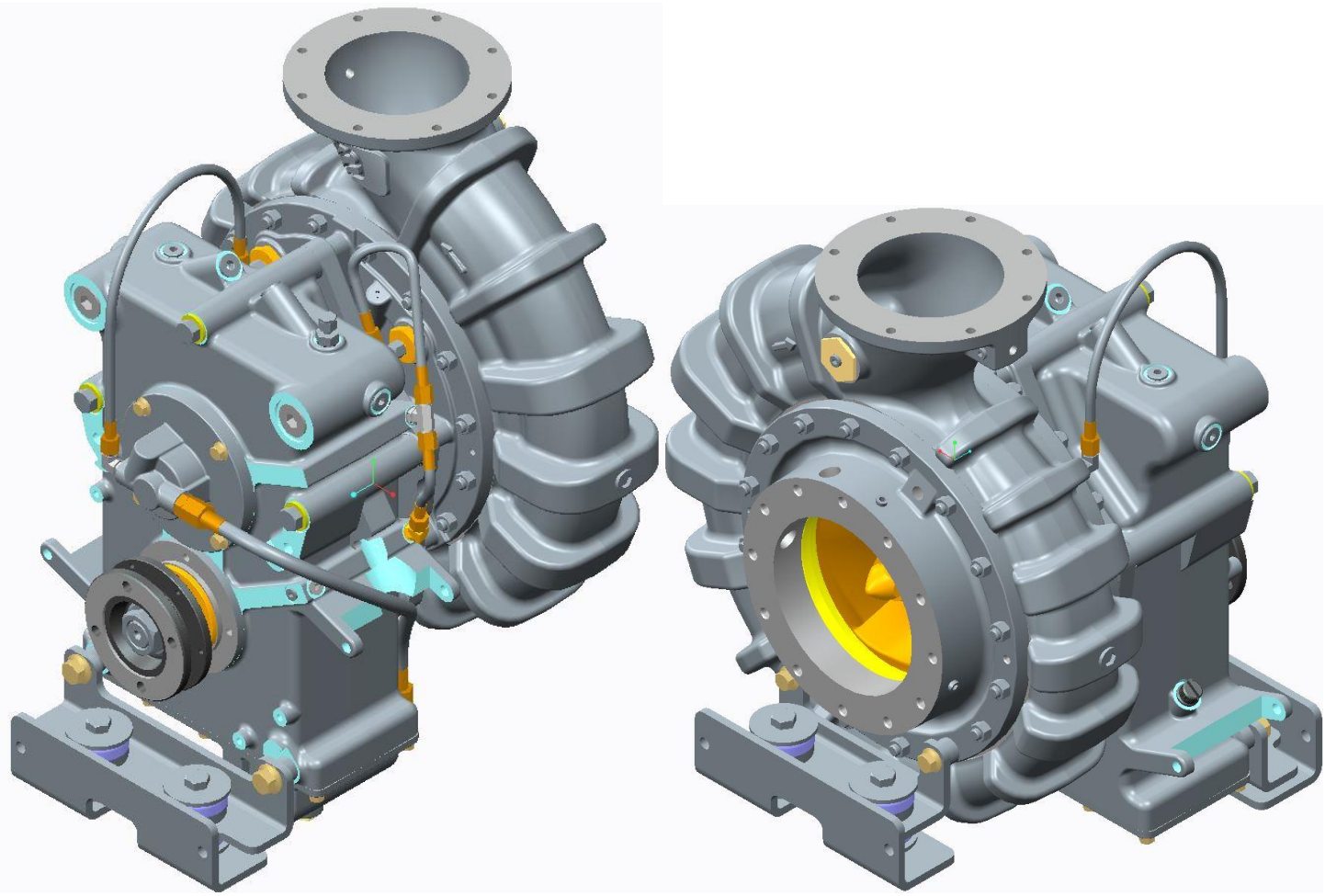
INSTALLATION OF TYPE
ZSP PTO DRIVEN Fire Pump



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Approved by: WAH
Revised by: WAH VIA ECO 11337

Revision: A
Original release date: 03/16/12
Revision release date: 02/19/2016
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Important

⚠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 driveshaft or pump when the engine is running or without the wheels chocked.

⚠WARNING

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

W.S. Darley requires that Power Take Off (PTO) driven pumps have at most 500 radians per second^2 torsional vibration and at most 1000 radians per second^2 inertial drive torsional vibration, as calculated by the Allison Multiple Joint Driveline Analysis program, for a completed driveline installation. A completed driveline installation includes the entire multi-driveshaft assembly from the power source of the PTO output flange to the input flange of the PTO driven pump.

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

⚠WARNING 

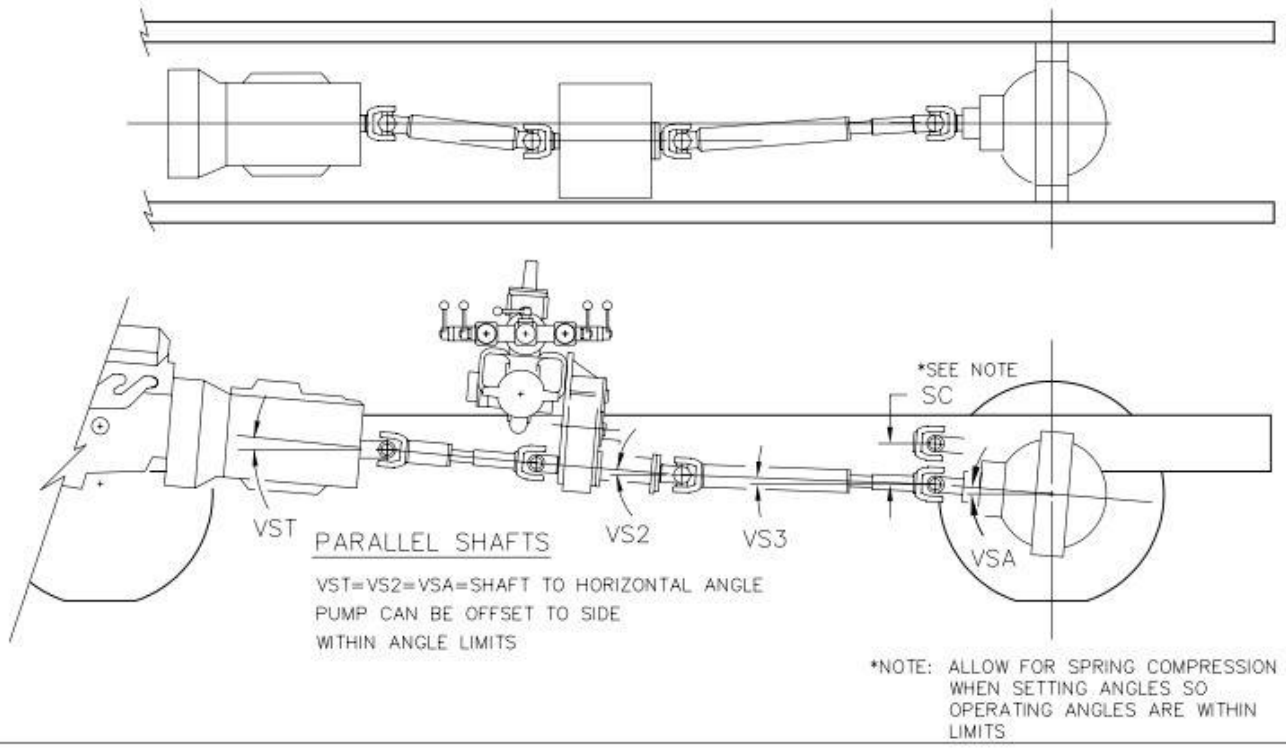
Exposed rotating drive-shafts should be guarded.

It is highly recommended by Darley to use safety rings around drive tubes. Especially near connecting u-joint crosses. Such safety rings would be sufficiently attached to the chassis frame and sufficiently strong enough to prevent a broken u-joint assembly from allowing a driveline to slide out from underneath the truck at high speeds while still rotating, causing severe personnel injury. Said safety rings would be larger than the drive tube OD and provide enough clearance for dynamic non-rotational movement of the drivelines through loaded and unloaded conditions, driving operations and where chassis flex may occur.

U-Joints:

- 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).
    - This arrangement may be required if the coupling shaft between pump and PTO is relatively short, or the engine is mounted with its driveshaft horizontal. Refer to attached drawing DGM1301 for examples of parallel shaft and intersecting angle installations.
    - DGM1301 shows a midship split shaft style pump, but the same installation recommendation/information applies to PTO's and PTO driven pumps.

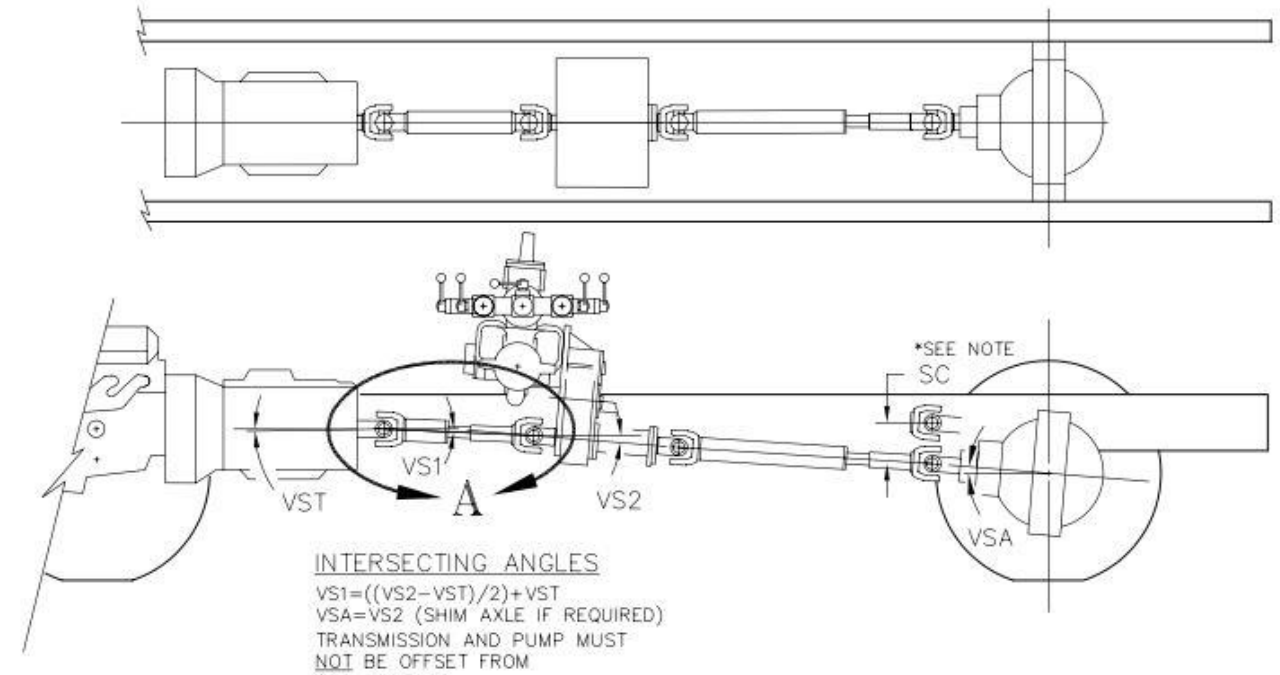
See the appendix of this portion of the manual for the Spicer Driveline Installation Guide (J3311-1-DSSP)



PARALLEL SHAFTS

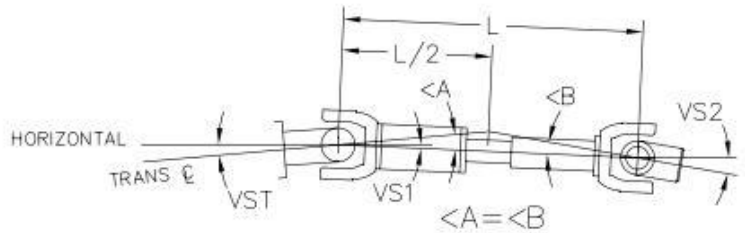
VST=VS2=VSA=SHAFT TO HORIZONTAL ANGLE
PUMP CAN BE OFFSET TO SIDE
WITHIN ANGLE LIMITS

*NOTE: ALLOW FOR SPRING COMPRESSION WHEN SETTING ANGLES SO OPERATING ANGLES ARE WITHIN LIMITS



INTERSECTING ANGLES

VS1=((VS2−VST)/2)+VST
VSA=VS2 (SHIM AXLE IF REQUIRED)
TRANSMISSION AND PUMP MUST
NOT BE OFFSET FROM
ONE ANOTHER



DETAIL A

(ANGLES VST, VS1, VS2 RELATIVE TO HORIZONTAL)

DGM1301 (LT40) 4−23−92

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Revision: A
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Driveline and Mounting:

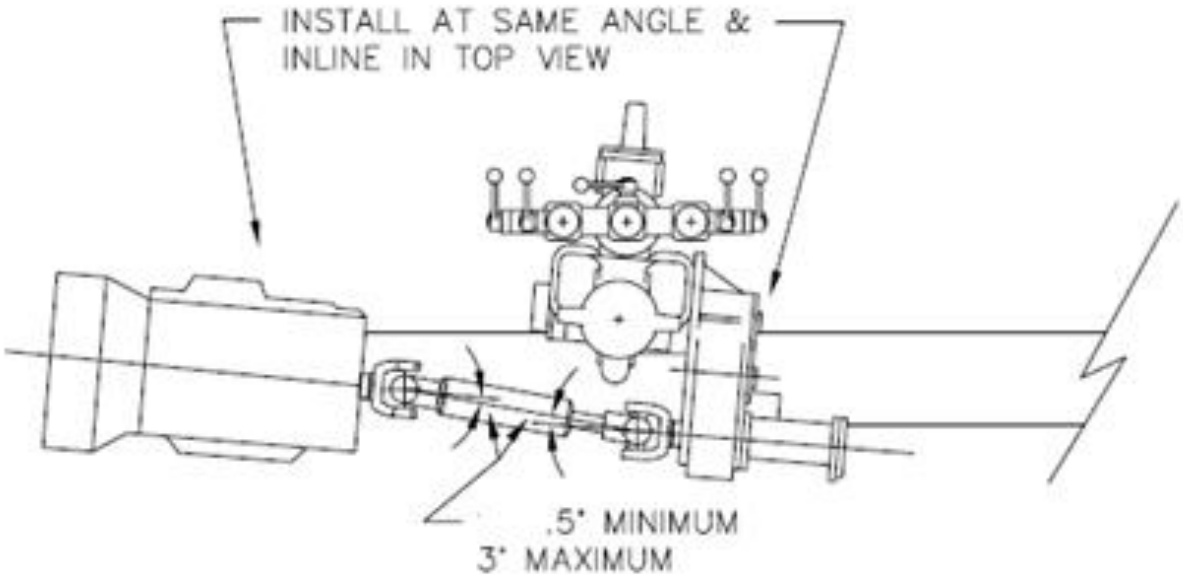
Determine the best location for the pump in your chassis. Allow adequate room for pump maintenance.

Place the pump/cross-member assembly on the chassis frame at the desired location. Be sure to set the suction manifold and transmission support brackets at a position allowing the best possible operating angle and driveline performance. This can be done by drilling frame rail mounting holes in a manner to rotate the entire pump/transmission assembly at an angle. As well up and down positioning is important.

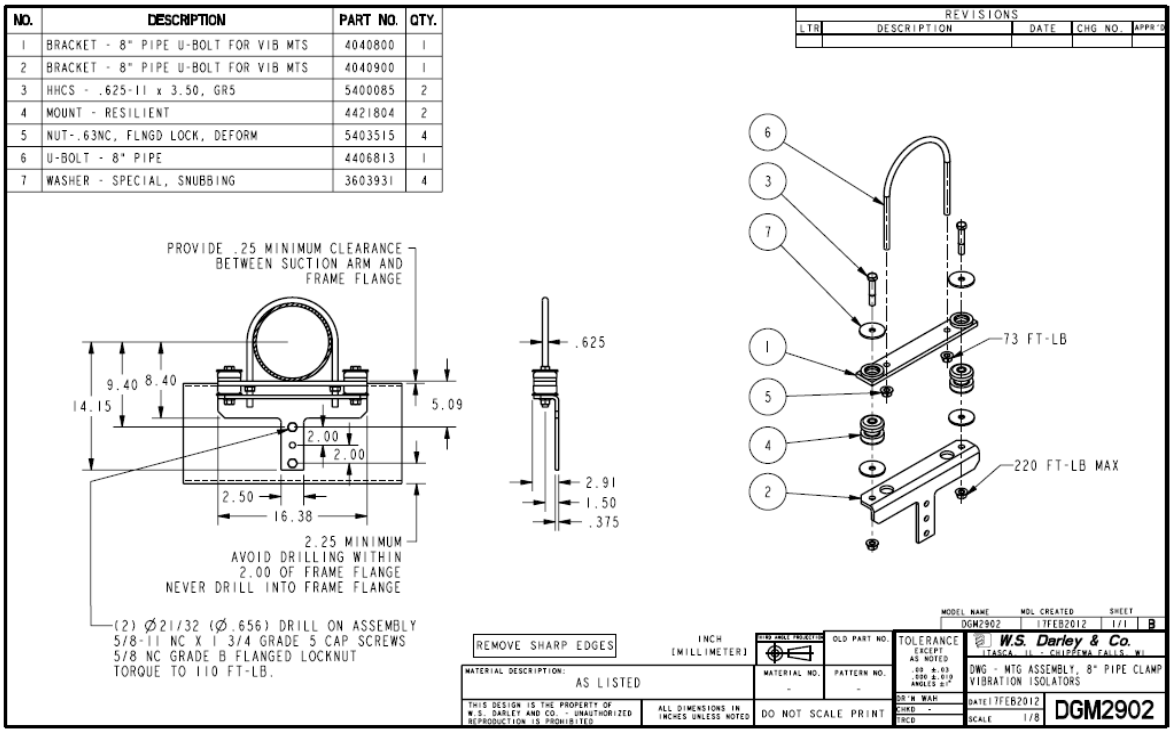
Measure the vertical angle between the truck PTO shaft centerline and chassis frame (often 4º).

Suspend the pump so that the pump driveshaft centerline is as close as possible to being inline and parallel to the truck PTO shaft centerline. Example: If the truck PTO is at 4º with horizontal, the pump driveshaft should also be set at 4º with horizontal. This will insure that even if the PTO and pump are offset from each other, the universal joint operating angles will be equal.

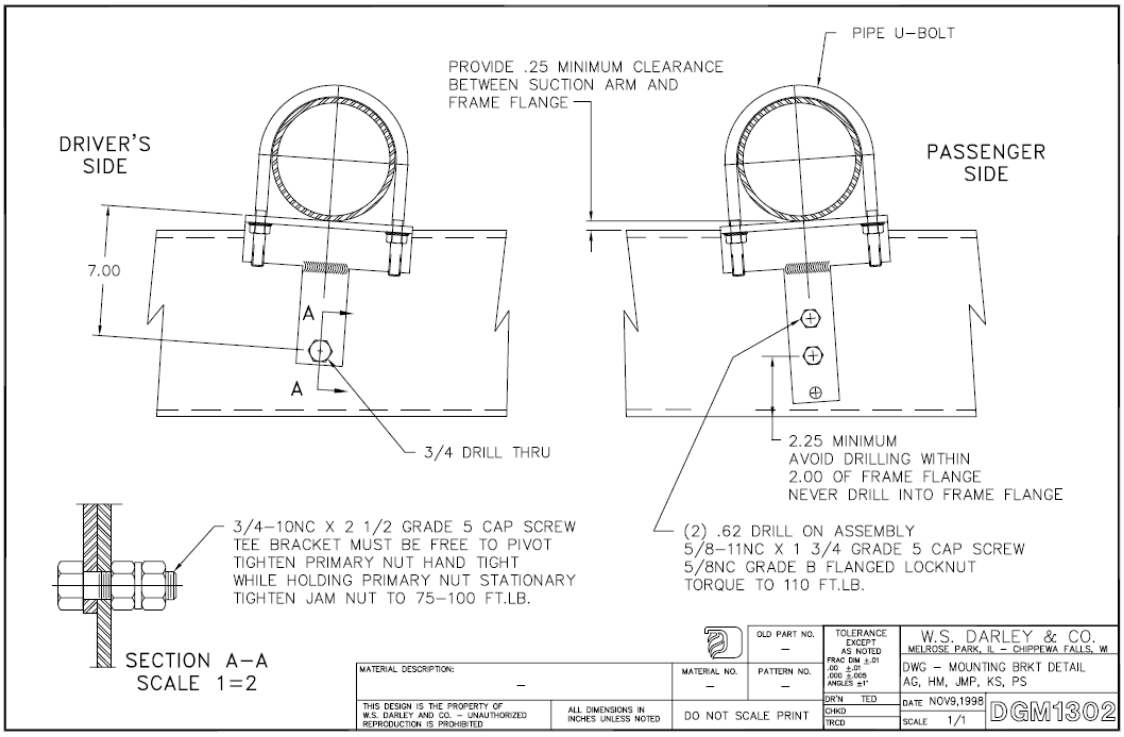
Check to confirm that the pump shaft is parallel to the PTO shaft.



Place suction manifold mounting brackets into position as shown on detail drawing DGM2902 and securely clamp against side of frames. Attach brackets to the suction extensions with pipe U-bolts.



One of the two suction manifold brackets must be free to pivot as seen in drawing DGM1302. Choose one side of the frame or the other for the location of the pivot, the opposite must be rigidly secured with (2) 5/8" fasteners.



Drill holes through the side frames and attach the mounting brackets. Note both mounting brackets are designed to permit truck frame flex without imposing stress on pump extensions.

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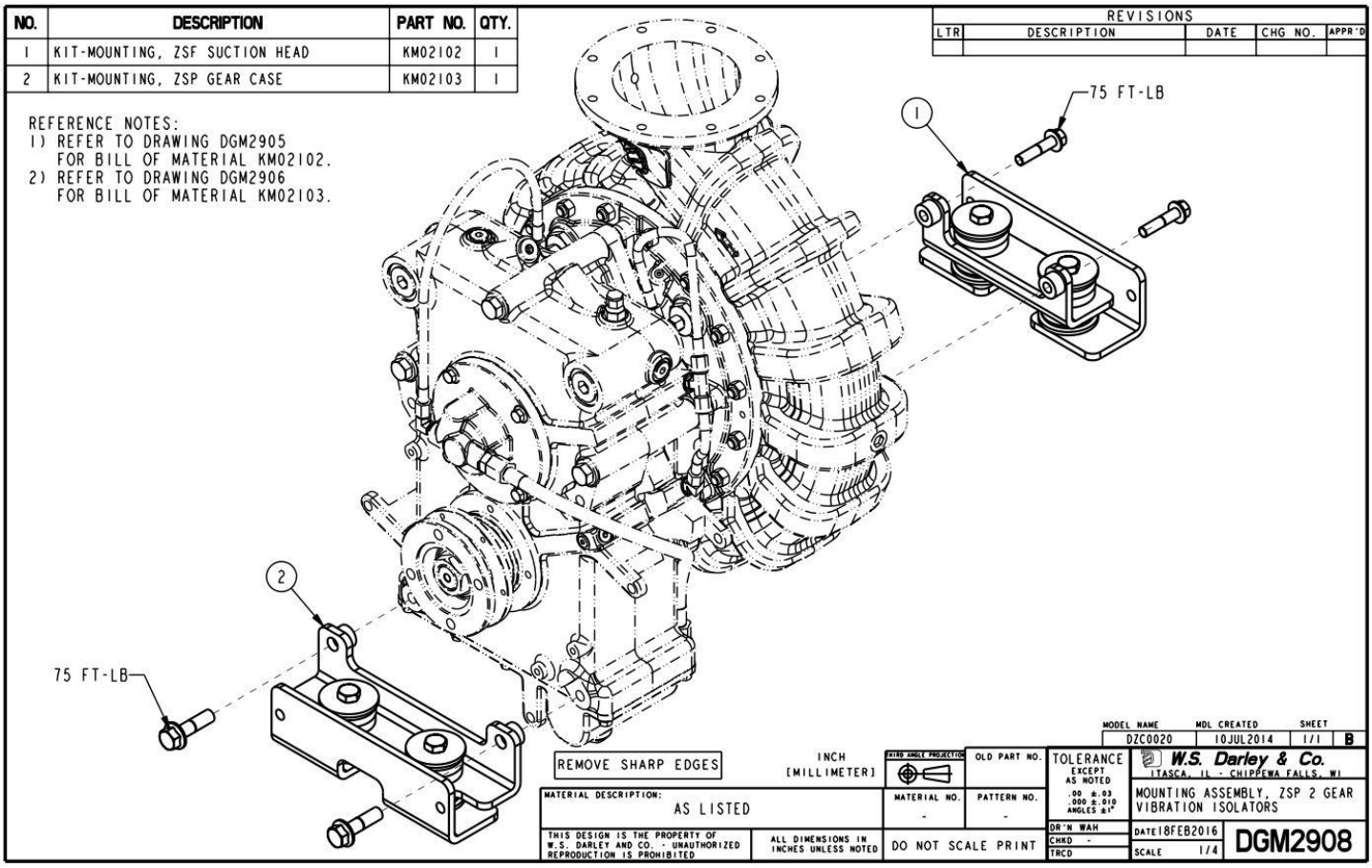
Reference drawing DGM2908 for the KM02102 and KM02103 bracket assembly locations on the ZSP.



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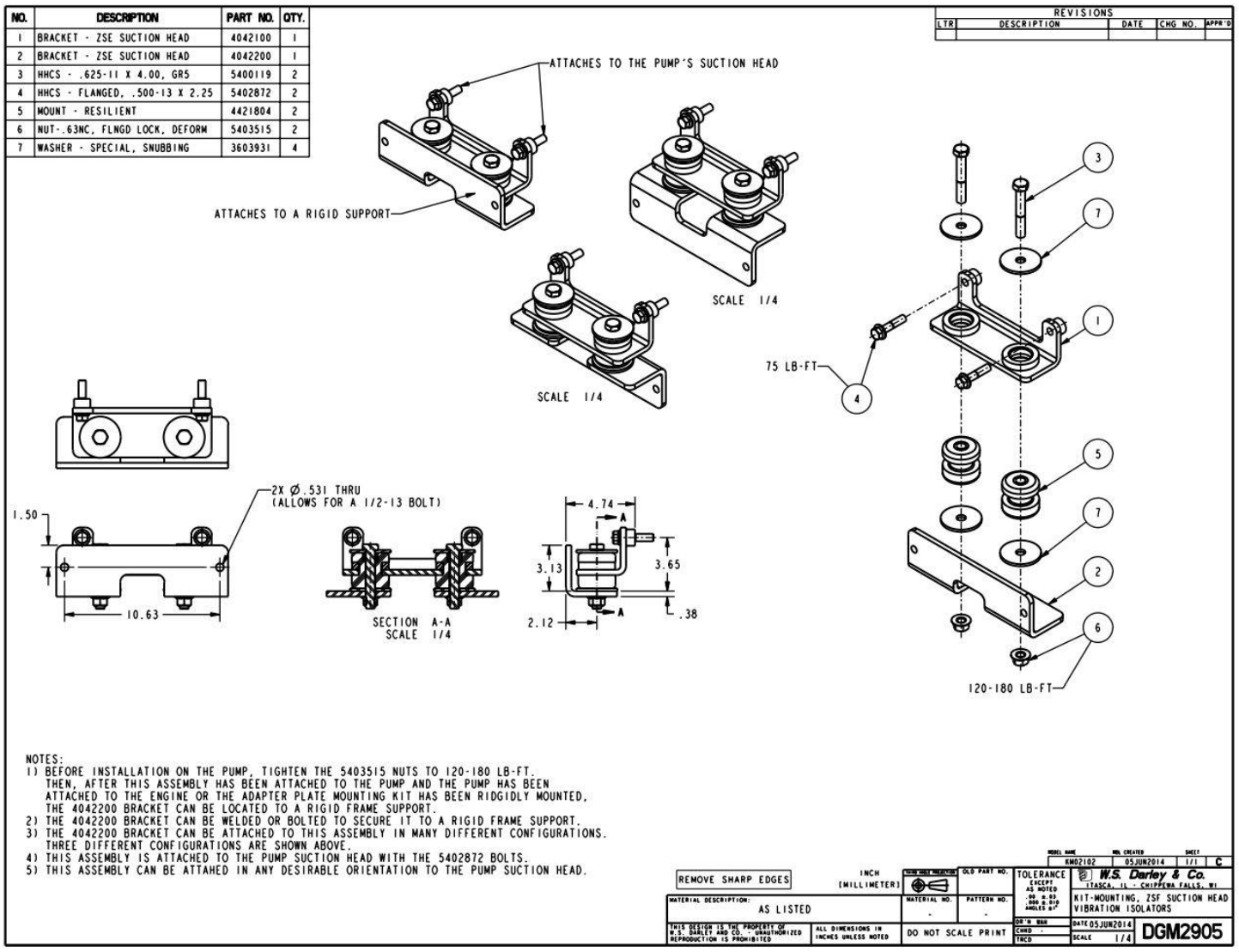
Assembly KM02102, depicted by drawing DGM2905, is the vibration isolating mounting bracket that attaches to the pump's suction head.



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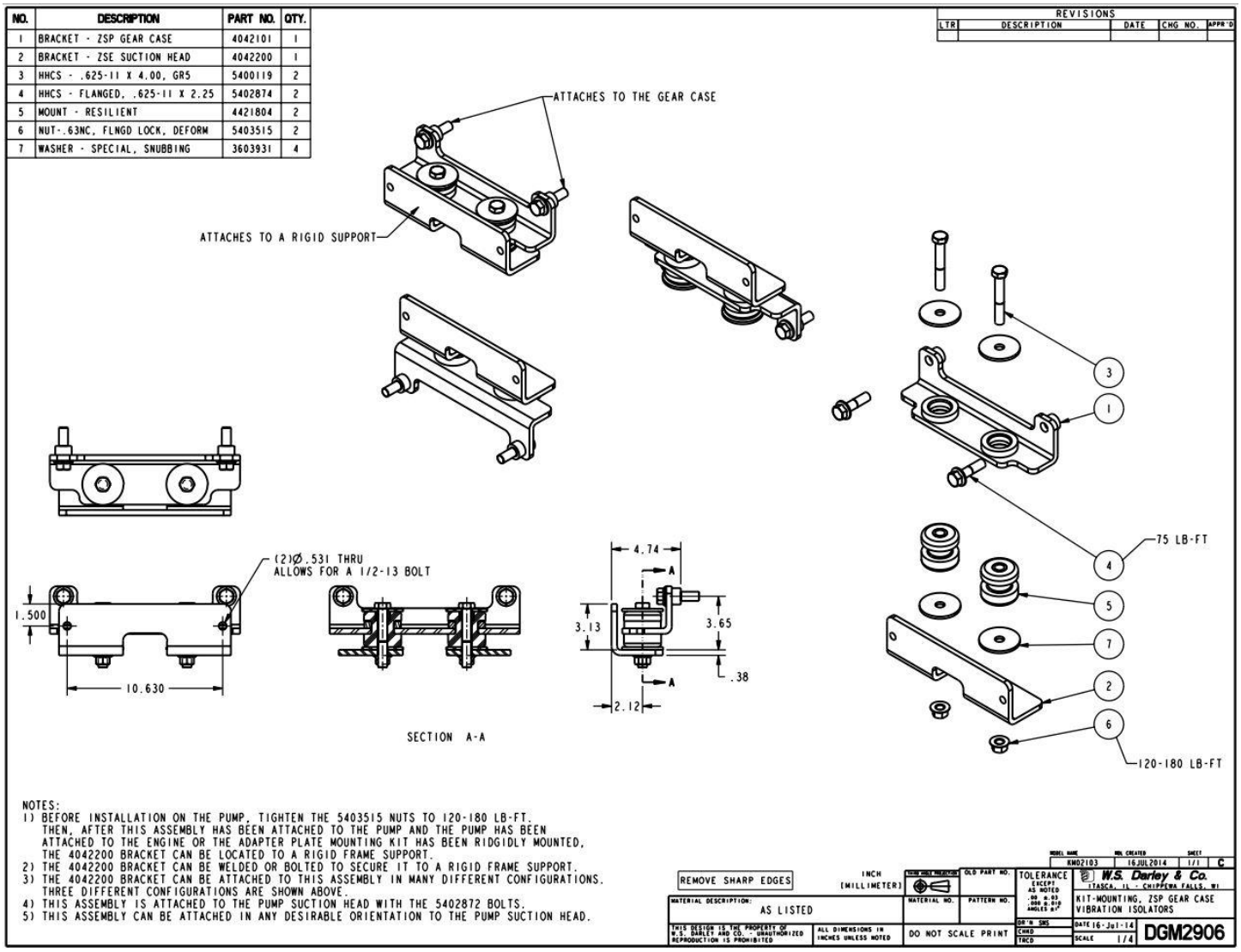
Assembly KM02103, depicted by drawing DGM2906, is the vibration isolating mounting bracket that attaches to the pump's gearbox.



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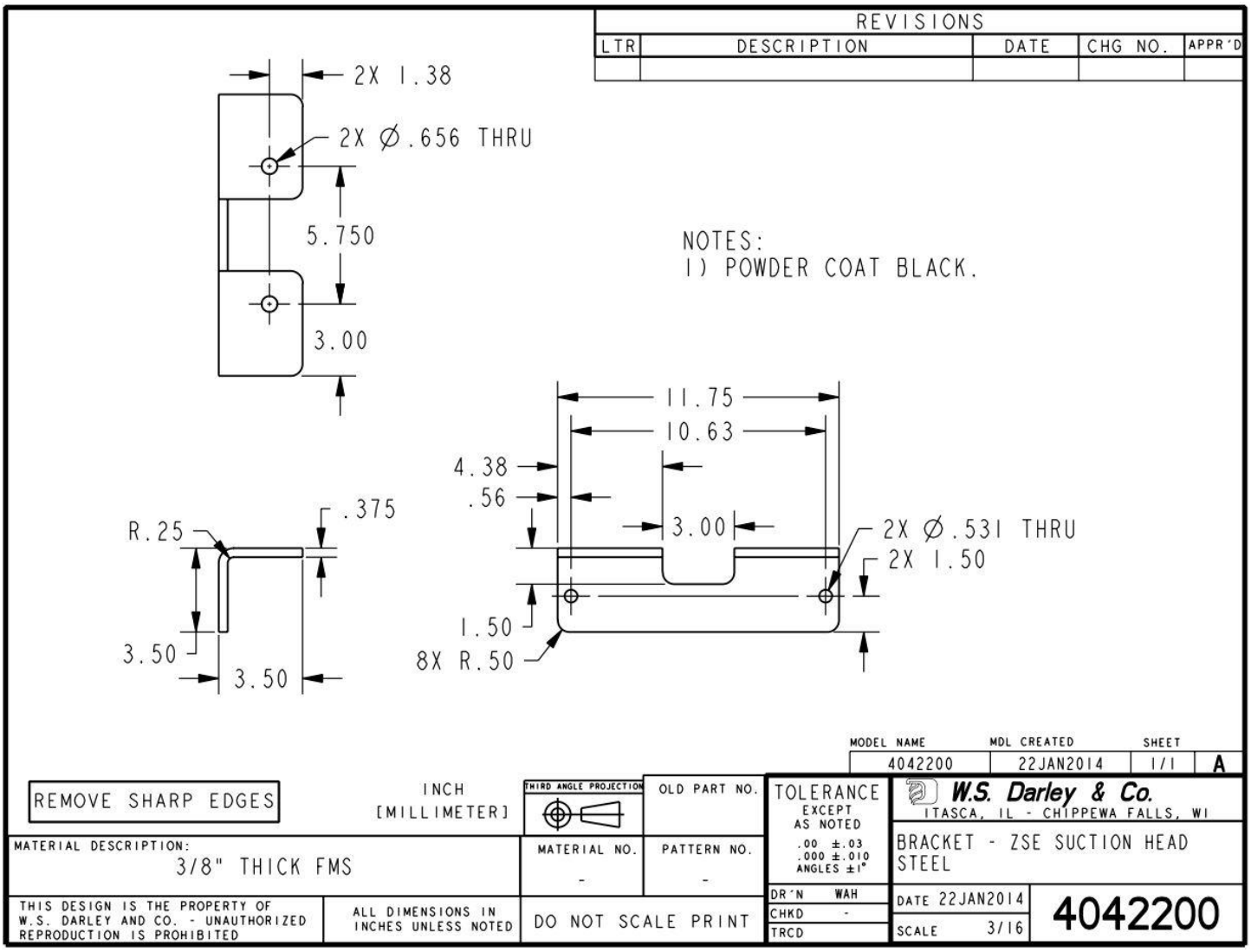
The 4042200 bracket is item 2 from both the KM02102 and KM02103 assemblies. 4042200 is the item that the customer will have to attach their own fabricated bracketing and cross members to for securing the ZSP back to the apparatus frame rails. If need be, customers can fabricate their own bracket to replace the 4042200 bracket from within the KM02103 or KM02103 assemblies.



The 4042200 bracket is intended to be secured with 1/2” fasteners or welded back to the customers bracketing and cross members.

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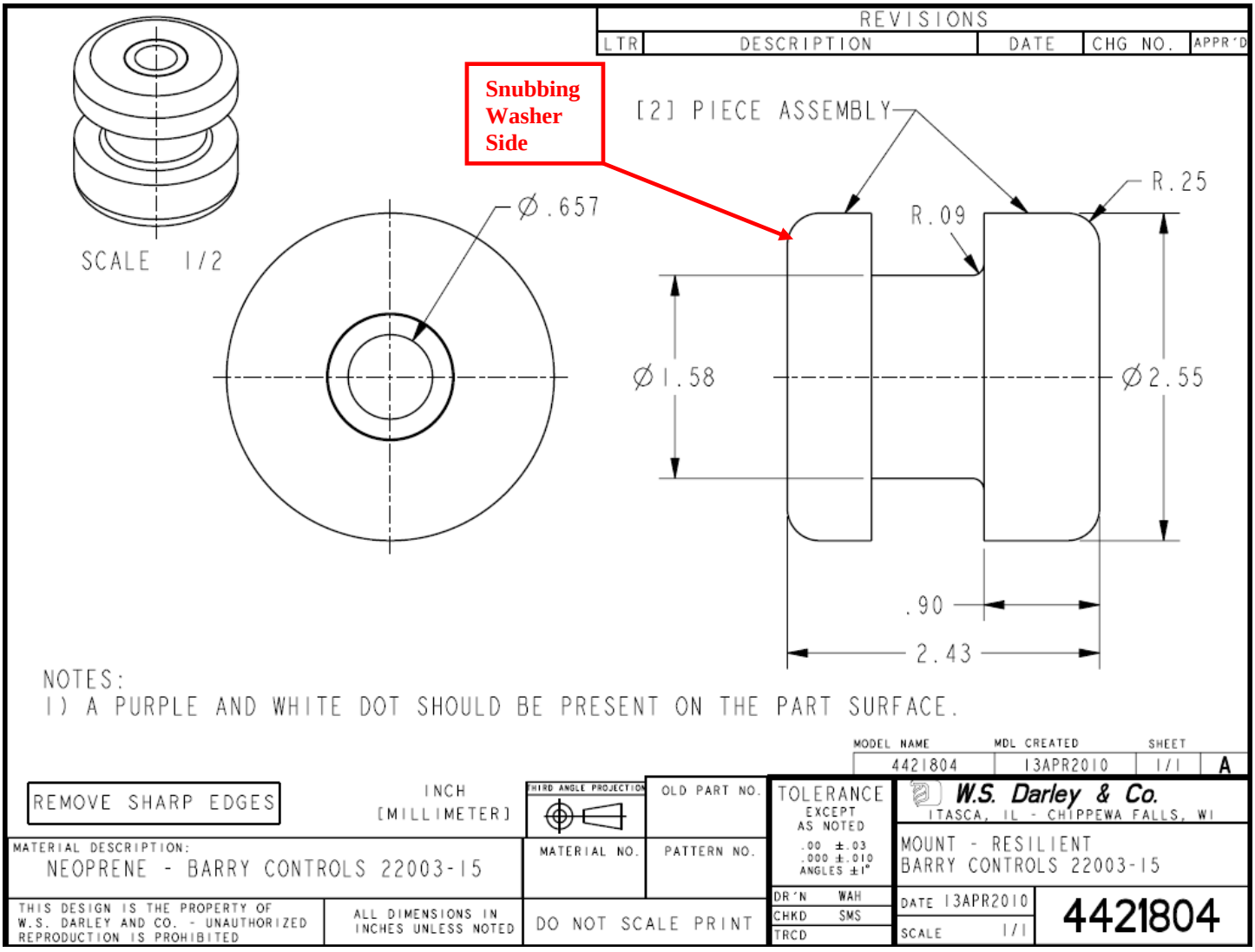
Reference drawing 4421804 and 3603931 for vibration isolating mounts and washers for adapting the mounting brackets to attach to the customer's supplied cross member or bracketing.



IMPORTANT: These rubber isolators are a two piece design. The loading on these isolation mounts is cantilevered in this application (i.e. the center of gravity of the transmission and pump assembly is not directly above the centerline of the rubber isolators, it is offset), therefore the snubbing washer (see 3603931 on the next page) should be on the core/bushing side of the rubber isolator (see below images). Therefore the snubbing washer should be on top of the smaller rubber section of the isolator, not the ring portion. So, for this application the stack-up from top to bottom should be as follows: bolt head, snubbing washer, core/bushing side of isolator, transmission mount bracket, ring portion of isolator, customer supplied cross member, nut or lock nut. Torsional loading should never be placed on the ring portion of the isolator.

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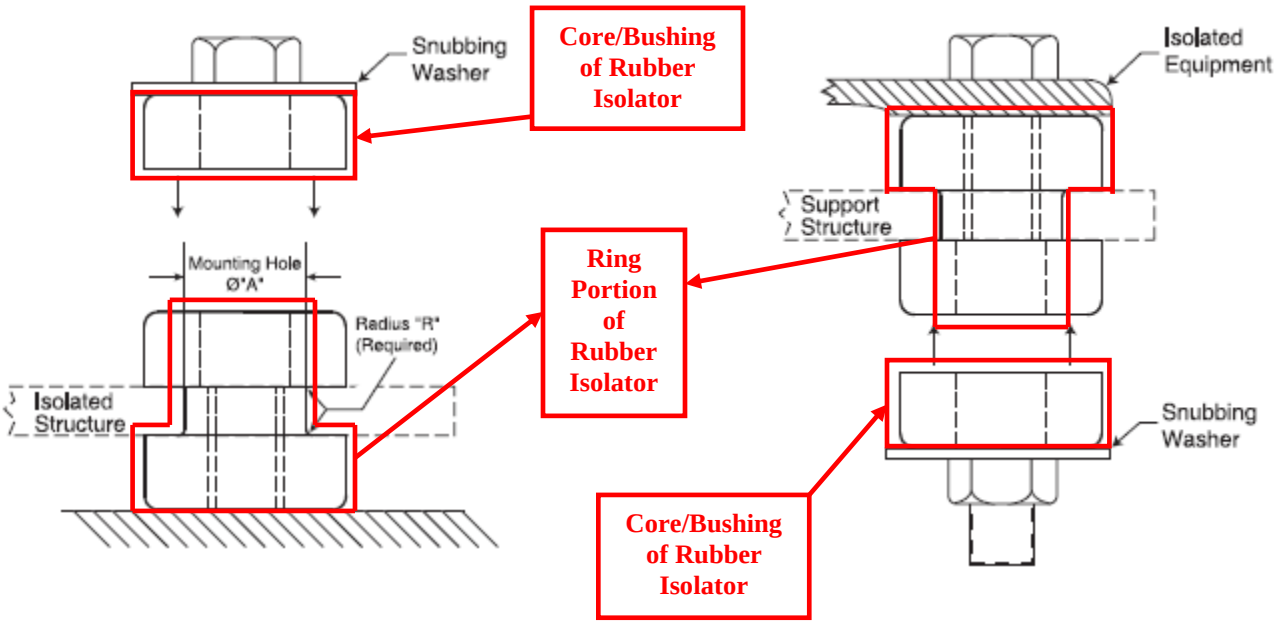

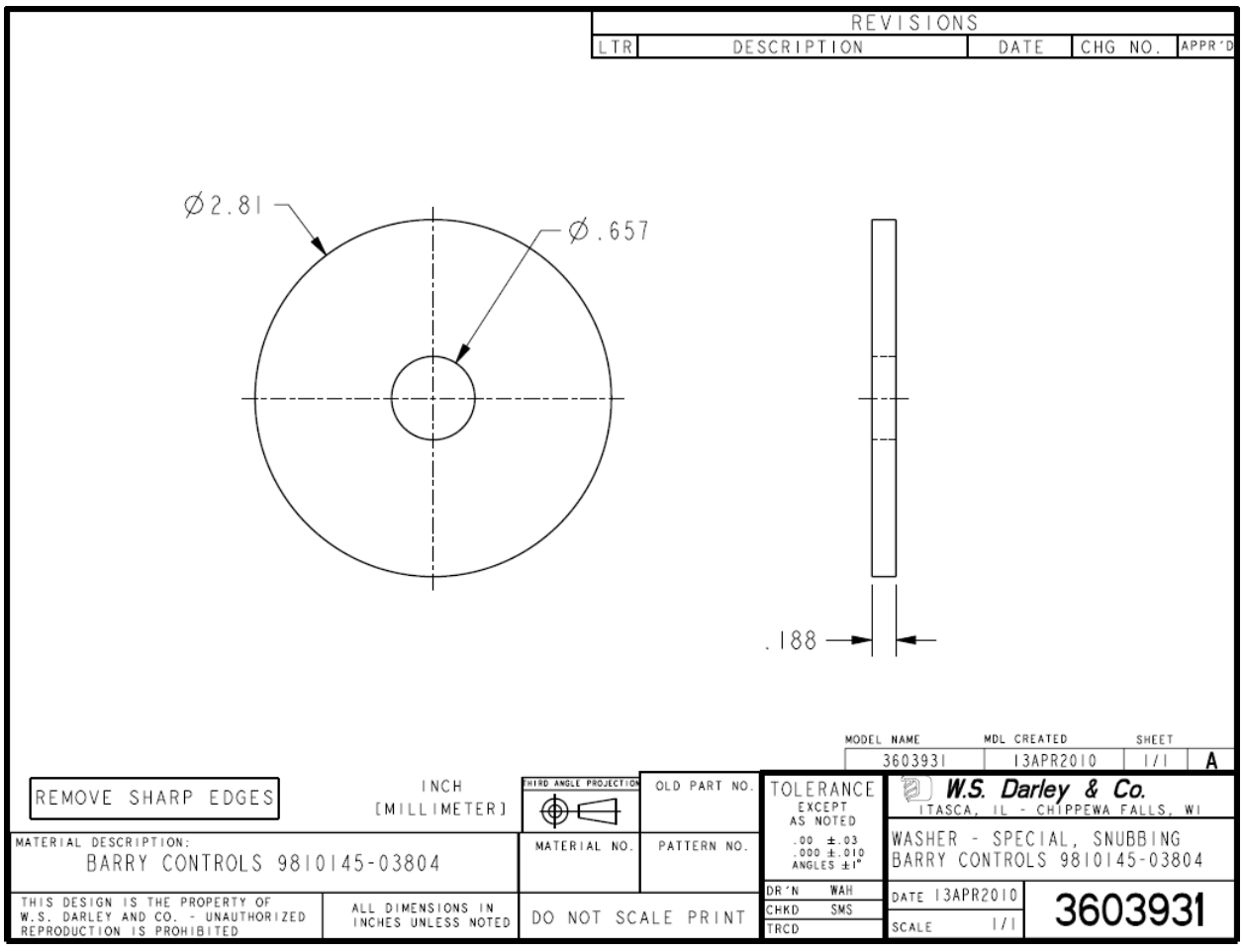

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Drill holes through the apparatus frame rails and attach necessary mounting brackets and cross members. Note, the KM02102 and KM02103 mounting bracket assemblies are designed to permit truck frame flexing without imposing stress on the pump. The installed brackets must be free to pivot as shown in drawing DGM1302. Choose one side of the frame or the other for the location of the pivot, the opposite must be rigidly secured with (2) 5/8" fasteners.

Provide adequate support for all piping.

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

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

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 lockstraps 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.

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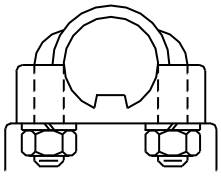
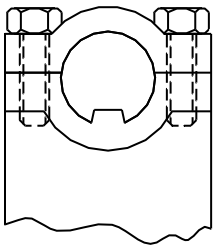
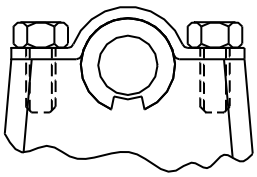


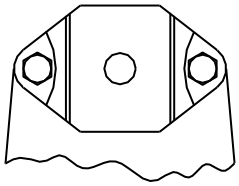
U-BOLT



CAP &
BOLT



BEARING
STRAP



BEARING
PLATE

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.

PRIMER CONNECTION: For 12/24-volt electrically-clutched belt-driven priming pump installation, see drawings DVC0306 through DVC0309 found in “Section 4 - Pump Detail” of the “ZSP Installation, Operation, Maintenance, Repair and Troubleshooting Manual”.

ENGINE COOLING/PUMP HEATER: 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.

PUMP SHIFT INSTALLATION: For power shift installation, refer to DGS1100 for automatic transmission wiring details.