Statement of Work for Fabrication of Vacuum Jacketed (VJ) Piping

I. General Information:

1. VJ Piping used for transfer of Liquid Nitrogen (LN_2) from storage tank to transfer pump.
2. VJ Piping will replace existing insulated pipe presently in use.
3. VJ Piping must mate to fixed (6" 150#) flange on the valve and existing fixed (6" 150#) flange on the other end.
4. VJ Piping must avoid interference with adjacent piping and equipment.
5. Attached drawings show current configuration of existing pipe and how it is fabricated to avoid interference with surrounding pipe.
6. Vendor is responsible for verifying dimensions, and generating isometric drawings of VJ Pipe.
7. Vendor assumes responsibility for dimensional accuracy, proper configuration, and fit of VJ Pipe.
8. Installation is not required, this will be performed by MSFC personnel.

II. VJ Pipe Specifications:

1. One 6" Worcester non-insulated cryogenic flanged ball valve (P/N C5166PT150), or equivalent. Valve will mount to LN_2 Storage Tank with new VJ Pipe mounting to "downstream" side of the valve.
2. Approximately 24 ft of 6" x 8" Sch5s seamless 304SS VJ Piping.
3. VJ Pipe and all attachments shall have MAWP of at least 150 psig @ LN_2 service.
4. One ½" 150# set point ASME Pressure Relief Valve on VJ riser.
5. Two feet of 6" x 8" VJ Flex built into the pipe referenced in item 2.
6. Two 6" 150# RFWN Flanges welded to VJ Pipe.
7. Two 1" VJ Risers (height TBD by where proposed risers are located) terminating with 1" NPT that will be used as attachment points for gas venting devices (vent devices not included, they will be provided by NASA).
8. VJ Piping is to be shipped by dedicated truck FOB Destination with any shipping cost to be included in quote.

III. Pipe Configuration:

1. See attachment for dimensions of existing pipe.
2. Existing pipe does not include a valve. Pipe dimensions shall be adjusted to accommodate valve described in section **II.** 1.
3. Attached drawing package accurately describes dimensions and relative location of existing LN_2 pipe. Existing pipe that VJ Pipe will replace is Find Number 3 and is shown in detail on page 3. Modeling of these pipes would accurately reveal proper fit and potential interference of new VJ Pipe and valve. However, a optional site visit (Date & Time will be specified in RFQ) would probably be in order to ensure proper fit of new VJ Pipe.
4. PDF of LN_2 Pipe Drawings referenced above.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

PRELIMINARY
HAS NOT COMPLETED REVIEW CYCLE
AND IS SUBJECT TO CHANGE
08/12/2010

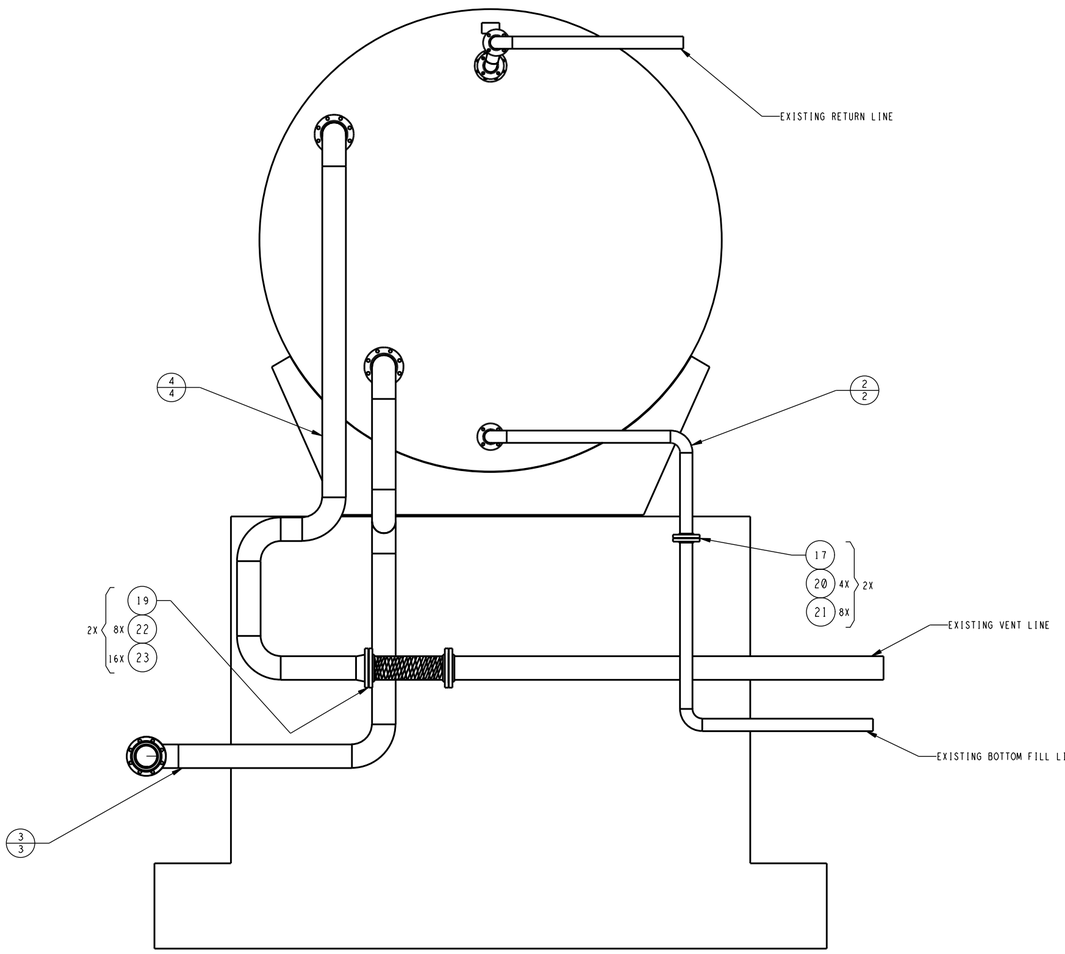
GENERAL NOTES

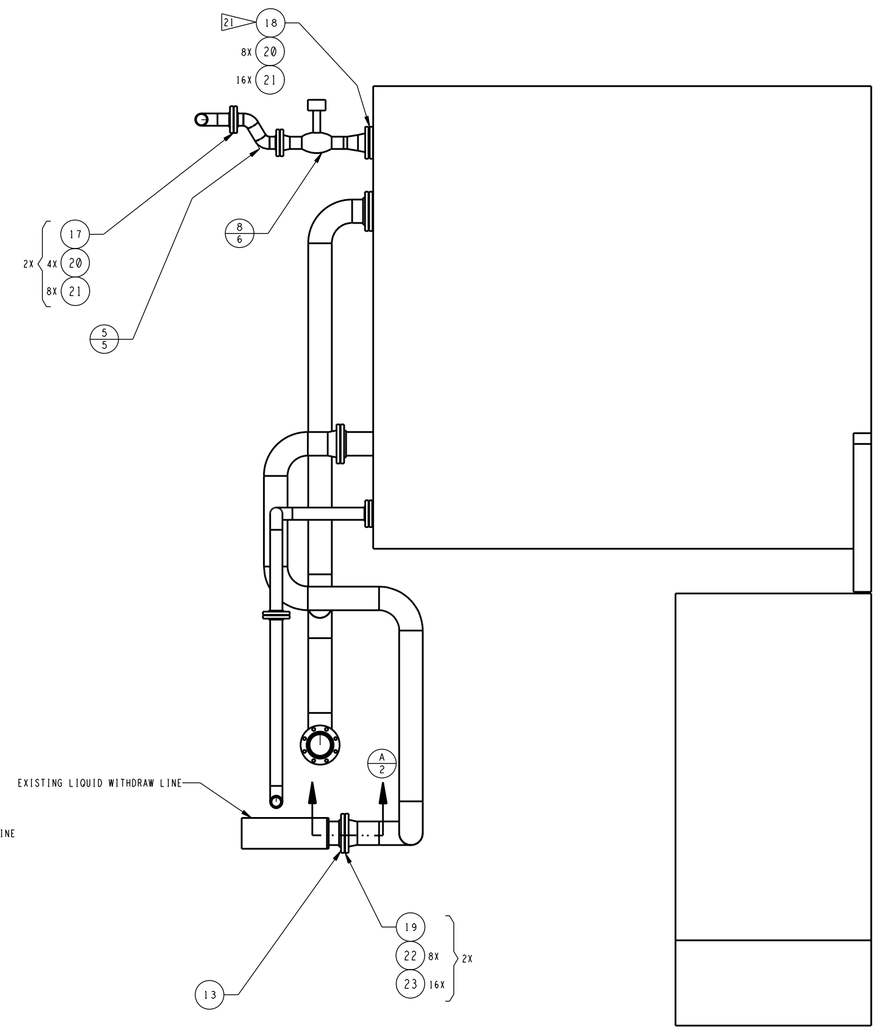
1. REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.
2. FIELD TO VERIFY ALL TIE-IN CONNECTIONS.
3. ALL PIPE SIZES AND SCHEDULES SHALL CONFORM TO THE DIMENSIONS OF ASME-B36.10 OR ASME-B36.19.
4. ALL FITTINGS SHALL CONFORM TO THE DIMENSIONS OF ASME-B16.9 OR ASME-B16.28. NO BLOCK PATTERN FITTING SHALL BE USED. THE CROTCH AREA OF TEES AND CROSSES SHALL BE REINFORCED WITH LONG RADIUS DESIGN TO ELIMINATE SHARP CORNERS.
5. ALL PIPE FLANGES SHALL CONFORM TO THE DIMENSIONS AND PRESSURE - TEMPERATURE RATINGS OF ASME-B16.5.
6. ALL NON-METALLIC FLAT GASKETS FOR PIPE FLANGES SHALL CONFORM TO THE DIMENSIONS OF ASME-B16.21.
7. ALL BEVELS FOR BUTTWELDING ENDS OF PIPE FITTINGS, FLANGES, VALVES, AND COMPONENTS SHALL CONFORM TO ASME-B16.25.
8. ALL SCREW THREADS SHALL CONFORM TO THE "UNIFIED INCH SCREW THREADS" STANDARD ASME-B1.1.
9. ALL PIPE FLANGE BOLT HOLES SHALL STRADDLE THE CENTERLINE OF THE PIPE.
10. ALL MACHINED PARTS TO HAVE A 125 MICROINCH ROUGHNESS HEIGHT RATING SUFACE FINISH.
11. ALL PIPING SHALL BE IDENTIFIED AND COLOR CODED PER ASME-A13.1.
12. ALL PIPING SYSTEMS SHALL BE HYDROSTATED TO 1.5 TIMES THE WORKING PRESSURE OF THE SYSTEM PER ASME-B31.3.
13. ALL PIPING SYSTEMS AND STRUCTURAL ATTACHMENTS TO PIPING SHALL BE WELDED PER ASME-B31.3. FOR SERVICE TEMPS BELOW -155F APPROPRIATE QUALIFIED, IMPACT TESTED, WELD PROCEDURES SHALL BE USED. SERVICE TEMPS DOWN TO -320F USE 308L WELD WIRE, SERVICE TEMPS BELOW -320F USE 316L WELD WIRE.
14. ALL PIPING SYSTEMS SHALL BE DESIGNED PER ASME-31.3.
15. ALL STRUCTURAL STEEL SHAPES SHALL CONFORM TO THE DESIGNATIONS AND DIMENSIONS OF THE AISC "STEEL CONSTRUCTION MANUAL".
16. ALL STEEL PIPE SUPPORTS SHALL BE WELDED AND 100% VISUALLY INSPECTED PER ASME-31.3.
17. ANY STAINLESS STEEL PIPING SUPPORTS OR ANCHORS THAT ARE WELDED TO A STAINLESS STEEL PIPING SYSTEM SHALL BE OF A LOW CARBON CONTENT STAINLESS STEEL MATERIAL ("L" GRADE).
18. BOLTS SHALL BE TORQUED PER MSFC-STD-486B, EXCEPT FOR VENDOR SUPPLIED COMPONENTS, WHICH SHALL BE TORQUED PER VENDOR SPECIFICATIONS. FLANGE JOINT STUDS FOR FLANGES CONTAING NON-METALLIC FLAT GASKETS OR METALLIC RING SEALS SHALL BE TORQUED AS NECESSARY TO PREVENT LEAKAGE. THERE SHALL BE NO GASKET EXTRUSION OR COLD FLOW.
19. MATERIAL SPECIFICATIONS FOR STAINLESS STEEL PIPING SYSTEMS
    PIPE: ASTM-A312-TP304L SST. - SEAMLESS
    PIPE FLANGES: ASTM-A182-F304L SST.
    PIPE FITTINGS: ASTM-A403-WP-S 304L SST.
    STUD BOLTS: ASTM-A193- GR.8 CLASS 2 SST.
    HEXAGON NUTS: ASTM-A94-GR.8 SST.
    FLAT GASKETS: GYLON
20. ALL PIPING SYSTEM FILLET WELD JOINTS SHALL BE 100% VISUALLY AND 100% DYE PENETRANT EXAMINED PER ASME-B31.3. ACCEPTANCE CRITERIA PER PARAGRAPH 341.3.2.

2 ATTACH MODIFIED RETURN VALVE DIRECTLY TO TANK.

SUGGESTED VENDORS:

1. SOUTHERN PIPE & SUPPLY
   9471 US HIGHWAY 431
   ALBERTVILLE, AL 35950
   (256) 878-1090
   WWW.SOUTHERNPIPE.COM
2. HUNTSVILLE FASTENER AND SUPPLY, INC.
   100 SKYLAB DRIVE
   HUNTSVILLE, ALABAMA 35806
   205-859-6707





FIND NO. 1

SCALE:1:16

13 SERVICE: LN2
TEMPERATURE: -325F TO 100F
PRESSURE: 2000 PSIG

FIND NO.	SHEET NO.	NO. REQ'D FOR F.N. 1	NO. REQ'D FOR F.N. 2	NO. REQ'D FOR F.N. 3	NO. REQ'D FOR F.N. 4	NO. REQ'D FOR F.N. 5	TOT. REQ'D		PART NO.	DESCRIPTION	VEND. NO.	REMARKS
23	1	64					64	P	90M13343-23	HEX NUT, 3/4-10 UNC-2B	2	MATL: SEE NOTE 19
22	1	32					32	P	90M13343-22	STUD BOLT, 3/4-10 UNC-2A X 4.00 LG	2	MATL: SEE NOTE 19
21	1	48					48	P	90M13343-21	HEX NUT, 5/8-11 UNC-2B	2	MATL: SEE NOTE 19
20	1	24					24	P	90M13343-20	STUD BOLT, 5/8-11 UNC-2A X 3.75 LG	2	MATL: SEE NOTE 19
19	1	4					4	P	90M13343-19	FLAT GASKET FOR 6" 150# RF FLANGE	1	MATL: SEE NOTE 19
18	1	1					1	P	90M13343-18	FLAT GASKET FOR 4" 150# RF FLANGE	1	MATL: SEE NOTE 19
17	1	4					4	P	90M13343-17	FLAT GASKET FOR 3" 150# RF FLANGE	1	MATL: SEE NOTE 19
16	6	1					1	P	90M13343-16	4 X 3" SCH 10S CONCENTRIC REDUCER	1	MATL: SEE NOTE 19
15	3,4			A/R	A/R		A/R	P	90M13343-15	6" SCH 10S PIPE	1	MATL: SEE NOTE 19
14	2,5		A/R			A/R	A/R	P	90M13343-14	3" SCH 10S PIPE	1	MATL: SEE NOTE 19
13	1,4	1			1		2	P	90M13343-13	6" 150# R.F. SLIP ON FLANGE	1	MATL: SEE NOTE 19
12	3			5	4		9	P	90M13343-12	6" LONG RADIUS ELBOW SCH 10S	1	MATL: SEE NOTE 19
11	5					2	2	P	90M13343-11	3" SHORT RADIUS ELBOW SCH 10S	1	MATL: SEE NOTE 19
10	2		2				2	P	90M13343-10	3" LONG RADIUS ELBOW SCH 10S	1	MATL: SEE NOTE 19
9	3			2	1		3	P	90M13343-9	6" 150# R.F. WELD NECK FLANGE, SCH 10S BORE	1	MATL: SEE NOTE 19
8	1,6	1					1	M	90M13343-8	EXISTING PRESSURE CONTROL VALVE V1080		
7	6	1					1	P	90M13343-7	4" 150# R.F. WELD NECK FLANGE, SCH 10S BORE	1	MATL: SEE NOTE 19
6	2,5		2			2	4	P	90M13343-6	3" 150# R.F. SLIP ON FLANGE	1	MATL: SEE NOTE 19
5	1,5	1				-	1	A	90M13343-5	LIQUID RETURN ASSEMBLY		
4	1,4	1			-		1	A	90M13343-4	TANK VENT ASSEMBLY		
3	1,3	1		-			1	A	90M13343-3	LIQUID WITHDRAW ASSEMBLY		
2	1,2	1	-				1	A	90M13343-2	BOTTOM FILL ASSEMBLY		
1	1						-	A	90M13343-1	LN2 RETRO FIT ASSEMBLY		

A=ASSEMBLY/SUB-ASSEMBLY/INSTALLATION E=EXISTING ITEM/FACILITY F=FABRICATED ITEM M=MODIFIED ITEM P=PURCHASED ITEM

90M13343
~
REVISION

UNLESS OTHERWISE SPECIFIED
(DIMENSIONS ARE IN INCHES, DO NOT SCALE DRAWING)
FRACTIONS ± 1/16, 1°
DECIMALS .X ± .06, .XX ± .03, .XXX ± .010, ∠ ± .5°

LOCATION: BUILDING 4718
NEXT ASSEMBLY: LAST DETAIL, SECTION, OR VIEW LETTER USED: A

ITEM DESIGN ENGINEER / TEST ENGINEER/REGISTER / STRESS / MATERIALS / INDUSTRIAL SAFETY / ITEM APPROVAL — DATE

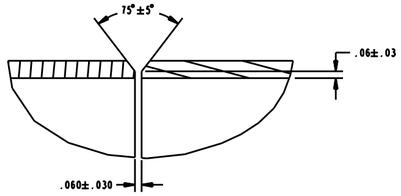
DESIGNER: A. J. RIVERA
CHECKER
DATE: 2010-08-04
OFFICE SYM: ET50
SCALE: NOTED

PIPE LINES FOR LN2 VESSEL

SPECIAL TEST EQUIPMENT DESIGN BRANCH
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA

DRAWING SIZE: E
90M13343
SHEET 1 OF 6

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



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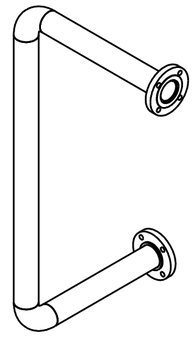
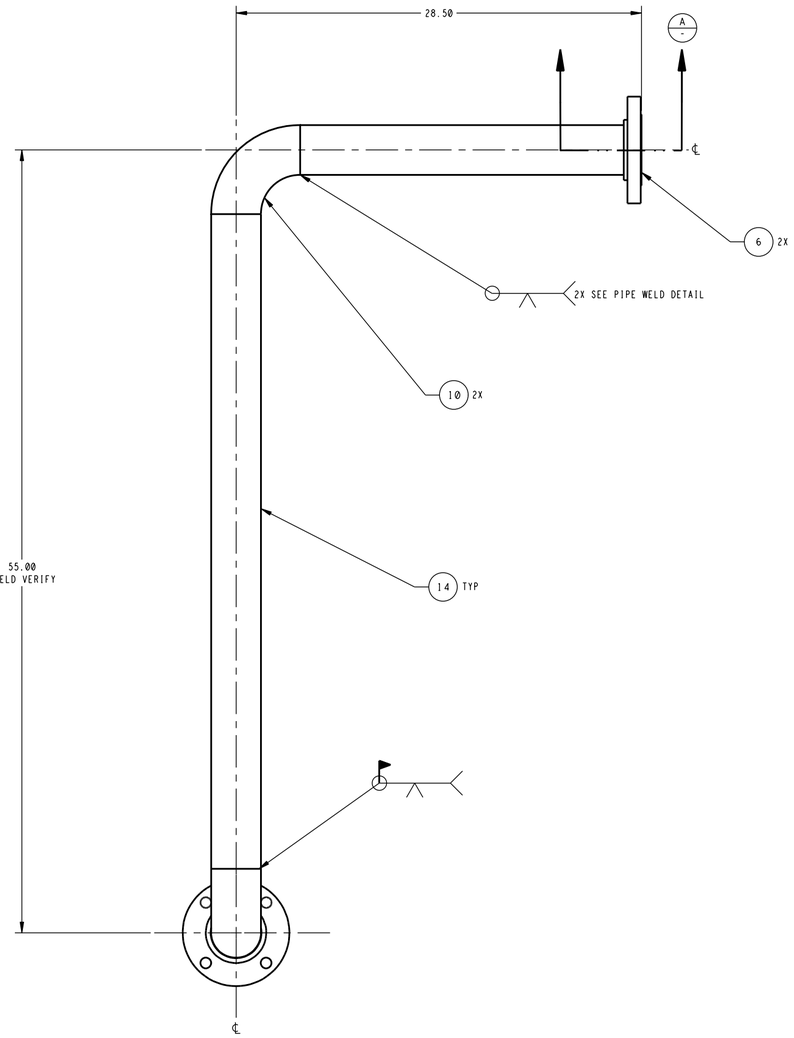
SCALE: NONE



ISO VIEW
FOR REFERENCE ONLY

SCALE 1/8



SECTION 2/1

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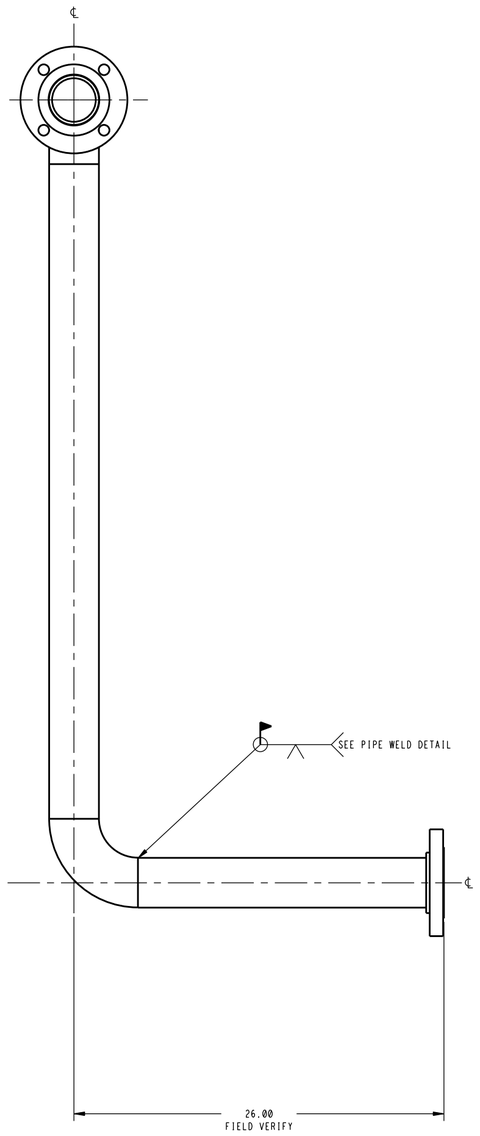
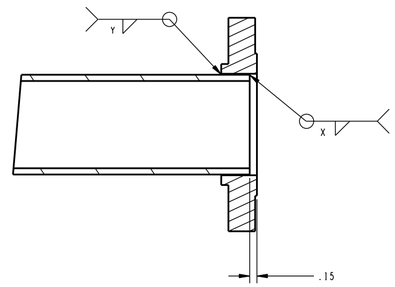




SLIP ON FLANGE WELD SECTION A/1-3.5

FLANGE SIZE	WELD X	WELD Y
3	.12	.17
4	.12	.17
6	.13	.19

90M13343

SEE SHT1

REVISION

PIPE LINES
FOR LN2 VESSEL

SPECIAL TEST EQUIPMENT DESIGN BRANCH

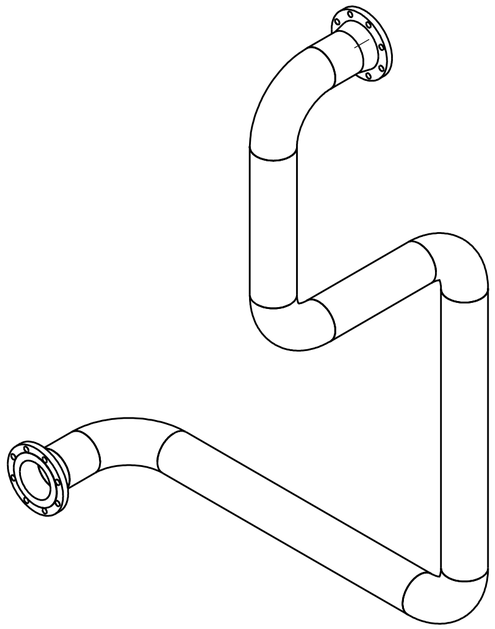
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA

DATE	2010-08-04	OFFICE CODE	ET50
DESIGNED	A. J. RIVERA	SCALE	NOTED

SIZE E | DRAWING NO. 90M13343

SHEET 2 OF 6

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



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FOR REFERENCE ONLY

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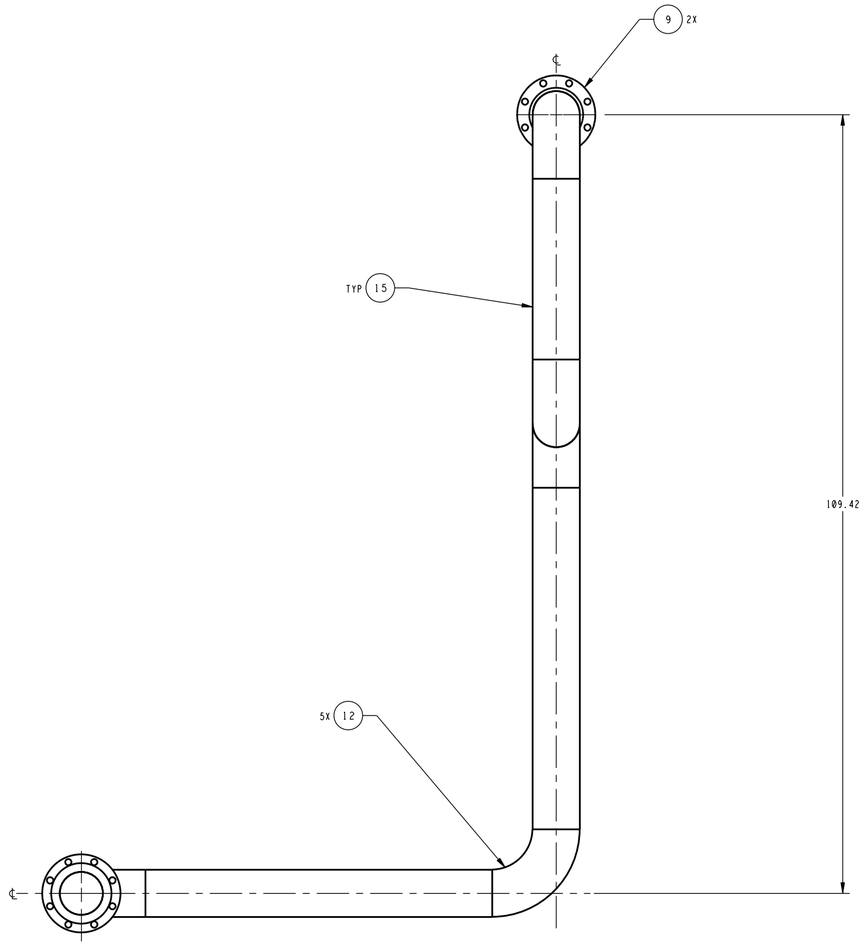

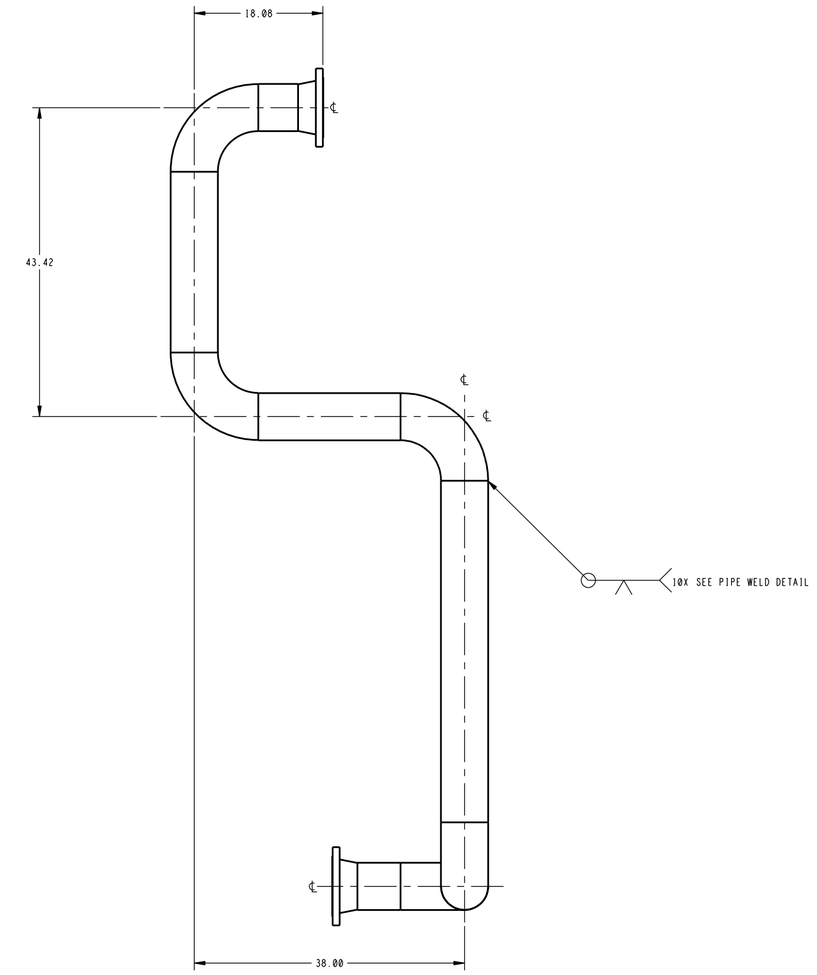

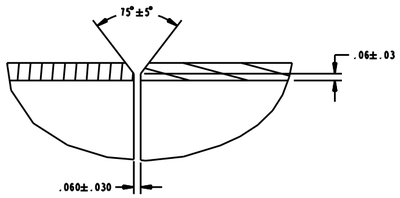

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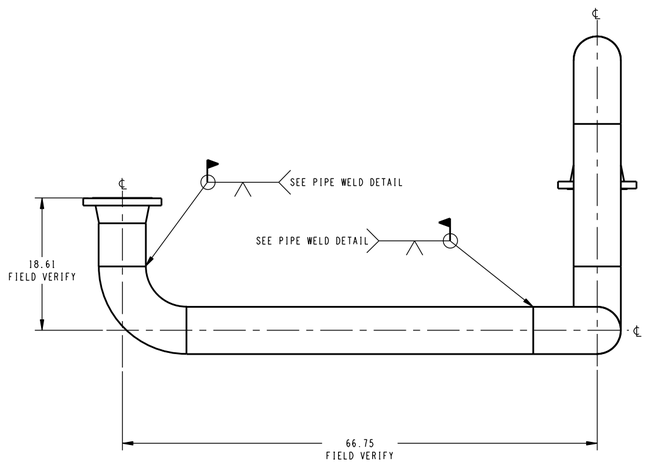


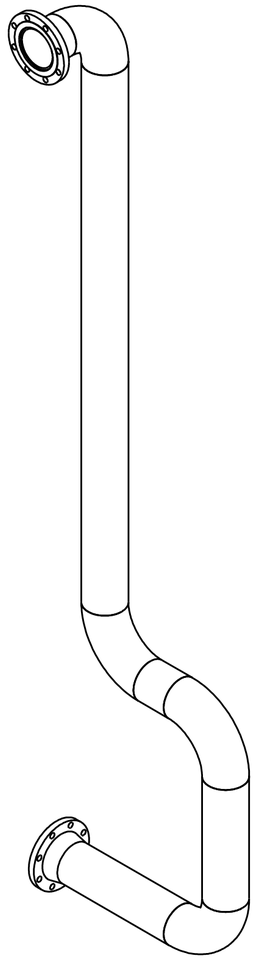
FIND NO. 3/1

SCALE: 1:8

90MI3343
SEE SHT1
REVISION

PIPE LINES FOR LN2 VESSEL		SPECIAL TEST EQUIPMENT DESIGN BRANCH GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
DATE 2010-08-04	OFFICE CODE ET50	DRAWING SIZE F — 90MI3343
DETAILED A. J. RIVERA	SCALE NOTED	SHEET 3 OF 6

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



ISO VIEW
FOR REFERENCE ONLY

SCALE 1/8

TYPICAL PIPE WELD DETAIL

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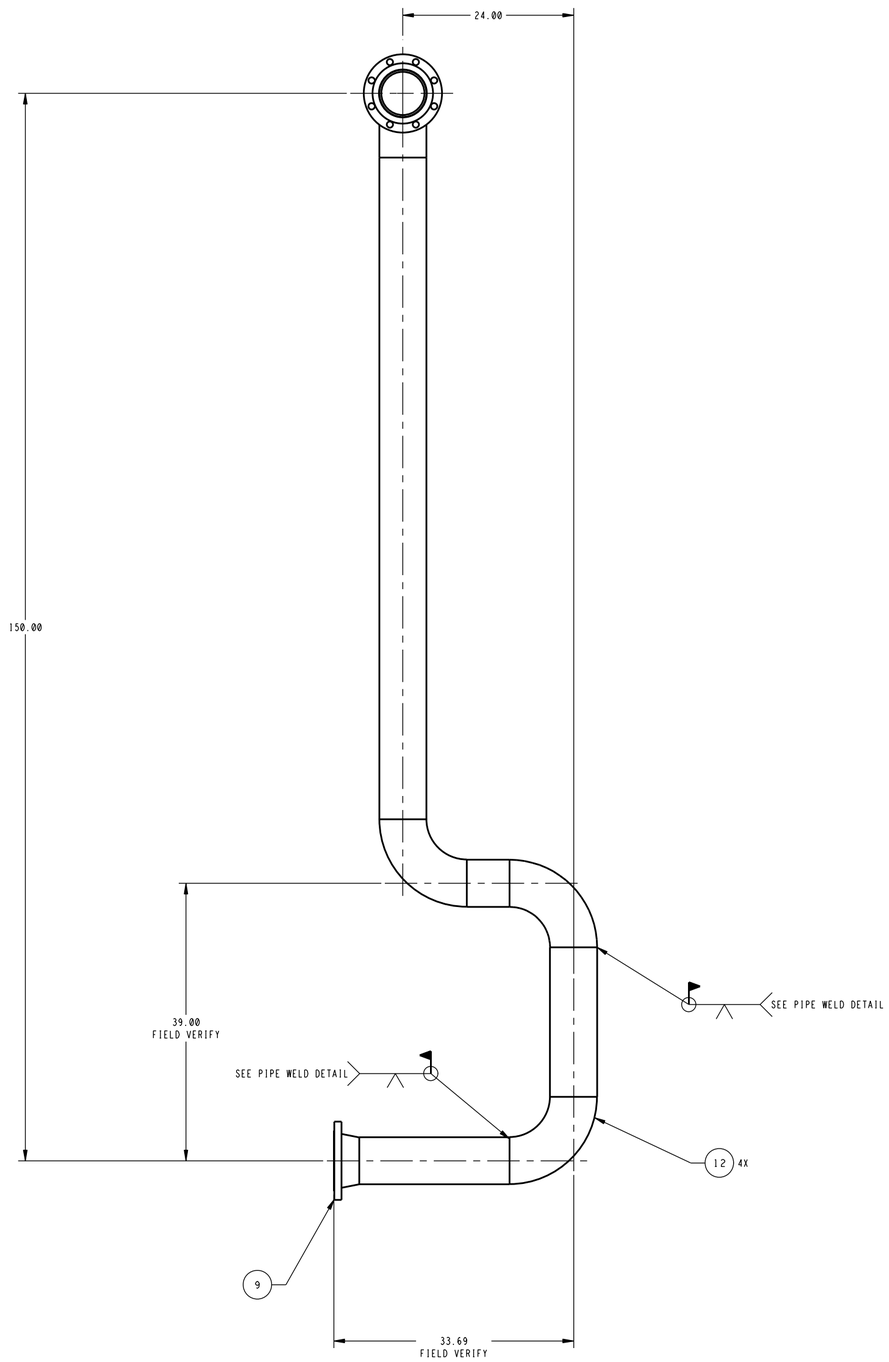

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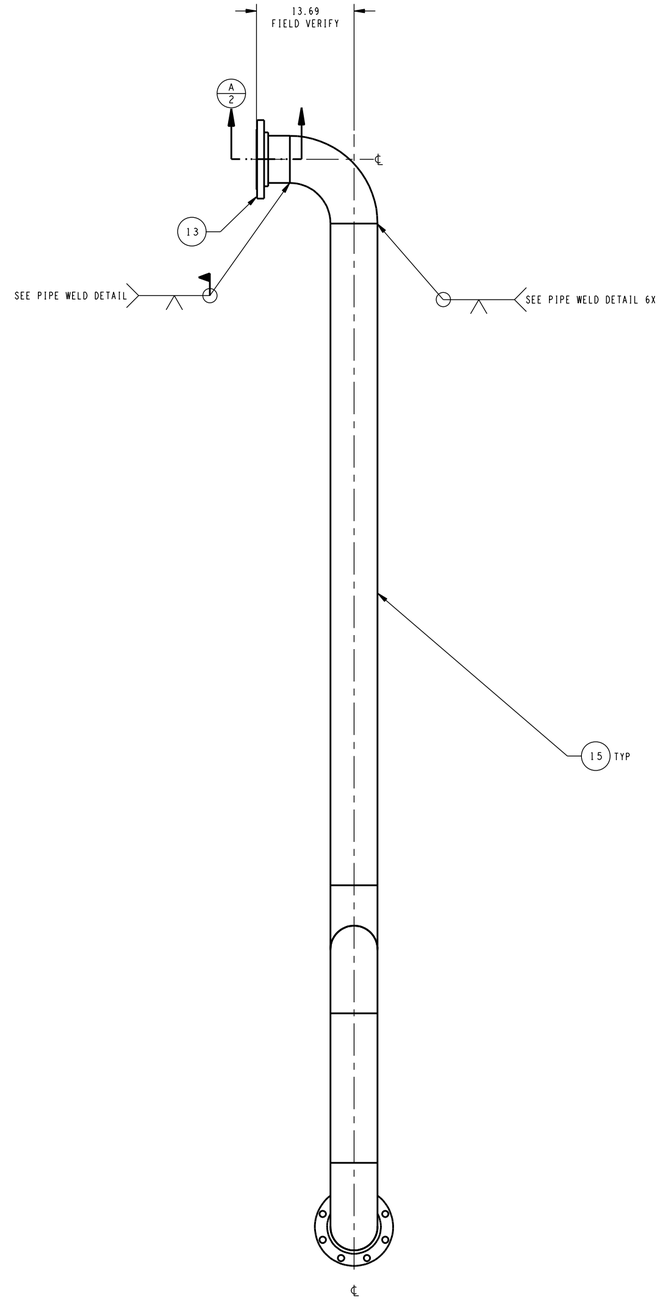
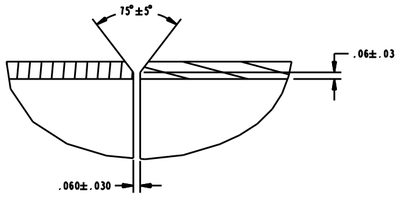


90M13343
SEE SHT1
REVISION

PIPE LINES FOR LN2 VESSEL		SPECIAL TEST EQUIPMENT DESIGN BRANCH GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA	
DATE 2010-08-04	OFFICE CODE ET50	DRAWING SIZE E	90M13343
DETAILED A. J. RIVERA	SCALE NOTED	SHEET 4 OF 6	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



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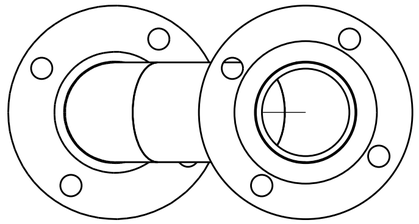
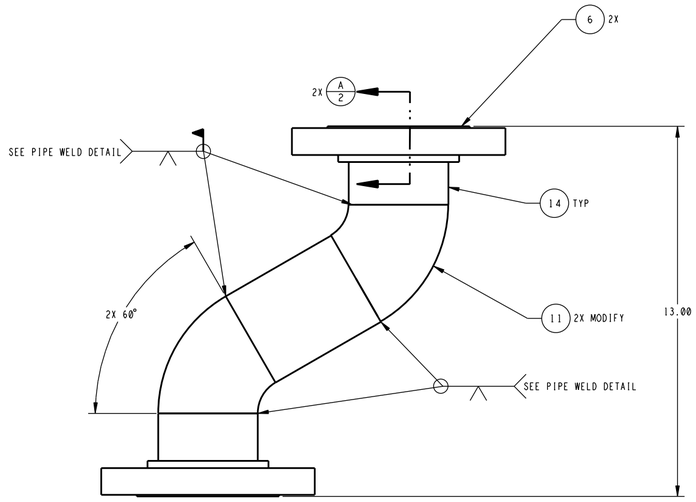
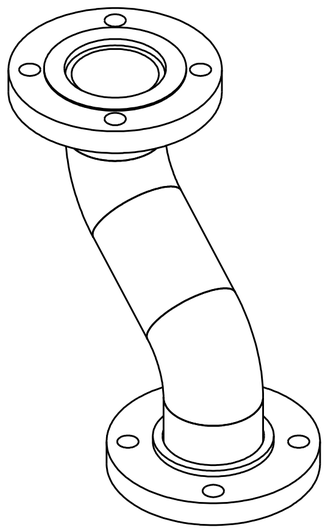
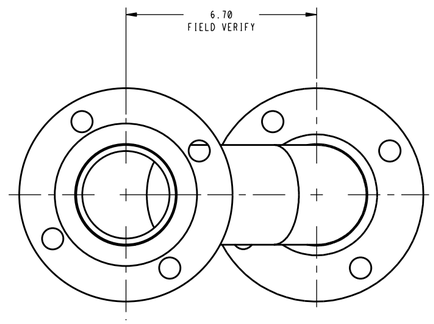






ISO VIEW
FOR REFERENCE ONLY

SCALE 1/2



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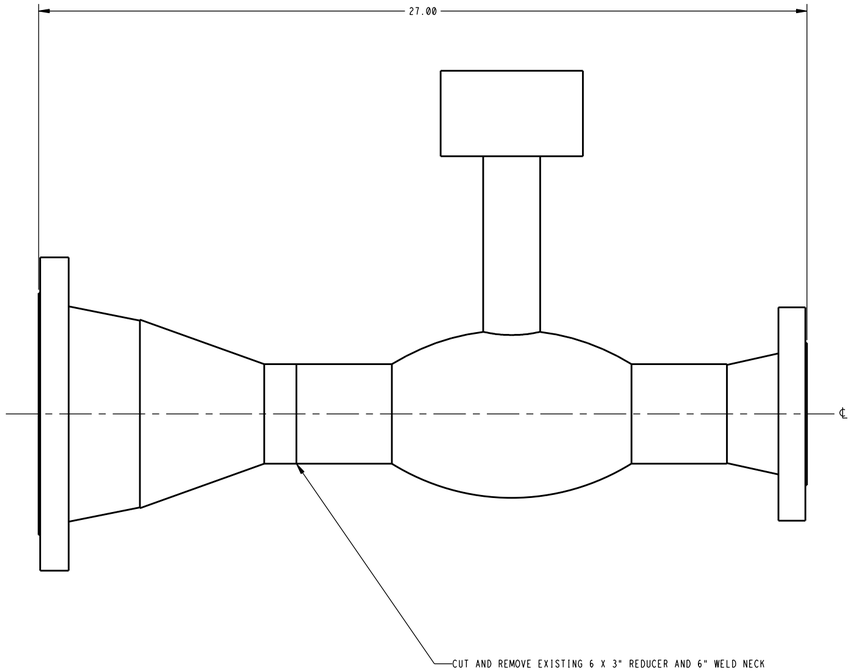
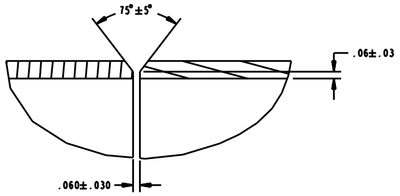
SCALE: 1:2

90M13343
SEE SHT1
REVISION

PIPE LINES FOR LN2 VESSEL		SPECIAL TEST EQUIPMENT DESIGN BRANCH GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
DATE 2010-08-04	OFFICE SYM ET50	DRAWING SIZE E — 90M13343
DRAWN A. J. RIVERA	SCALE NOTED	SHEET 5 OF 6

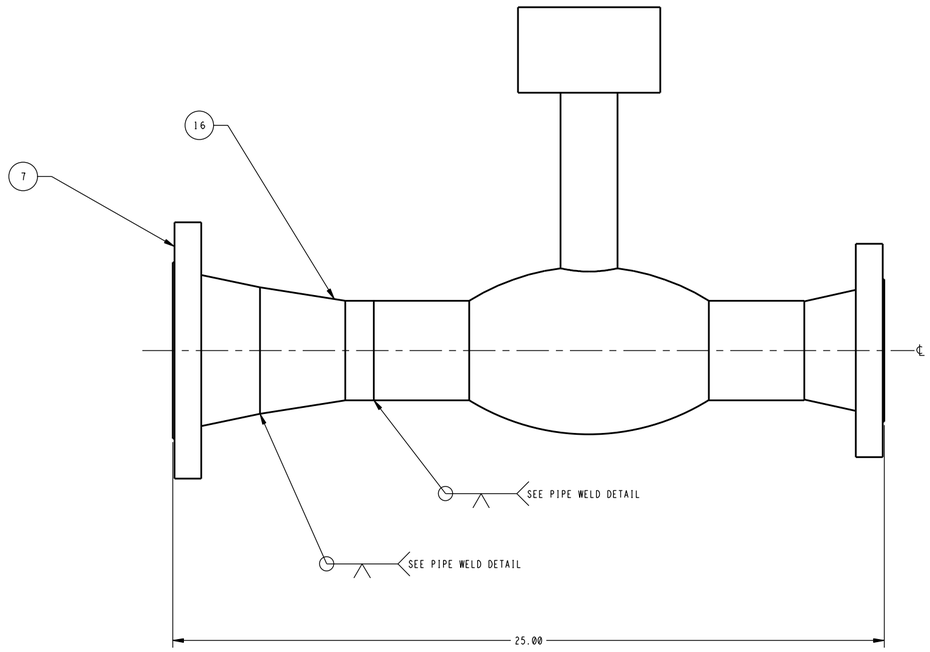
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL





TYPICAL PIPE WELD DETAIL

SCALE: NONE



21 FIND NO. 8/1

SCALE: 1:2

90MI3343

SEE SHT1

REVISION

PIPE LINES FOR LN2 VESSEL		SPECIAL TEST EQUIPMENT DESIGN BRANCH GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
DATE 2010-08-05	OFFICE CODE ET50	DRAWING SIZE E 90MI3343
DRAWN A. J. RIVERA	SCALE NOTED	SHEET 6 OF 6