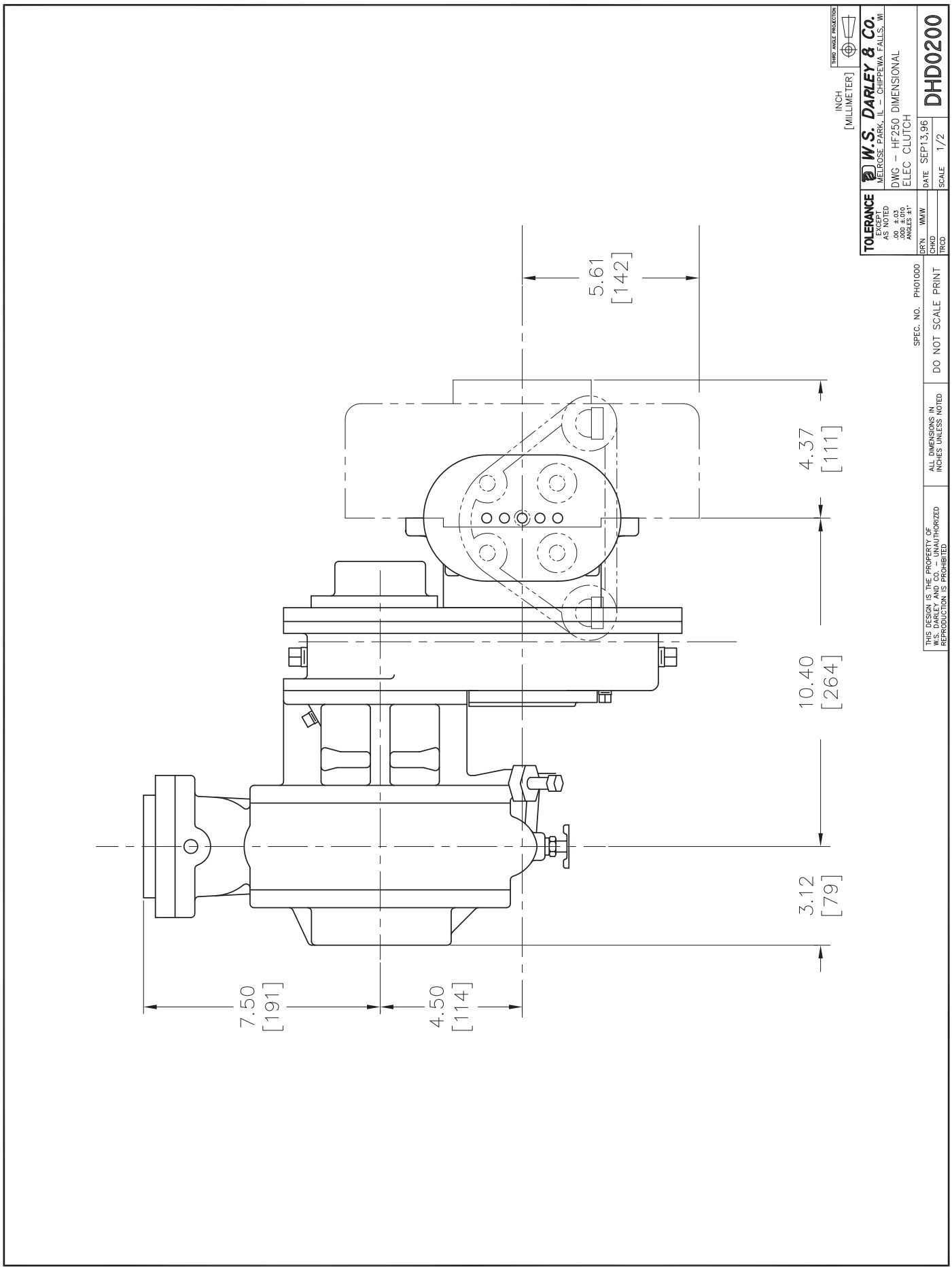
W.S. Darley & Co.
ITASCA, IL. CHICAGO'S FINEST, SINCE 1915

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

DATE 18-Apr-08

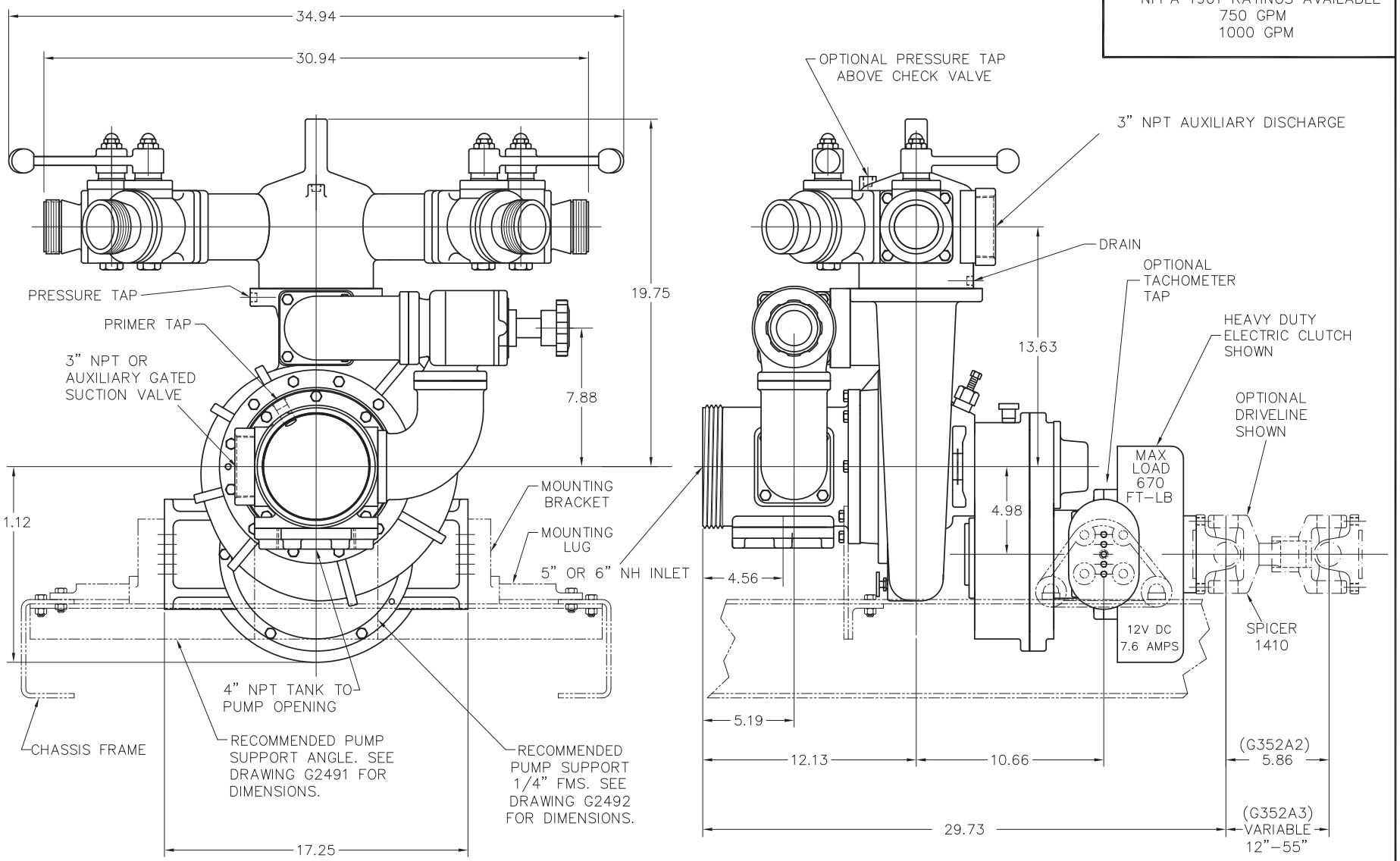
SCALE 1/2

DVC0209


5.61
[142]
4.37
[111]
10.40
[264]
3.12
[79]
7.50
[191]
4.50
[114]
INCH
[MILLIMETER]
THIRD ANGLE PROJECTION
W.S. DARLEY & Co.
MELROSE PARK, IL – CHIPPEWA FALLS, WI
DWG – HF250 DIMENSIONAL
ELEC CLUTCH
DHD0200
TOLERANCE
EXCEPT
AS NOTED
.00 ±.03
.000 ±.010
ANGLES ±1°
DRN WMW
CHKD
TRCD
DATE SEP13,96
SCALE 1/2
SPEC. NO. PH01000
ALL DIMENSIONS IN
INCHES UNLESS NOTED
DO NOT SCALE PRINT
THIS DESIGN IS THE PROPERTY OF
W.S. DARLEY AND CO. – UNAUTHORIZED
REPRODUCTION IS PROHIBITED

Prepared By: EAP
Approved By: TED

NFPA 1901 RATINGS AVAILABLE
750 GPM
1000 GPM

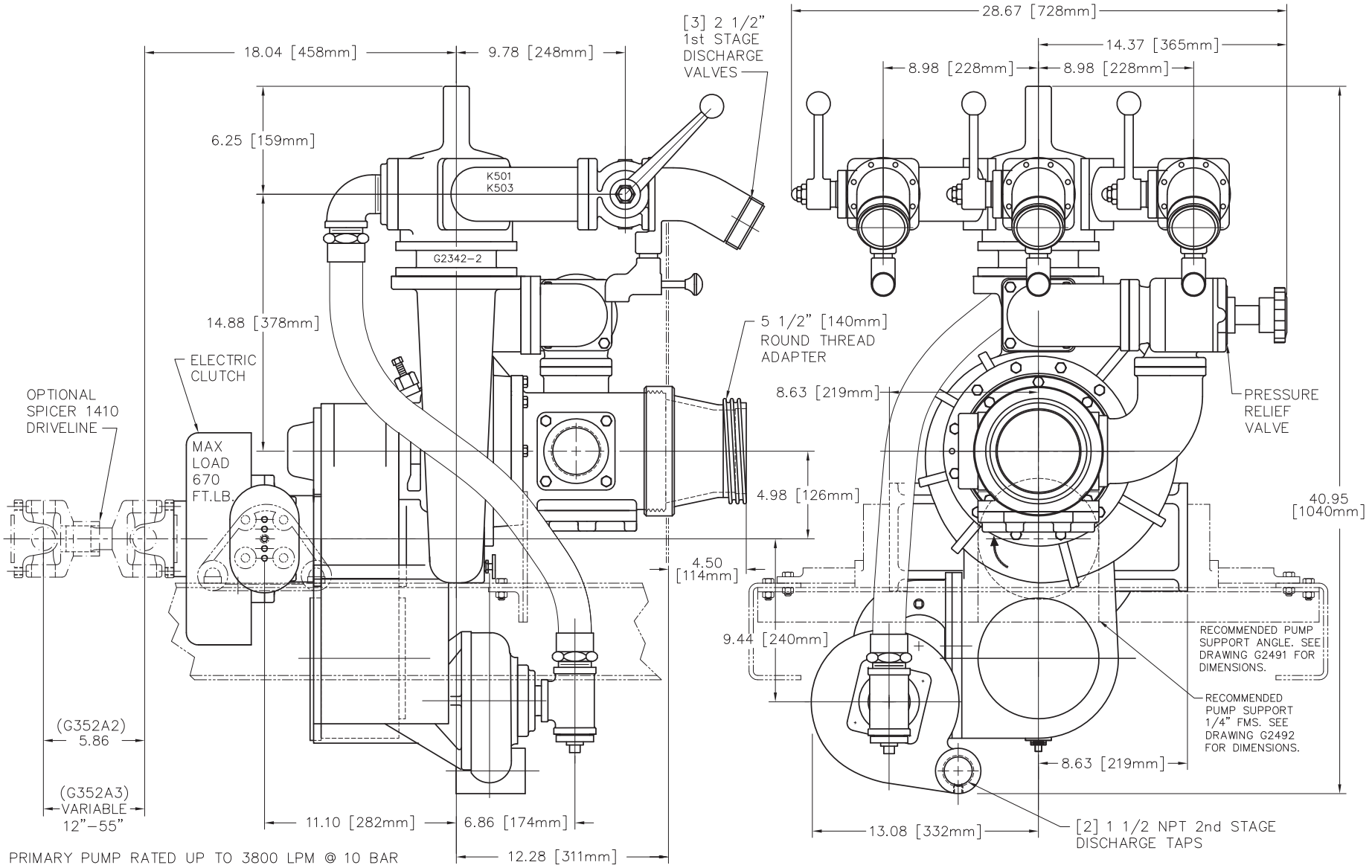


NOTES:
1) GEARCASE CAN BE INSTALLED UPSIDE-DOWN RESULTING IN A 4.98 DROP FROM DRIVELINE TO SUCTION CENTERLINE. MANY OTHER POSITIONS ARE AVAILABLE. PLEASE CONTACT W.S. DARLEY'S ENGINEERING DEPARTMENT FOR ADDITIONAL INFORMATION.

	OLD PART NO. K668	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI	
MATERIAL DESCRIPTION: –	MATERIAL NO. –	PATTERN NO. –	DWG – KSF DIMENSIONAL –	
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 MCR CHKD TRCD 11/93 TED	DATE JUL09,91 SCALE 1/4

DKD0103

Rev. 4
Date: 11/20/08
1201015.doc



PRIMARY PUMP RATED UP TO 3800 LPM @ 10 BAR

SIMULTANEOUS PERFORMANCE: (1st STAGE & 2nd STAGE)

3030 LPM @ 10 BAR & 760 LPM @ 22 BAR
3400 LPM @ 10 BAR & 380 LPM @ 27 BAR
1140 LPM @ 17 BAR & 760 LPM @ 35 BAR
1500 LPM @ 17 BAR & 380 LPM @ 39 BAR
380 LPM @ 21 BAR & 760 LPM @ 42 BAR
760 LPM @ 21 BAR & 380 LPM @ 46 BAR

APPROX WEIGHT = 575 LBS [261 KG]

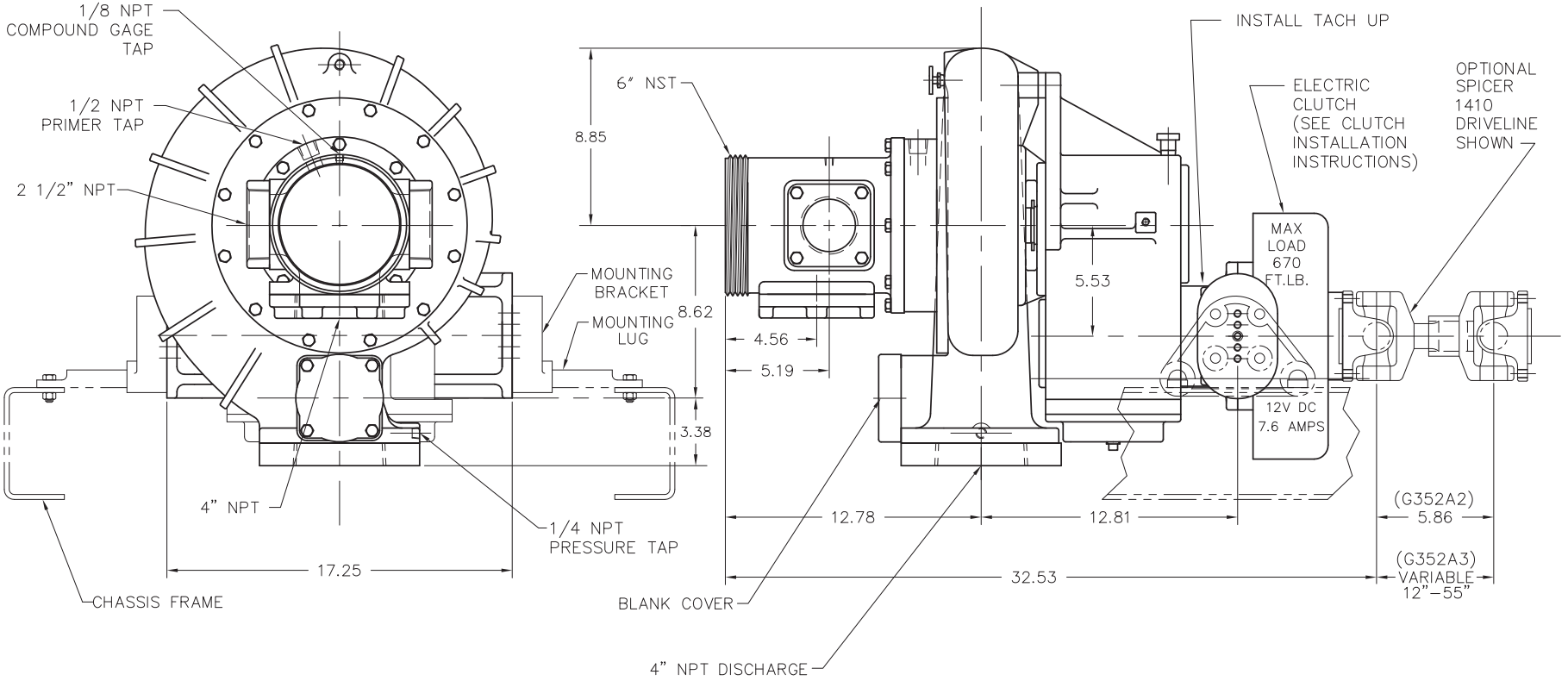
MATERIAL DESCRIPTION:	MATERIAL NO.	OLD PART NO. K717	TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
	PATTERN NO.			DWG – KSFH DIMENSIONAL
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED	ALL DIMENSIONS IN INCHES UNLESS NOTED	DO NOT SCALE PRINT	DR'N DWS CHKD TRCD	DATE APR03,94 SCALE 1/4 DKD0600

Prepared By: EAP
Approved By: TED

Rev. 4
Date: 11/20/08
1201015.doc

Prepared By: EAP
Approved By: TED

PSF FRONT MOUNT PUMP
NFPA 1901 RATINGS AVAILABLE
1000 GPM
1250 GPM
1500 GPM



NOTE: INSTALL TACH UP

MATERIAL:		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	

PART NO.	DATE	CHANGE

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

DWG – PSF DIMENSIONAL
LOW PRO

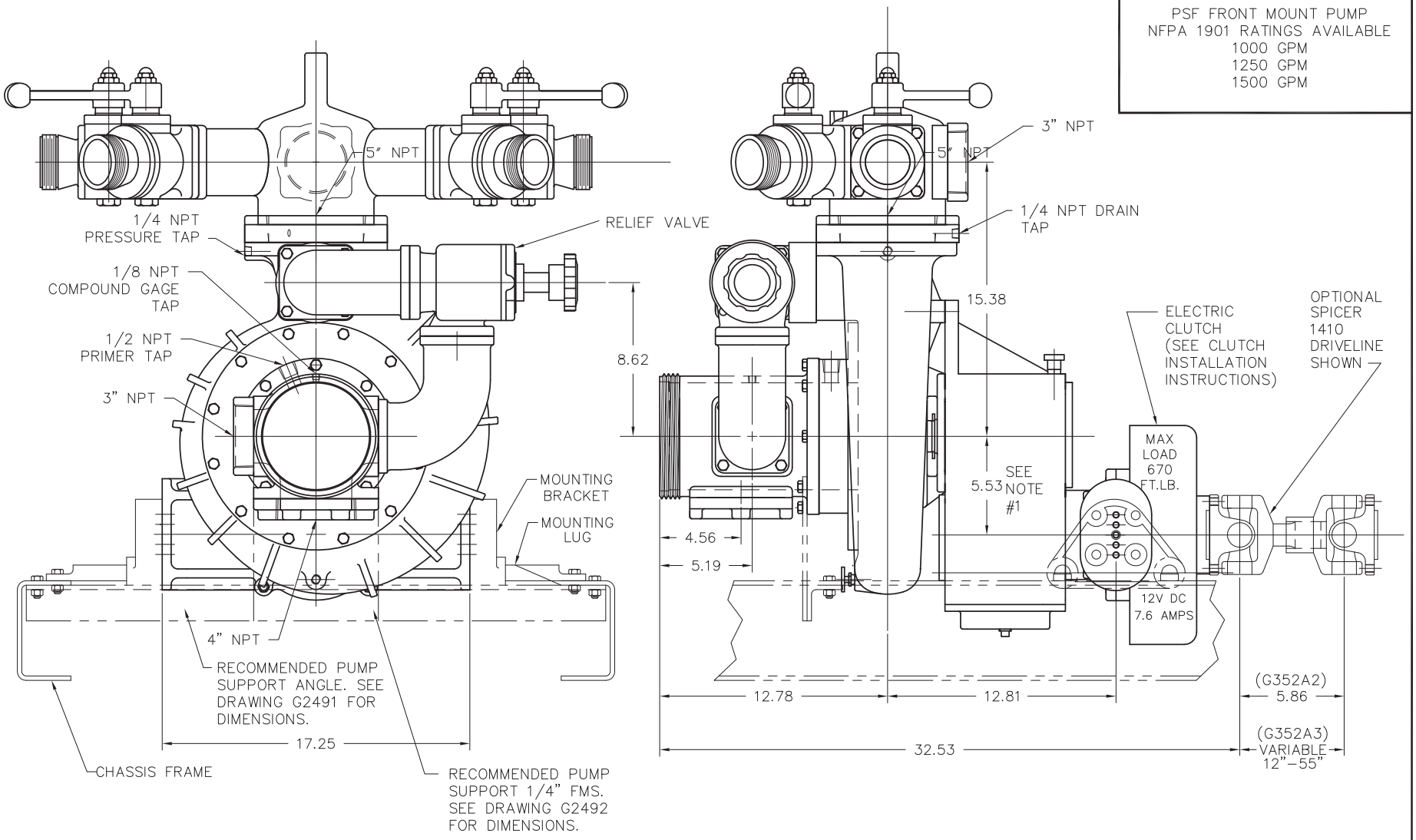
DR'N	TED
CHKD	
TRCD	
DATE	JAN28,97
SCALE	1/4

DPD0300

Rev. 4
Date: 11/20/08
1201015.doc

Prepared By: EAP
Approved By: TED

PSF FRONT MOUNT PUMP
NFPA 1901 RATINGS AVAILABLE
1000 GPM
1250 GPM
1500 GPM



NOTES:
1) GEARCASE CAN BE INSTALLED UPSIDE–DOWN RESULTING IN A 5.53 DROP FROM DRIVELINE TO SUCTION CENTERLINE. MANY OTHER POSITIONS ARE AVAILABLE. PLEASE CONTACT W.S. DARLEY'S ENGINEERING DEPARTMENT FOR ADDITIONAL INFORMATION.

PART NO.	DATE	CHANGE

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

DWG – PSF DIMENSIONAL

MATERIAL:	OLD PART NO. P187
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 MCR; CHKD; TRCD TED 11/93

DATE 11–1–90
SCALE 1/4

DPD0301

Rev. 4
Date: 11/20/08
1201015.doc

PTO Safety Information

These instructions are for your safety and the safety of the end user. Read them carefully until you understand them.

General Safety Information

To prevent injury to yourself and/or damage to the equipment:

- Read carefully all owner's manuals, service manuals, and/or other instructions.
- Always follow proper procedures, and use proper tools and safety equipment.
- Be sure to receive proper training.
- Never work alone while under a vehicle or while repairing or maintaining equipment.
- Always use proper components in applications for which they are approved.
- Be sure to assemble components properly.
- Never use worn-out or damaged components.
- Always block any raised or moving device that may injure a person working on or under a vehicle.
- Never operate the controls of the Power Take-Off or other driven equipment from any position that could result in getting caught in the moving machinery.

Proper Matching of P.T.O.

WARNING: A Power Take-Off must be properly matched to the vehicle transmission and to the auxiliary equipment being powered. An improperly matched Power Take-Off could cause severe damage to the vehicle transmission, the auxiliary driveshaft, and/or to the auxiliary equipment being powered. **Damaged components or equipment could malfunction causing serious personal injury to the vehicle operator or to others nearby**.

To avoid personal injury and/or equipment damage:

- Always refer to Chelsea catalogs, literature, and owner's manuals. Follow Chelsea recommendations when selecting, installing, repairing, or operating a Power Take-Off.
- Never attempt to use a Power Take-Off not specifically recommended by Chelsea for the vehicle transmission.
- Always match the Power Take-Off's specified output capabilities to the requirements of the equipment to be powered.
- Never use a Power Take-Off whose range of speed could exceed the maximum.

Cold Weather Operation of Powershift P.T.O.

WARNING: During extreme cold weather operation [32° F (0°C) and lower], a disengaged Powershift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the Power Take-Off clutch plates, the oil will rapidly heat up and the viscous drag will quickly decrease.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- The driven equipment must be left in the disengaged position when not in operation.
- Do not operate the driven equipment until the vehicle is allowed to warm up.

This symbol warns of possible personal injury.

Reprinted with permission from: Parker Hannifin Corporation, Chelsea Products Division
Bulletin HY25-1380-M1/US, April 2002

Rotating Auxiliary Driveshafts

WARNING:

- Rotating auxiliary driveshafts are dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.
- Do not go under the vehicle when the engine is running.
- Do not work on or near an exposed shaft when the engine is running.
- Shut off the engine before working on the Power Take-Off or driven equipment.
- Exposed rotating driveshafts must be guarded.

Guarding Auxiliary Driveshafts

WARNING: We strongly recommend that a Power Take-Off and a directly mounted pump be used to eliminate the auxiliary driveshaft whenever possible. If an auxiliary driveshaft is used and remains exposed after installation, it is the responsibility of the vehicle designer and P.T.O. installer to install a guard.

Using Set Screws

WARNING: Auxiliary driveshafts may be installed with either recessed or protruding set screws. If you choose a square head set screw, you should be aware that it will protrude above the hub of the yoke and may be a point where clothes, skin, hair, hands, etc. could be snagged. A socket head set screw, which may not protrude above the hub of the yoke, does not permit the same amount of torquing as does a square head set screw. Also, a square head set screw, if used with a lock wire, will prevent loosening of the screw caused by vibration. Regardless of the choice made with respect to a set screw, an exposed rotating auxiliary driveshaft must be guarded.

Important: Safety Information and Owner's Manual

Chelsea Power Take-Offs are packaged with safety information decals, instructions, and owner's manual. These items are located in the envelope with the P.T.O. mounting gaskets. Also, safety information and installation instructions are packaged with some individual parts and kits. **Be sure to read the owner's manual before installing or operating the P.T.O.** Always install the safety information decals according to the instructions provided. Place the owner's manual in the vehicle glove compartment.

WARNING: Operating the P.T.O. with the Vehicle in Motion

Some Power Take-Offs may be operated when the vehicle is in motion. To do so, the P.T.O. must have been properly selected to operate at highway speeds and correctly matched to the vehicle transmission and the requirements of the driven equipment.

If in doubt about the P.T.O. specifications and capabilities, avoid operating the P.T.O. when the vehicle is in motion. Improper applications and/or operation can cause serious personal injury or premature failure of the vehicle, the driven equipment, and/or the P.T.O.

Always remember to disengage the P.T.O. when the driven equipment is not in operation.

This symbol warns of possible personal injury.

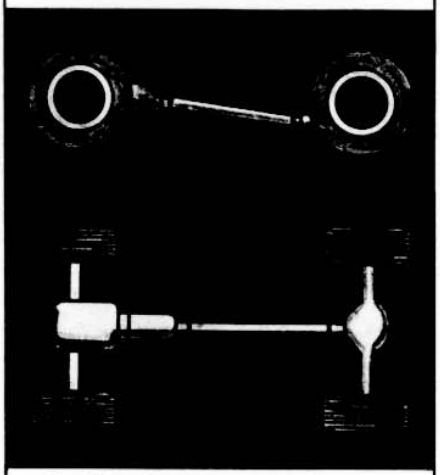
Reprinted with permission from: Parker Hannifin Corporation, Chelsea Products Division
Bulletin HY25-1380-M1/US, April 2002

ANGLES AND PHASING

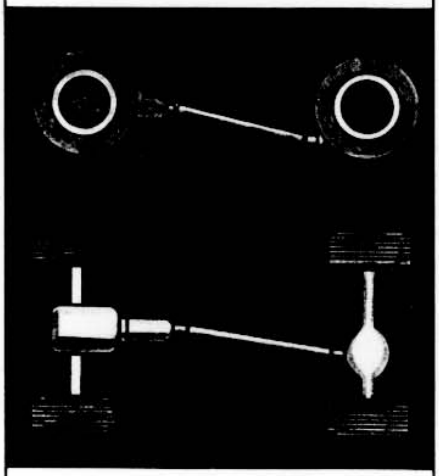
10-16-98 1201007 PG 1 OF 5

The u-joint operating angle is the angle formed by two yokes connected by a cross and bearing kit. There are two kinds of u-joint angles.

The simple one plane angle found in most installations has all driveline slope confined to one plane; usually the vertical plane. The other type of driveline angle is the compound angle in two planes. This is found in driveline designs where offset exists in both the vertical and horizontal planes. For detailed information on troubleshooting compound angles, contact your Spicer Service Representative.



One Plane Angle Driveshaft, Side and Top View



Two Plane Angle Driveshaft, Side and Top View

High angles combined with high R.P.M. is the worst combination, resulting in reduced u-joint life. Too large and unequal u-joint angles can cause vibrations and contribute to u-joint, transmission and differential problems. The improper u-joint angles must be corrected.

Ideally, the operating angles on each end of the driveshaft should be equal to or within 1 degree of each other, have a 3 degree maximum operating angle and have at least 1/2 of a degree continuous operating angle.

R.P.M. is the main factor though in determining maximum allowable operating angles. As a guide to maximum normal operating angles, refer to the chart listed.

DRIVESHAFT RPM	MAX. NORMAL OPERATING ANGLES
5000	3° 15′
4500	3° 40′
4000	4° 15′
3500	5° 0′
3000	5° 50′
2500	7° 0′
2000	8° 40′
1500	11° 30′

Tube diameter and normal operating RPM determine maximum allowable tube length. If "critical length" is reached, a three-joint driveshaft with center support or a Spicer Graph-Lite™ driveshaft must be used. Refer to the Spicer "Driveshaft Speed Calculator"—Form M3-11 TRNG.

When the transmission output shaft centerline and axle input shaft centerline are parallel, the u-joint operating angle permissible is length of driveshaft divided by five. Example: A short coupled driveshaft with a 15″ length would be limited to 3 degrees maximum operating angle. A 30″ shaft would be limited to 6 degrees.

When the transmission output shaft centerline and axle input shaft centerline intersect midway of the driveshaft, the joint angles are equal. However, due to the change to unequal joint angles during up and down axle movement, this is a more undesirable condition than parallel centerlines. In this case, the maximum u-joint operating angle is determined by dividing length of driveshaft by ten. Example: A 30″ driveshaft with intersecting angles would have a 3 degree permissible operating angle.

CHECKING DRIVESHAFT ANGLES IN THE VERTICAL OR HORIZONTAL PLANE

WARNING: Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Do not work on a shaft (with or without a guard) when the engine is running.

Use the following procedure to check driveshaft angles for proper u-joint operating angles.

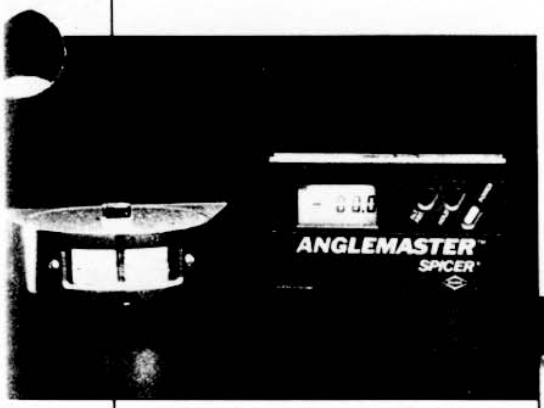
1. Inflate all tires to the pressure at which they are normally operated. Park the vehicle on a surface which is as nearly level as possible both from front-to-rear and from side-to-side. Do not attempt to level the vehicle by jacking up the front or rear axles. Shift the transmission to neutral and block the front tires. Jack up a rear wheel.

2. Rotate the wheel by hand until the output yoke on the transmission is vertical, and lower the jack. This simplifies measurement later. Check driveshaft angles in the same loaded or unloaded condition as when the vibrations or noise occurred. Always try to check driveline angles in both loaded and unloaded conditions.

ANGLES AND PHASING

OK

10-16-98 1201007 PG 2 OF 5



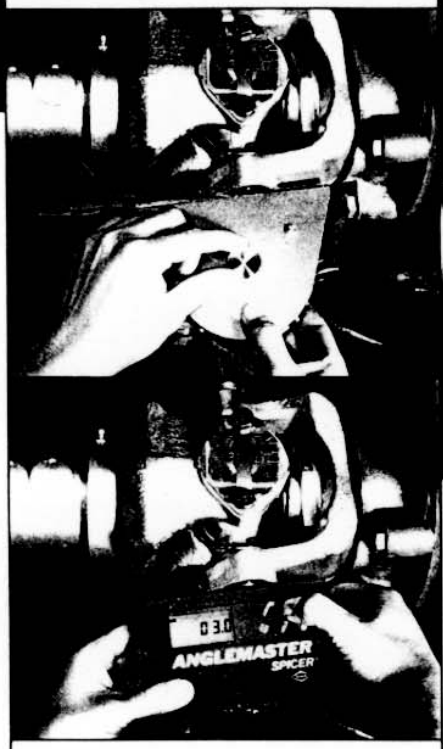
Spirit Level Protractor and Spicer "Anglemaster™" Inclinometer

3. To determine driveshaft angles, a spirit level protractor or Spicer Anglemaster™ Electronic Driveline Inclinometer is required. On a protractor, when angles are read from the 0 degree mark (horizontally—on the driveshaft) record and use the angle shown. When angles are read from either of the 90 degree marks (vertically—on the flange) do not record the angle shown on the protractor since the 90 degree marks must be understood to be the same as 0 degrees on the horizontal plane. Thus, if a vertical reading is 85 degrees, the angle being measured is 5 degrees (90-85 = 5 degrees).

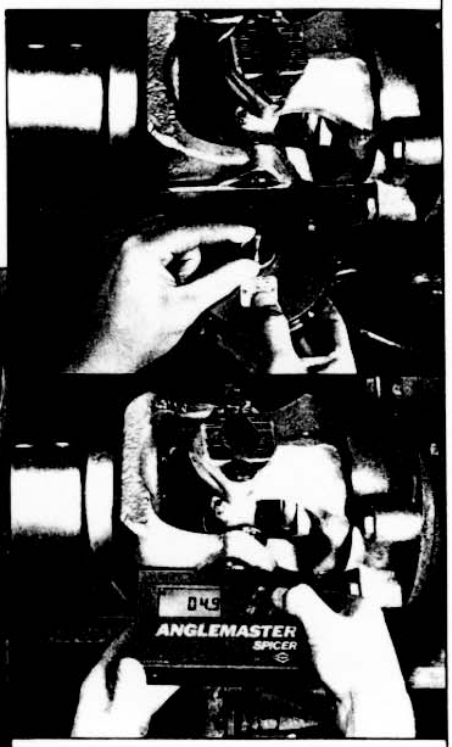
   To use the Spicer Anglemaster Electronic Driveline Inclinometer, simply place the sensor on the component to be measured. A display module will show what the angle is and in which direction it slopes. (Available only from Dana Corporation and your Spicer Service Representative.)

   If using a protractor, all angles should be read within 1/4 degree and they should be measured with the protractor held plumb on a clean flat surface. The Spicer Anglemaster Electronic Driveline Inclinometer is automatically accurate to within 1/10 of 1 degree.

Always measure the slope of the drivetrain going from front to rear. A component slopes downward if it is lower at the rear than the front. A component slopes upward when it is higher at the rear than it is in front.



4. Check and record the angle on the main transmission. This reading can be taken on the end yoke lug, with the bearing assembly removed or on a flat surface of the main transmission parallel or perpendicular to the output yoke lug plane. *Record your readings on a sketch.*



5. Now check the driveshaft angle between the transmission and axle or forward axle. On short tube length driveshafts, check the angle of the driveshaft on either the tube or slip yoke lug with the bearing assembly removed. On long tube length driveshafts, measure the angle on the tube at least 3" away from the circle welds or at least 1" away from any balance weights. Be sure to remove any rust, scale or sound deadening compounds from the tube to obtain an accurate measurement.

A 5 minute videotape that outlines instructions for "Measuring and Calculating Driveline Operating Angles" is available at $60.00 from

Spicer Universal Joint Division
Dana Corporation
P.O. Box 955
Toledo, Ohio 43695
Attn: Advertising Department

OK

UNIVERSAL JOINT SIZES/RATINGS/SPEEDS/TUBE SIZES

10-16-98 1201007 PG 3 OF 5

Spicer U-Joint Sizes	Electric Motor Torque		Gas or Diesel Torque		Short Duration Torque		Torsional Strength Min. Elastic Limit		*Max. r.p.m.	Standard Tube Size	**Max. Length ℄-℄ Installed@ Max. Rated r.p.m.	
	Lbs. ft.	N.m	Lbs. ft.	N.m	Lbs. ft.	N.m	Lbs. ft.	N.m			In.	mm
Light Duty												
1000	75	100	50	70	310	420	420	570	2,500	1¾" × .065	55	1,397
1210	95	130	65	90	420	570	850	1,150	6,000	2½" × .065	43	1,092
1280	140	190	95	130	570	775	1,250	1,695	6,000	2½" × .083	43	1,092
1310	195	265	130	175	800	1,085	1,600	2,170	6,000	3" × .083	47	1,194
1330	220	300	150	205	890	1,205	1,850	2,510	5,000	3½" × .083	50.5	1,283
										4" × .083	54	1,377
Medium Duty												
1350	310	420	210	285	1,240	1,680	2,260	3,065	5,000	3" × .083	51	1,295
										3½" × .083	55	1,397
										4" × .083	59	1,499
1410	375	510	250	340	1,500	2,035	2,700	3,660	5,000	3" × .083	51	1,295
										3½" × .083	55	1,397
										4" × .083	59	1,499
1480	1500	1680	1,000	1,460	12,000	16,270	11,300	15,475	5,000	3½" × .083	55	1,397
										4" × .083	59	1,499
										4½" × .095	63	1,600
Heavy Duty												
1550	640	870	430	585	2,400	3,255	4,400	5,965	5,000	3½" × .095	55	1,397
										4" × .083	59	1,499
										4" × .095	63	1,600
1610	975	1,320	640	870	3,650	4,950	6,500	8,815	4,500	3½" × .134	58	1,473
										4" × .134	62	1,574
1710	1,330	1,805	900	1,220	4,800	6,510	8,000	10,845	4,500	4" × .134	62	1,575
										4½" × .134	66	1,676
1760	1,630	2,210	1,100	1,490	5,800	7,865	10,200	13,830	4,500	4 1/16" × .165	62	1,575
										4 3/32" × .180	62	1,676
1810	1,850	2,510	1,250	1,695	6,500	8,815	12,000	16,270	4,500	4½" × .134	66	1,676
										4½" × .259	65	1,651
1880	2,550	3,455	1,700	2,305	8,900	12,065	16,000	21,695	3,000	4½" × .259	80	2,032
Heavy Duty												
1910	3,600	4,880	2,400	3,255	12,000	16,270	20,800	28,201	2,500	5" × .258	80	2,032
1930	5,400	7,320	3,600	4,880	18,000	24,405	34,000	46,100	2,500	5" × .258	80	2,032
2010	11,280	15,300	7,523	10,200	37,600	51,000	75,200	102,000	3,500	6¾" × .361	80	2,032
2110	16,000	21,760	10,800	14,500	53,470	72,500	106,940	145,000	3,200	8" × .875	80	2,032
2210	24,300	33,000	16,220	22,000	81,130	110,000	162,260	220,000	2,500	8" × .984	80	2,032

* Rating applies to Universal Joint.

** Lengths shown with exception of 1900 thru 2210 sizes are based on .66 of the calculated critical speed at max. rated RPM (as applied to industrial applications). For vehicle applications or driveshaft assembly lengths exceeding 80 inches, consult Spicer Universal Joint Division, Application Engineering with complete design requirements.

MAXIMUM OPERATING ANGLES■

For Two Joint Shafts with Equal or Intersecting Angles

R.P.M. is the main factor in determining maximum allowable operating angles. As a guide to maximum normal operating angles, refer to the chart listed.

Tube diameter and normal operating RPM determine maximum allowable tube length. If "critical length" is reached, a three-joint driveshaft with center support or a Spicer Graph-Lite™ driveshaft must be used. Refer to the Spicer "Driveshaft Speed Calculator"—Form M3-11 TRNG.

Driveshaft RPM	Max. Normal Operating Angles		Driveshaft RPM	Max. Normal Operating Angles	
5000	3°	15′	3000	5°	50′
4500	3°	40′	2500	7°	0′
4000	4°	15′	2000	8°	40′
3500	5°	0′	1500	11°	30′

■ Based on application experience (1000 rad/sec² acceleration)

STRAIGHTENING AND BALANCING ANGLES AND PHASING

OK

10-16-98 1201007 PG 4 OF 5

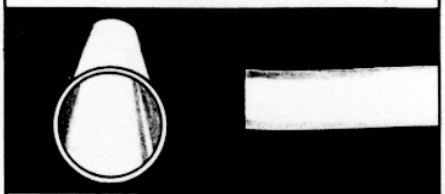
STRAIGHTENING AND BALANCING THE DRIVESHAFT
(Excluding Aluminum)

The rebuilding of a driveshaft assembly usually consists of replacing worn cross and bearing assemblies with a new kit. These kits replace the part of a driveshaft most subject to wear in operation. The potential off-center condition present in the cross and bearing assemblies makes it desirable to balance every assembly after installing new cross and bearing kits.

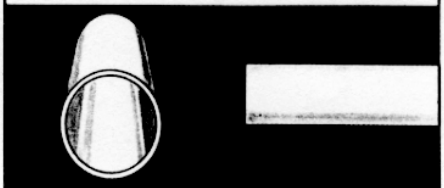
When the tubing is bent or twisted or the tube fittings are distorted, it will be necessary to replace the damaged parts.

Properly assemble the new components into the tube and straighten the shaft assembly before tack welding, to be sure the parts are on center. This can be done by mounting the complete assembly in the appropriate tooling and straightening until the ends of the tube run concentric within 0.005 T.I.R. Recheck for runout.

RUNOUT VERSUS OVALITY



Runout-circular diameter, bent tubing



Ovality-oval diameter straight tubing

When checking for runout, it is important to distinguish between runout and ovality. Runout is when the tube is slightly bent but still maintains its circularity throughout the tube. During dynamic balancing, a dial indicator will show runout ONCE per revolution.

Ovality occurs when the tube is not circular but oval in shape. During dynamic balancing, a dial indicator will display ovality TWICE per revolution. Even though a tube may be straight, ovality will make it seem bent. A tube with ovality may be used up to a 0.010 T.I.R. runout reading. Beyond this limit the tube must be discarded for driveshaft purposes.

After welding, the entire driveshaft should be straightened to the following limits:

Heavy Duty Driveshaft Runout Limits

Light and Medium Duty Driveshaft Runout Limits for Unbalanced Driveshaft

HEAVY DUTY

0.005 T.I.R. on the neck of the slip tube shaft
0.010 T.I.R. on ends of tubing 3" from welds
0.015 T.I.R. at linear center of the tube

LIGHT AND MEDIUM DUTY

0.005 T.I.R. on the neck of the slip tube shaft
0.020 T.I.R. on ends of tubing 3" from welds
0.010 T.I.R. at linear center of the tube
0.020 T.I.R. for full length of tube with 30" or less

(T.I.R.—Total Indicator Reading)

These runouts should be taken with entire driveshaft assembly mounted on master tooling which locates on the outboard bearing assemblies of the u-joint kit (light and medium duty), or the trunnions of the outboard u-joint kit (heavy duty) or on selected flange yokes or yokes.

All flange yokes or yokes should be selected for dynamic balance to eliminate as much unbalance as possible. During balancing, the driveshaft again should be mounted on the same master tooling or selected flanges or yokes.

After straightening, balance the entire assembly to Original Equipment Manufacturer specifications.

ANGLES AND PHASING
(All Types)

Proper driveshaft angles and correct phasing of the yokes are very important in maintaining long life and quiet running shafts.

When in phase, the slip yoke lugs (ears) and tube yoke lugs (ears) are in line. Normally, this is the ideal condition and gives the smoothest running shaft. There should be an alignment arrow stamped on the slip yoke and on the tube shaft to assure proper phasing when assembling these components. If there are no alignment marks, they should be added before disassembly of the shaft to assure proper reassembly.

An "In Phase" Driveshaft

Phasing is relatively simple on a two-joint set . . . be sure that the slip yoke lugs and the tube yoke lugs are in line. Driveshaft angles are a little more complicated.

For further reference the following Dana/Spicer driveline aids are recommended.

DANA/SPICER LITERATURE

Spicer Universal Joints and Driveshafts - Service Manual - Form 3264
- Servicing the driveshaft.
- Balance/runout/operating angles.
- How to measure angles.

Spicer Driveline Components - Troubleshooting Guidline - Form 3119-3
- Causes and Solutions to Field Problems.
- Measuring and calculating operating angles.
- Measuring and calculating U-Joint angle cancellation.

OK

DANA/SPICER ANGLEMASTER (digital protractor)
- Highly recommended for accurate driveline measurement.

DANA/SPICER DRIVELINE SUPPORT HOTLINE: 1-800-666-8688
- A general "clearing house" for your driveline questions - telephone personnel will further direct you to the appropriate activity based upon your question.

DANA DRIVETRAIN SERVICE ADDRESS:

Dana Corporation
Drivetrain Service Division
P.O. Box 320
Toldeo, Ohio 43619
Phone: (419) 866-3900

W.S. Darley & Co.
Fire Pump Division
1051 Palmer Street, Chippewa Falls, WI, 54729
Phone 715 726 2650 Fax 715 726 2655

TECHNICAL BULLETIN

1202510

TITLE: BEST PRACTICES FOR FRONT MOUNT PUMPS
DATE: MARCH 31, 2005

Driving a fire pump off the front of an engine is a well established means of powering the pump, dating back decades. Due to changes in engine design, as well as factors intrinsic to front mount applications, special steps should be taken to ensure a safe and reliable installation.

Darley now recommends all front mount applications be driven by a torsionally damped driveshaft, such as the ISO-TEC brand manufactured by Dana and sold through Machine Service and other driveline suppliers. Machine Service can be contacted at 920-339-3000 or through their website at http://www.machineservice.com/isotec.htm.

These torsionally damped driveshafts provide two benefits. First, the elastomer joint absorbs the torsional vibration caused when each cylinder fires. This will reduce the knocking or clanking noise that comes from the pump transmission when the truck is at an idle or at engine speeds below around 1000 RPM. Second, the shaft critical speed is significantly reduced, allowing for safer operation with less chance of operating in a condition of resonance.

Failure to use a torsionally damped driveshaft may lead to sudden catastrophic driveline failure due to either cumulative damage caused by torsional vibration or due to operating at a resonant frequency.

All driveshafts that will be rotating when the vehicle is stationary should be equipped with guards. Please refer to installation instructions when installing drivelines.

Please direct any questions regarding this bulletin to our engineering office at 800-634-7812 or 715-726-2650.

Michael C. Ruthy
VP - Engineering