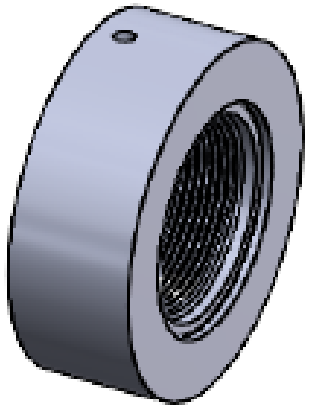
Section: Make MTS tanks	**Procedure:** Manufacture tank necks
Step: Make dummy tank	
Lead: Altamont	**Images:**
Parts Needed: MTS-MOC004-AD	
Tools Needed: Machining	



MTS-MOC004-AD

Section:
Make MTS tanks

Step:
Make dummy tank

Lead:
EDarby vendor

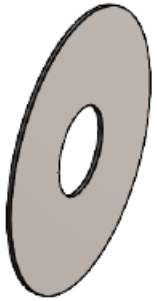
Parts Needed:
cyl MTS-MOC002-AD
disc MTS-MOC006-AA
port MTS-MOC007-AA
(will arrive welded together)

Tools Needed:

Procedure:
Manufacture tank cylinders (x2) and discs (x4)

Images:

MTS-MOC002-AD



MTS-MOC006-AA

MTS-007-AA

Section: Make MTS tanks	**Procedure:** Connect components together via screws (neck to ports in mock tanks) - AL to Steel
Step: Make dummy tank	
Lead: Altamont	**Images:**
Parts Needed: Assy dwg MTS-MOC005-AD Screws from hardware store (countersunk)	
Tools Needed: Phillips head screwdriver	

MTS-MOC005-AD

Section: Make MTS tanks	**Procedure:** Make and clean serpentine tube (tank-part)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB001-AC (fore) MTS-TUB015-AA (aft)	
Tools Needed: Sanding straight lengths of tube	

Section: Make MTS tanks	**Procedure:** Plug inlet to tank (fill) tube so that we can pressurize tubing later (Helium test)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB002-AB	
Tools Needed: Weld	

Section:
Make MTS tanks

Step:
Prepare tank connections

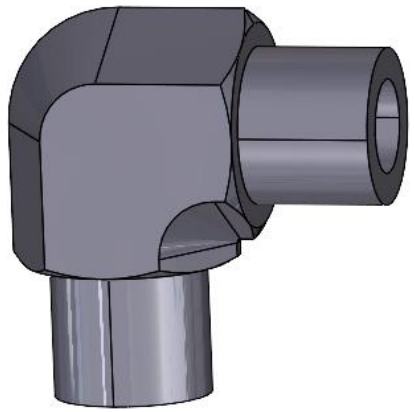
Lead:
Altamont

Parts Needed:
MTS-TUB002-AB
Parker 3/8" socket weld elbow (6-6EW-SS)

Tools Needed:
Weld

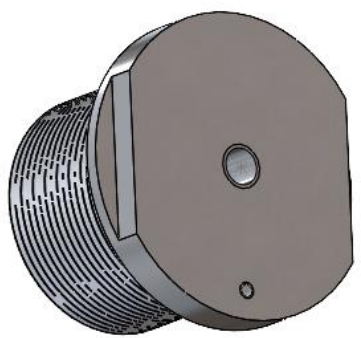
Procedure:
Weld fill tube to elbow for insert feedthrough

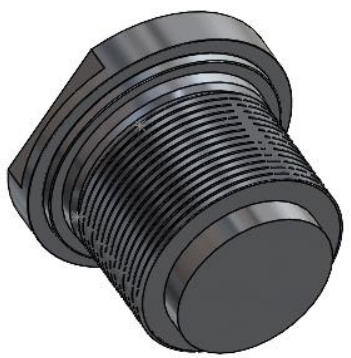
Images:



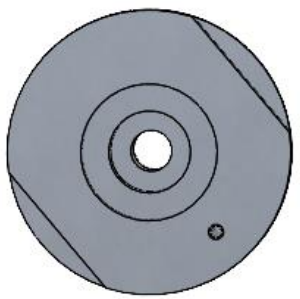
Section: Make MTS tanks	**Procedure:** Weld serpentine tube to elbow with inlet tube (to be fed into bimetal insert)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB001-AC (fore) MTS-TUB015-AA (aft) weld to Parker elbow already attached to MTS-TUB002-AB	
Tools Needed: Weld	

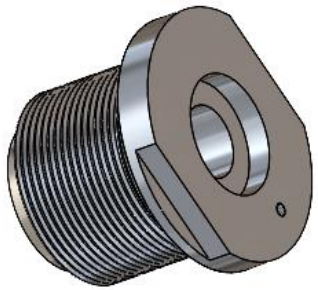
Section: Make MTS tanks	**Procedure:** Make back plug (x2)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-INS002-AE (rear)	
Tools Needed: Machining Altamont has aluminum	

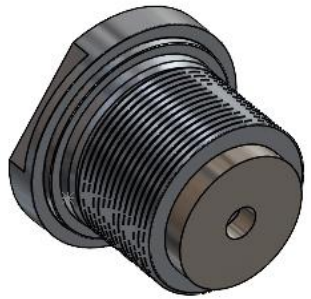




Section: Make MTS tanks	**Procedure:** Make bimetal insert (x2)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-L-INS003-AE (front BM)	
Tools Needed: Machining Verne provided bimetal plate	







Section: Make MTS tanks	**Procedure:** Weld fill tube & serpentine assembly to bimetal insert at hole (feed tube through insert, elbow should be at head of insert with prescribed depth)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: Reference MTS-TUB012-AC (2) for "Right" Tank (vehicle front) Reference MTS-TUB016-AA (2) for "Left" Tank (vehicle rear)	
Tools Needed: Weld	

Section:
Make MTS tanks

Step:
Prepare tank connections

Lead:
Altamont

Parts Needed:
MTS-INS002-AE (rear)

Tools Needed:
Torque wrench w/ 2.2in diam capability (spreader?)

Procedure:
Screw back plug into PV with specified torque (220-230 ft-lb)

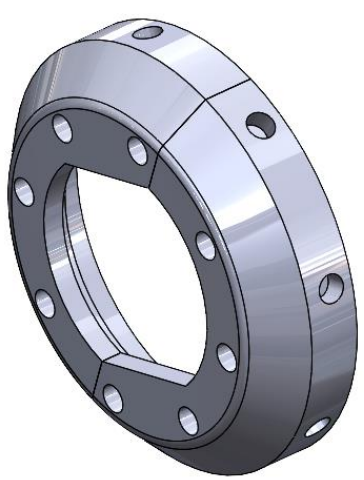
Images:

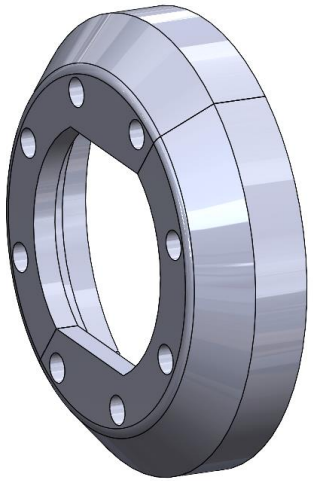
Section: Make MTS tanks	**Procedure:** Weld back plug to PV liner
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-S-MOC006-AA (Right tank) MTS-S-MOC007-AA (Left tank) MTS-VES_R001-AA (Right tank) MTS-VES_L001-AA (Left Tank)	 
Tools Needed: Aluminum weld	

Section: Make MTS tanks	**Procedure:** Screw bimetal insert into PV (seal with weld) with specified torque (220-230 ft-lb)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-L-INS003-AE (front BM)	
Tools Needed: Torque wrench w/ 2.2in diam capability (spreader?)	

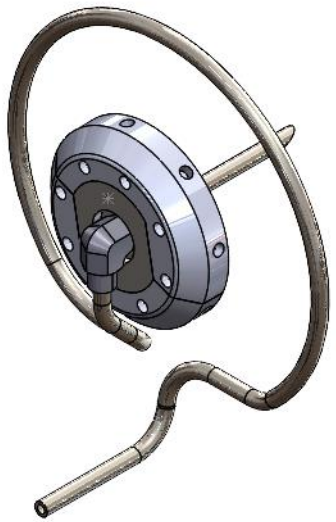
Section: Make MTS tanks	**Procedure:** Weld bimetal insert to PV liner
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-S-MOC006-AA (Right tank) MTS-S-MOC007-AA (Left tank) MTS-VES_R001-AA (Right tank) MTS-VES_L001-AA (Left Tank)	
Tools Needed: Aluminum weld	

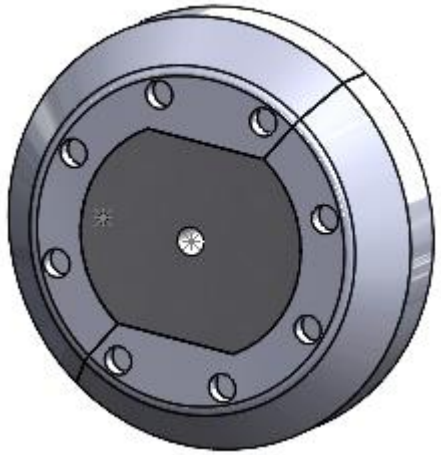
Section: Make MTS tanks	**Procedure:** Make front collar (x2) & rear collars (x2) and back hex support (x2)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: Collar front: MTS-SUP009-AA Collar rear: MTS-SUP015-AA Rear hex sup: MTS-SUP019-AA	
Tools Needed: Machining	





Section: Make MTS tanks	**Procedure:** Tack-weld front collar to front insert (orient around flats)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-INS_R004-AA (Right tank) MTS-INS_L004-AA (Left tank)	
Tools Needed: Weld	



Section: Make MTS tanks	**Procedure:** Tack-weld rear collar to rear insert (orient around flats)
Step: Prepare tank connections	
Lead: Altamont	**Images:**
Parts Needed: MTS-INS_R005-AA (fore tank) MTS-INS_L005-AA (aft tank)	 
Tools Needed: Weld	

Section:
Make MTS tanks

Step:
Prepare tank connections

Lead:
Altamont

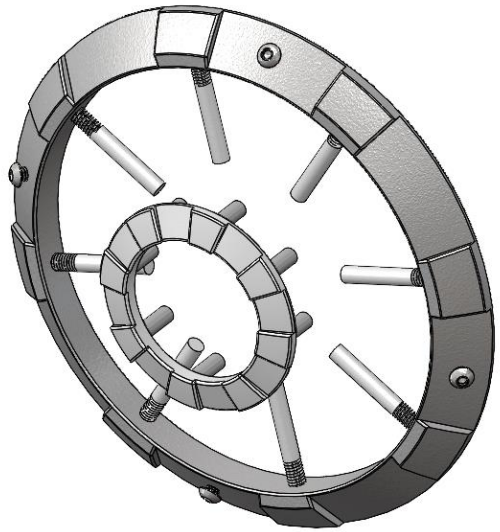
Parts Needed:
Present on drawing
Collar front: MTS-SUP009-AA
Collar rear: MTS-SUP015-AA

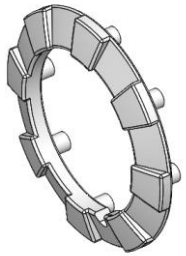
Tools Needed:
Weld

Procedure:
Tack-weld collar halves together

Images:

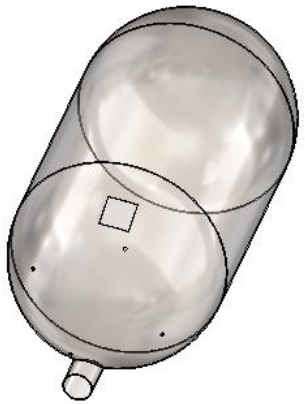
Section: Make MTS tanks	**Procedure:** Make G10 components, Verne pick up G10 when ready
Step: Prepare supports	
Lead: Altamont	**Images:**
Parts Needed: MTS-SUP010-AA MTS-SUP018-AA	
Tools Needed: Machining	



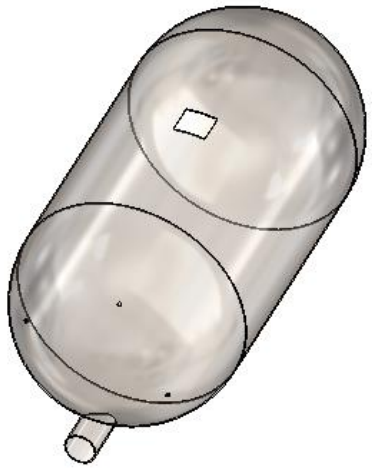


Section: Make MTS tanks	**Procedure:** Add inner ring to cylinder or dome to assist in welding later
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: No drawing - RJ making	
Tools Needed: Stainles steel material / mill	

Section: Make MTS tanks	**Procedure:** Cut hole in rear dome of rear tank for accelerometer window
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: MTS-S-SHL_R001-AA	
Tools Needed: Machining	



Section: Make MTS tanks	**Procedure:** Cut hole in center of cylinder of front tank for accelerometer window
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: MTS-S-SHL_L001-AA	
Tools Needed: Machining	



Section: Make MTS tanks	**Procedure:** Cut holes in front SS dome for G10 screw attachments
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: MTS-SHLXXX-XX	
Tools Needed: Machining	

Section: Make MTS tanks	**Procedure:** Cut hole in front SS dome for fill tube outlet
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: MTS-SHL003-AA	
Tools Needed: Machining	

Section:
Make MTS tanks

Step:
Prepare SS jacket

Lead:
Altamont

Parts Needed:
MTS-SHL004-AA

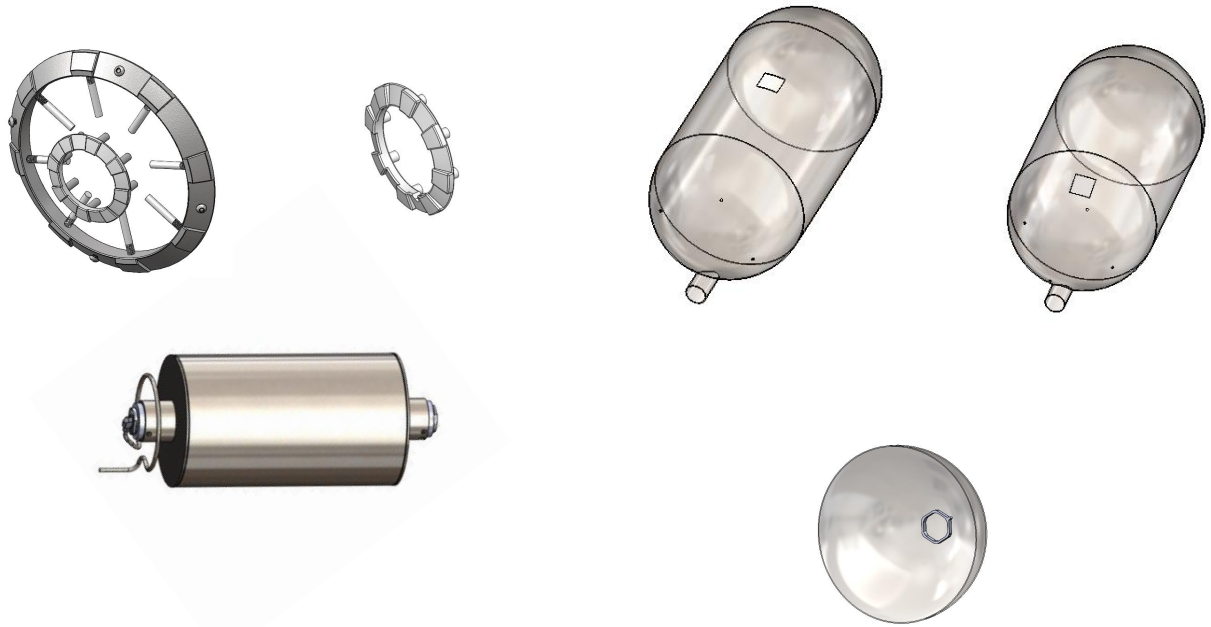
Tools Needed:
Machining

Procedure:
Make or procure SS pipe for fill tube outlet (port)

Images:

Section: Make MTS tanks	**Procedure:** Weld SS shell (port) for fill tube outlet to SS dome
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: MTS-SHL003-AA	
Tools Needed: Weld	

Section: Make MTS tanks	**Procedure:** Weld SS support hex into rear dome (centered)
Step: Prepare SS jacket	
Lead: Altamont	**Images:**
Parts Needed: Supp: MTS-SUP019-AA MTS-DOM_R001-AA (fore tank) MTS-DOM_L001-AA (aft tamk)	
Tools Needed: Weld w/ 316 SS filler	

Section: Make MTS tanks	**Procedure:** Verne pick up mock tanks (with inserts, serpentine tube, collars) and G10 to bring back for final inner vessel prep
Step: Prepare tank connections	
Lead: Verne	**Images:** 
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Set up mock tanks / vessels @ Verne
Step: Prepare inner vessel	
Lead: Verne	**Images:**
Parts Needed: dollies or 2x4 wedges to hold tanks steady	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Add temporary holding screw to back plug
Step: Prepare inner vessel	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Pink eye bolt from McMaster-Carr: 3059T69	
Tools Needed: Hand tighten / use standard tools @ Verne	

Section:
Make MTS tanks

Step:
Prepare inner vessel

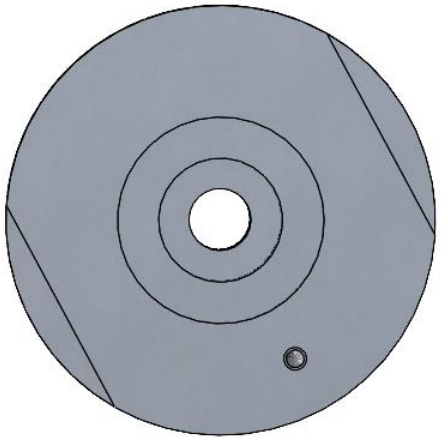
Lead:
Verne - (2 people)

Parts Needed:
Front: PT sensors w/ 6-32 screw (MMC 91223A312)
Rear: SD sensors w/ 4-40 screw (MMC 90357A116)

Tools Needed:
Allen wrenches (small)

Procedure:
Screw T sensors blocks to front and back insert

Images:



Section:
Make MTS tanks

Step:
Prepare inner vessel

Lead:
Verne - (2 people)

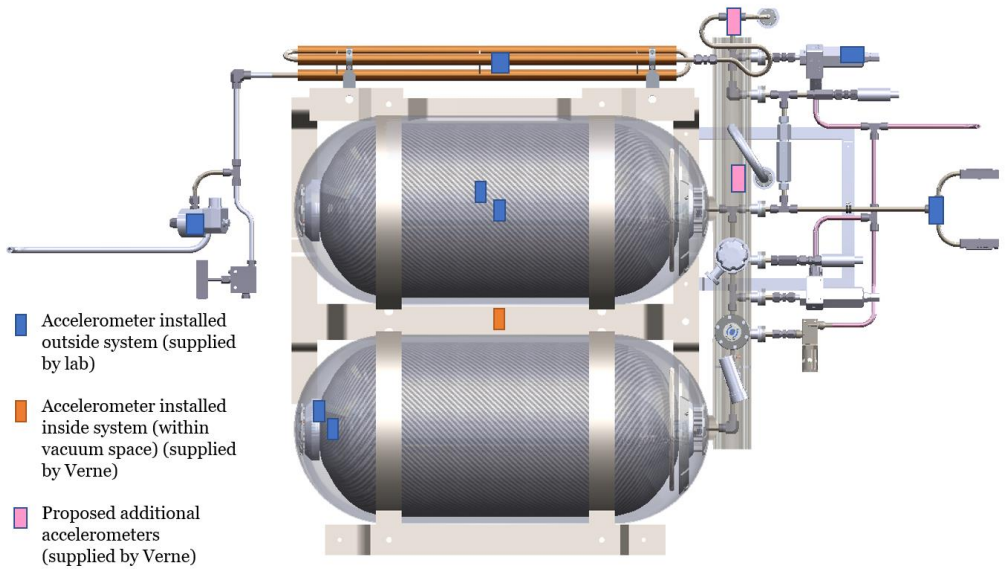
Parts Needed:
Accelerometer PN

Tools Needed:
Super glue or 5 min epoxy

Procedure:
Add accelerometers to mock tank at rear end of vehicle rear tank (left tank if looking at manifold - side vehicle view), aligned along proper xyz axis (relative to serpentine tube)

Images:

Total accelerometers: 12 (8 Quanta, 4 Verne)
Extras if desired: 6 (additional Verne)



Section: Make MTS tanks	**Procedure:** Hang tank by screw in back plug
Step: Prepare inner vessel	
Lead: Verne - (3 people)	**Images:** 
Parts Needed:	
Tools Needed: ED Assembly equipment (gantry crane)	

Section:
Make MTS tanks

Step:
Prepare inner vessel

Lead:
Verne - (1 person)

Parts Needed:
Front G10 rods: MTS-SUP004-AA
Front G10 axial nut: MTS-SUP002-AA
Rear G10 rods: MTS-SUP016-AA
Rear G10 axial nut: MTS-SUP017-AA
Epoxy: MasterBond EP29LPSPZ0005

Tools Needed:
Cups, scale, popsicle sticks, thermometer

Procedure:
Slide G10 axial rods into axial nuts and epoxy for hold (G10-G10)

Images:

Section:
Make MTS tanks

Step:
Prepare inner vessel

Lead:
Verne - (1 person) it takes a day

Parts Needed:
Front G10 rods: MTS-SUP004-AA
Front G10 axial nut: MTS-SUP002-AA
Rear G10 rods: MTS-SUP016-AA
Rear G10 axial nut: MTS-SUP017-AA
Epoxy: MasterBond EP29LPSPZ0005

Tools Needed:
Heat guns
Clamps

Procedure:
Apply heat to cure epoxy from previous step

Images:

Section:	**Procedure:** Apply light epoxy to radial rods and the holes they go into - Do not apply heat yet
Step:	
Lead:	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Screw G10 radial rods into front radial collar (over-screw) (G10-G10), ensure alignment of screw holes to tank for final dome assy
Step: Prepare inner vessel	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Front G10 radial rods: MTS-SUP003-AA Front G10 radial ring: MTS-SUP001-AA	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Slide radial G10 ring over front assembly (serpentine) and unscrew rods to seat into extender
Step: Prepare inner vessel	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Assembly dwg MTS-SUP010-AA	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Slide dome over to test dome to g10 position, and then remove dome
Step: Prepare inner vessel	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment (gantry crane) Add'l strap?	

Section: Make MTS tanks	**Procedure:** Apply epoxy to radial rods and their contact points with the hole (i.e. circumference of rods in holes)
Step: Prepare inner vessel	
Lead: Verne - (1 person)	**Images:**
Parts Needed:	
Tools Needed:	

Section:	**Procedure:** Apply epoxy to axial ring
Step:	
Lead:	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Slide axial G10 ring with spokes into front extender
Step: Prepare inner vessel	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Assembly dwg MTS-SUP010-AA	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Slide axial G10 ring with spokes into rear extender
Step: Prepare inner vessel	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Assembly dwg MTS-SUP018-AA	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Pull SS front dome up from underneath tank and align it to G10 feet, screw-holes, and serpentine tube through-port from outside
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment (gantry crane) Add'l strap?	

Section: Make MTS tanks	**Procedure:** Ensure T sensor leads and fill-tube are coming through fill-tube port
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** If needed, adjust G10 feet
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Epoxy G10 rods to aluminum extending collar once in correct position and heat with heat guns
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (2 people)	**Images:**
Parts Needed: Epoxy: MasterBond EP29LPSPZ0005	
Tools Needed: Heat guns Clamps	

Section: Make MTS tanks	**Procedure:** Place foam rings around front (bottom) dome's connection point to cylinder
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Slide rods with plastic spacers to ensure foam rings are at right position with respect to the tank
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Push up THS bottom jack to hold dome and cylinder
Step: Enclose tank: cylinder & front dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Ensure bottom jack with middle strap can hold tank
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Unscrew bolt and chain from back plug
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Place SS back dome on top (back port), ensuring alignment with steel hex and G10 (slot aligned)
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Place foam rings around back (i.e.top) dome's connection point to cylinder
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Slide rods with plastic spacers to ensure rings are at right position
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Enclose transportation structure
Step: Enclose tank: back dome	
Lead: Verne - (3 people)	**Images:**
Parts Needed:	
Tools Needed: ED Assembly equipment	

Section: Make MTS tanks	**Procedure:** Take system enclosed in transportation structure to Altamont
Step: Weld SS components around tanks	
Lead: Verne - (2 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Take customer cradle to Altamont
Step: Weld SS components around tanks	
Lead: Verne - (2 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section:
Make MTS tanks

Step:
Weld SS components around tanks

Lead:
Altamont

Parts Needed:
MTS-SHL_R005-AA (fore tank)
MTS-SHL_L005-AA (aft tank)

Tools Needed:
Weld
Figure out tank holding setup during welding @ Altamont - bring jack, or have RJ develop custom holder like Proto1?

Procedure:
Weld SS domes to SS cylinder (will need to maintain vertical orientation for this)

Images:

Section: Make MTS tanks	**Procedure:** Plug each SS dome with SS circle (weld for vacuum seal)
Step: Weld SS components around tanks	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed: Weld Additional mat'l from Altamont	

Section: Make MTS tanks	**Procedure:** Place each tank in customer cradle with straps aligned on welds
Step: Place tanks in cradle	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS tanks	**Procedure:** Verify strap fit around tanks with provided fasteners
Step: Place tanks in cradle	
Lead: Verne (1 person)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut straight H2 tube part for insulated manifold ("Rear Spacer to BOP in Manifold")
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: MTS-SUP017-AA	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Make manifold G10 ring
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: MTS-SUP022-AA	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Slide manifold G10 ring onto long tube between tanks
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: don’t forget to slide the g10 and clam before weld	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Prepare manifold temperature sensor mount (clamp)
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: MTS-SNS001-AA	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Slide manifold temp sensor mount onto long tube between tanks, do not yet install temperature sensor or screw (should stay put on tube without issue)
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Provide elbow joints (2 for this tube assy) to Altamont
Step: Prepare manifold insulated tubing	
Lead: Verne	**Images:**
Parts Needed: Parker 3/8" socket weld elbow (6-6EW-SS)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Provide T joints (7 for this assembly, 2 more will be external to manifold) to Alamont
Step: Prepare manifold insulated tubing	
Lead: Verne	**Images:**
Parts Needed: Swagelok 3/8" socket weld T's (SS-6-TSW-3)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld tubing and joints together to form tubing assembly: - Elbow from rear tank to straight tube - Prep T from front tank to remaining tubes, this will be last weld (need to slide on once assembled to ensure tubing lengths align) - T to short tube to T to short tube to T to med tube to T @ front tank - BOP extension tubes out from T's - Separate assembly: front tube from ck valve (T) to elbow to short tube to T to bent manifold exit tube (remaining T can be assembled later)
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: Reference MTS-TUB009-AD (contains all drawing PNs) add steps	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld manifold T and elbow to tanks' fill tubes (elbow to vehicle rear tank "left" and T to vehicle front tank "right" with center of T extending parallel inside manifold)
Step: Prepare manifold insulated tubing	
Lead: Altamont	**Images:**
Parts Needed: Reference MTS-TUB009-AD (contains all drawing PNs)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Secure temperature sensor to clamp with screw and nut
Step: Prepare manifold insulated tubing	
Lead: Altamont or Verne	**Images:**
Parts Needed: Screw: MMC 4-40 low-profile screw PN 90357A116 Nut: MMc 4-40 narrow nut PN 91834A102	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Screw 5th temperature sensor into holder
Step: Prepare manifold insulation	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut SS pipe to length for manifold
Step: Prepare manifold insulation	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut holes in SS pipe for tank ports and tube half nipples
Step: Prepare manifold insulation	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC (1)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld tank ports onto manifold shell (NOT half nipples)
Step: Prepare manifold insulation	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC (1)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut manifold SS piping horizontally in half
Step: Prepare manifold insulation	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC (2)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Wrap manifold H2 tube with MLI
Step: Prepare manifold insulation	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Place halves around insulated manifold tubing (clamshell)
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC (2)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Orient 5x temperature sensor leads from tank ports through TCF port
Step: Close out manifold space	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld clamshell halves of manifold shell together and to each tanks' ports, ensure tubes extending from T's in nipple holes
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC (2)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Bend LPBD u-tube and cut to length
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB013-AA	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld LPBD u-tube to assembled manifold
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Create SS disc for back and front side of manifold tube
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Bore hole in front manifold disc for tubing
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Slide front disc over exposed inlet tubing
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Enclose sides of manifold tube with SS discs (welded)
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Provide half nipples (1.33" and 2.75" OD) to Altamont
Step: Close out manifold space	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut half nipples to match bend of manifold
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN001-AC	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Slide half nipples over protruding tubes and weld half nipples onto manifold side
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld half nipples onto top half of manifold, ensuring temp sensor leads feed through
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-MAN002-AD	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Provide 1.33" blank flanges (non-tapped) for BOP to have a tube hole cut in them
Step: Close out manifold space	
Lead: Verne	**Images:**
Parts Needed: KJL PN F0133N000NLN (or 316SS variant)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut 3/8" through-hole in blank flanges for BOP
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed: MTS-FLG002-AA (x6)	
Tools Needed:	

Section:
Make MTS manifold

Step:
Close out manifold space

Lead:
Altamont

Parts Needed:
MTS-FLG002-AA (x6)

Tools Needed:

Procedure:
Slide copper gaskets and blank flanges (with hole) over protruding BOP tubes

Images:

Section:
Make MTS manifold

Step:
Close out manifold space

Lead:
Verne (1 person)

Parts Needed:
KJL copper gaskets: KJL GA-0133 (x6)
Bolts: SBS832075S4-25 or equivalent bolt on hand from KJL (~0.75" length)

Tools Needed:
Torque wrench (small)
Torque values found @ Reference https://www.lesker.com/newweb/flanges/flanges_technicalnotes_conflat_1.cfm

Procedure:
Assemble flanges to half-nipples using correct torque [add torque spec]

Images:

Section: Make MTS manifold	**Procedure:** Weld around tubes to flanges and front disc to close out vacuum space (all)
Step: Close out manifold space	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive bent tube parts for BOP
Step: Prepare exposed tubing	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut bent tube parts to size
Step: Prepare exposed tubing	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB010-AB (x2) MTS-TUB023-AA (x1) MTS-TUB007-AD (x1)	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Cut straight tube parts for remaining BOP
Step: Prepare exposed tubing	
Lead: Altamont	**Images:**
Parts Needed: Inlet: MTS-TUB005-AB Ext from ck vlv: MTS-TUB008-AB	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Provide T joints (2 for this region)
Step: Prepare exposed tubing	
Lead: Verne	**Images:**
Parts Needed: Swagelok 3/8" socket weld T's (SS-6-TSW-3)	
Tools Needed:	

Section:
Make MTS manifold

Step:
Prepare exposed tubing

Lead:
Altamont

Parts Needed:
Reference MTS-MAN002-AD
MTS-TUB010-AB (x2)
MTS-TUB023-AA (x1)
MTS-TUB007-AD (x1)

Tools Needed:

Procedure:
Weld joints and tubing together to create full manifold fill tube:
- weld extended inlet line to T @ check valve
- weld T to extended line, 2x bent lines from T (for inlet valves)
- weld BOP line from T after check valve for PT2
- weld bent line to HPRD from T after manifold exit (outboard)
- weld bent line to HX from T after manifold exit (inboard)

Images:

Section: Make MTS manifold	**Procedure:** Transport two-tanks and manifold to Verne
Step: Attach vacuum components	
Lead: Verne - (2 people)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Solder sensor leads to TCF
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Attach TCF
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Attach vacuum valve
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Attach low pressure rupture disc
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Attach vacuum gauge
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Connect vacuum pump and start pulling vacuum
Step: Attach vacuum components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive HP rupture disc
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive PRV x2
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed: Flowsafe - 1x 400 bar, 1x 455 bar	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive PRV inlet fittings (x2)
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive PRV outlet fittings (x2)
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive manual valves
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive check valves
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive TPRD
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld TPRD
Step: Attach HP components	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Take HP components to Altamont
Step: Attach HP components	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Weld HP components to manifold fill tube
Step: Attach HP components	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB-040-AA	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Receive SS tubing for Heat exchanger
Step: Heat exchanger	
Lead: HEAT (via Verne)	**Images:**
Parts Needed:	
Tools Needed:	

Section: Make MTS manifold	**Procedure:** Make & send heat exchanger
Step: Heat exchanger	
Lead: HEAT	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Receive HX
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Receive ambient temperature sensors
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Weld HX tubing to SS tubing before & after HX
Step: Heat exchanger	
Lead: Altamont	**Images:**
Parts Needed: MTS-TUB041-AA	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Stick or epoxy (conductive, cryogenic) ambient T sensors to tubing
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Make HX triad pieces
Step: Heat exchanger	
Lead: Altamont	**Images:**
Parts Needed: MTS-SUP007-AB	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Attach triad pieces to HX
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Make supports to connect triad to chassis
Step: Heat exchanger	
Lead: Altamont or Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Weld supports to clamp
Step: Heat exchanger	
Lead: Altamont	**Images:**
Parts Needed: DWG NEEDED	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Take detachable equipment to Verne
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Provide valves for detachable fueling equipment
Step: Heat exchanger	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: HX, PR, Inlet	**Procedure:** Take parts to Altamont
Step: The section below is not relevant for the shaker test	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Cut tubing for detachable fueling equipment
Step: Inlet equipment (detachable)	
Lead: Altamont	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Weld parts together
Step: Inlet equipment (detachable)	
Lead: Altamont	**Images:**
Parts Needed: DWG NEEDED	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Take detachable equipment to Verne
Step: Inlet equipment (detachable)	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Test attachment to MTS
Step: Inlet equipment (detachable)	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Receive pressure regulator
Step: Inlet equipment (detachable)	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Refueling Hardware	**Procedure:** Take PR to Altamont
Step: Inlet equipment (detachable)	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Testing Hardware	**Procedure:** Attach pressure regulator to tubing after HX (compression fitting)
Step: Pressure regulator	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Testing Hardware	**Procedure:** If required add post-PR tubing
Step: Pressure regulator	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Testing Hardware	**Procedure:** Asssemble frame
Step: Pressure regulator	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Detacheable Testing Hardware	**Procedure:** Attach straps to tanks
Step: Pressure regulator	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	

Section: Mounting structure	**Procedure:** Attach straps to frame
Step: Tank mounting	
Lead: Verne	**Images:**
Parts Needed:	
Tools Needed:	