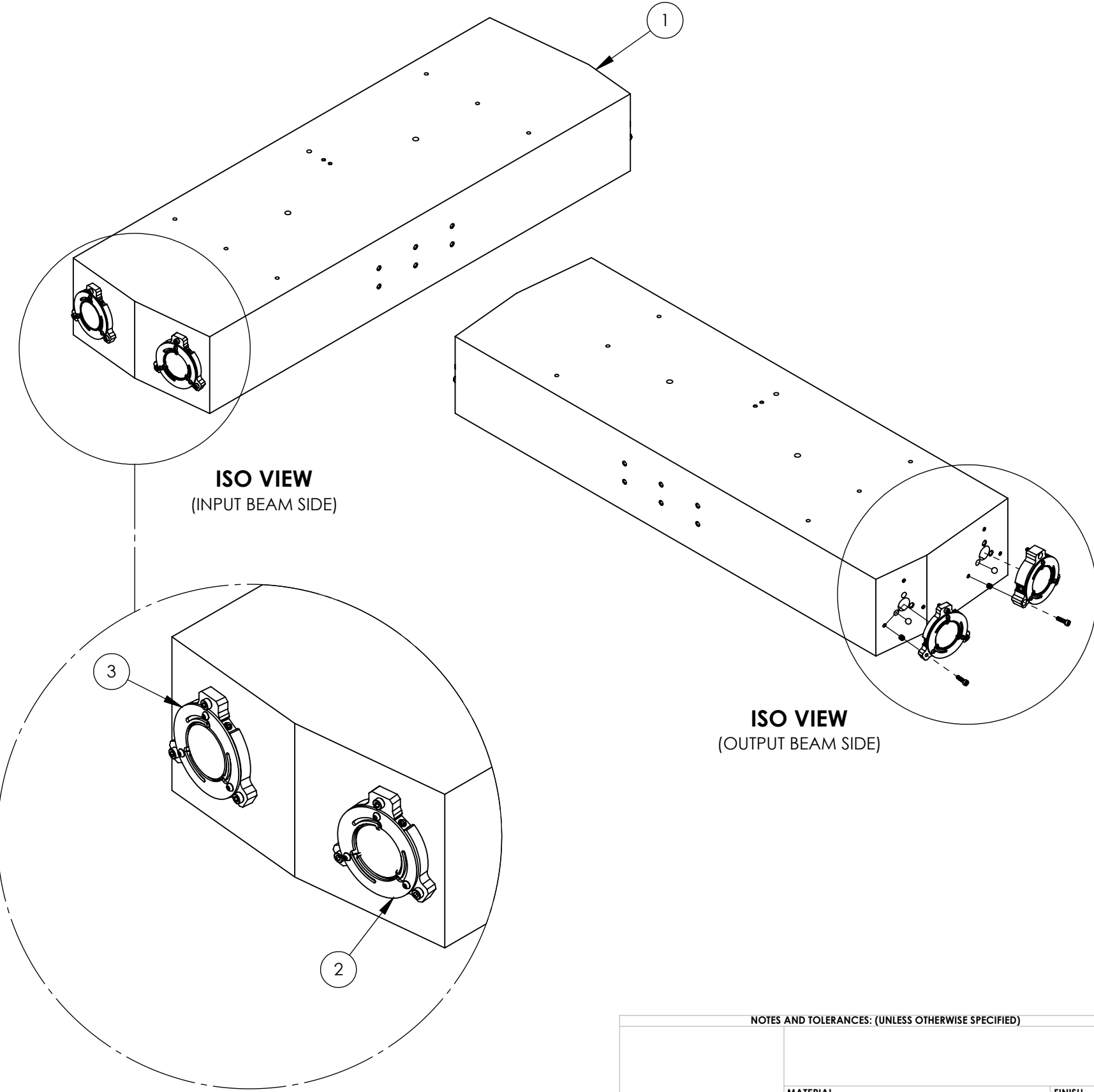


8 7 6 5 4 3 2 1

REV.	DATE	DCN #	DRAWING TREE #
v1	15 SEP 2016	E1600209-x0	-
v2	5 DEC 2016	E1600365-x0	-
-	-	-	-

1. ASSEMBLY IS TO BE COMPLETED BY LIGO PERSONNEL IN ACCORDANCE WITH THE LATEST REVISION OF LIGO-T1600555.
2. TEMPORARY LIST OF PRELIMINARY INSTRUCTIONS, HOUSED HERE FOR CONVENIENCE:
 1. INSERT NECESSARY HELICOILS. REGARDING THE INSERTION OF TANGLESS HELICOILS WITH SMALL DIAMETERS:
 1. MORE DETAIL ON FOLLOWING SHEET
 2. AFFIX BOLTED OPTIC MOUNTS TO BODY:
 1. MORE DETAIL ON FOLLOWING SHEET



ITEM NO.	PART NUMBER	DESCRIPTION	MATERIAL	QTY.
7	MC-2.510 UC COMPONENTS OR EQ.	SCREW, SHC, M2.5 X 0.45 X 10mm LG.	304, 316 OR 302 SSTL	12
6	93914A026 McMASTER-CARR OR EQ.	HELICOIL, M2.5 X .45mm X 3.8mm Lg. (N60)	Anti-Seizing Nitronic	12
5	D1600269	aLIGO, PSL, PreMode Cleaner, PZT/Mirror MT. Assembly	N/A	1
4	9642K35 McMASTER-CARR	HARDENED TIGHT-TOLERANCE BALL, 3/16" DIA.	AISI 440C	12
3	D1600244	aLIGO, PSL, PreMode Cleaner, 1" Mirror Assembly (Curved)	N/A	1
2	D1600243	aLIGO, PSL, PreMode Cleaner, 1" Mirror Assembly	N/A	2
1	D1600227	aLIGO, PSL, PREMODE CLEANER, BODY	6061 Alloy	1

NOTES AND TOLERANCES: (UNLESS OTHERWISE SPECIFIED)

MATERIAL		FINISH		NEXT ASSY		PART NAME		REV.	
N/A		N/A μinch		D1600297		aLIGO, PSL, PreMode Cleaner, SPACER ASSY.		v2	
LIGO CALIFORNIA INSTITUTE OF TECHNOLOGY MASSACHUSETTS INSTITUTE OF TECHNOLOGY				ADVANCED LIGO SUB-SYSTEM PSL		DESIGNER E.SANCHEZ DRAFTER E.SANCHEZ CHECKER SEE DCC APPROVAL SEE DCC		SIZE DWG. NO. B D1600270	
						SCALE: 1:4		PROJECTION: SHEET 1 OF 2	

D1600270 aLIGO, PSL, PreMode Cleaner, SPACER ASSY., PART PDM REV: X-003, DRAWING PDM REV: X-001

8 7 6 5 4 3 2 1

TEMPORARY LIST OF PRELIMINARY INSTRUCTIONS, HOUSED HERE FOR CONVENIENCE (EVENTUALLY, WILL BE HOUSED IN LIGO-T1 600555)

1. INSERT NECESSARY HELICOILS. REGARDING THE INSERTION OF TANGLESS HELICOILS WITH SMALL DIAMETERS:

1. PLUG GAUGE THE THREADS OF THE TAPPED BORES TO ENSURE THAT THE HOLES MEET SPECIFICATIONS.
2. VISUALLY CHECK THAT THERE ARE NO "FEATHERED EDGES" (I.E. EXTRA THIN THREADS AT THE START OF THE HOLE) WHICH OCCUR WHEN AN INCORRECT COUNTERSINK HAS BEEN USED IN THE HOLES PREPARATION.
3. VISUALLY CONFIRM THAT NO THREAD CUTTINGS OR OTHER PARTICULATE IS PRESENT IN THE TAPPED HOLE
4. PER STEPHEN'S EXPERIENCE, THE SLEEVE OF THE INSERTION TOOL MAY BE REMOVED AND SHOULD NOT BE USED, AS IT CAUSES MORE PROBLEMS THAN IT SOLVES. USE ONLY THE CENTRAL PIECE OF THE INSERTION TOOL.
5. ENSURE THAT THE PAWL OF THE INSERTION TOOL FIRMLY CAPTURES THE NOTCH OF THE INSERT. IF NOT, INSERTION WILL LIKELY FAIL (AND INSERT SHOULD BE SET ASIDE). IF ISSUE IS PERSISTANT, PAWL SHOULD BE REPLACED.
 1. IDEALLY, ALSO ENSURE THAT THE BOSS OF THE
6. WHEN INSERTING, PROCEED WITH SLOW, EVEN ROTATION OF THE HANDLE OF THE INSERTION TOOL. THE INSERT IS MORE LIKELY TO BE DISLODGED FROM THE PAWL (I.E. WHEN THE NOTCH IS NO LONGER HELD, AND THE INSERT DOES NOT TURN WITH THE TOOL ANYMORE) WHEN ROTATION STOPS AND STARTS AGAIN.
7. IF AN INSERT IS DISLODGED FROM THE PAWL, IT IS ACCEPTABLE TO ATTEMPT TO RECAPTURE THE NOTCH WITH THE PAWL BY ROTATING THE HANDLE OF THE INSERTION TOOL BACKWARDS PAST THE NOTCH, THEN THREADING FORWARD INTO THE NOTCH.
8. IF AN INSERT IS DISLODGED FROM THE PAWL AND CANNOT BE RECAPTURED, OR SOME OTHER FAILURE MODE OCCURS, USE THE BOSS OF THE REMOVAL TOOL TO CAPTURE THE ACCESSABLE NOTCH AND REMOVE THE HELICOIL. SET THE INSERT ASIDE AND DO NOT REUSE.
 1. IF NO NOTCH CAN BE CAPTURED USING THE REMOVAL TOOL (INSERTED TOO DEEP, NOTCH BREAKS OFF, ETC.) STANDARD TANGED HELICOIL REMOVAL TECHNIQUES MAY BE PRACTICED WITH THE SPADE-STYLE REMOVAL TOOL.

2. AFFIX BOLTED OPTIC MOUNTS TO BODY:

9. BACK THE SET SCREWS AND PLUNGER(S) MOST OF THE WAY OUT OF THE MIRROR MOUNT SO THAT THERE IS NOTHING PROTRUDING FROM THE INNER DIAMETER OF THE MIRROR MOUNT.
10. IT MAY BE NECESSARY TO PROP UP THE BODY AT AN INCLINE TO MAKE SUBSEQUENT STEPS EASIER, OR IT MAY BE NECESSARY TO WORK IN A TEAM SO THAT AN EXTRA SET OF HANDS MAY HOLD COMPONENTS IN PLACE DURING ASSEMBLY.
11. PLACE THE HARDENED SSSL BALLS [ITEM 4] IN THE BORES OF THE BODY [ITEM 1]. THE BALLS MAY FALL OUT, SO PROCEED WITH CAUTION.
12. BOLT THE MIRROR MOUNT TO THE BODY [1], VISUALLY CENTERING THE INNER DIAMETER OF THE MIRROR MOUNT WITH RESPECT TO THE EXIT OF THE BODY BORE.
13. ASSEMBLE THE COMPONENT(S) WITHIN THE MIRROR MOUNT.
 1. PLACE THE FIRST COMPONENT'S CAVITY-FACING SURFACE INTO CONTACT WITH THE HARDENED SSSL BALLS [ITEM 4].
 2. USE A SWAB OR SIMILAR CLEAN, NON-MARRING TOOL TO ASSIST IN HOLDING THE FIRST COMPONENT IN POSITION.
 3. IN THE CASE OF THE PZT MOUNT, ENSURE THAT THE PZT IS ORIENTED SO THAT THE WIRES MAY EXIT THROUGH THE SLOT IN THE MIRROR MOUNT.
 4. IN THE CASE OF THE PZT MOUNT, ADD THE PZT SPACER TO THE EXPOSED FACE OF THE PZT, THEN PLACE THE CURVED MIRROR IN CONTACT WITH THE PZT SPACER. THIS OPERATION MAY PROVE DIFFICULT (AT THE TIME OF THE WRITING OF V1, THIS HAD NEVER BEEN ATTEMPTED DUE TO AVAILABILITY OF PARTS.)
14. BOLT THE SPRING PLATE TO THE MIRROR MOUNT, AXIALLY CAPTURING THE COMPONENT(S).
 1. CENTER COMPONENT BY GRADUALLY TIGHTENING SET SCREW AND PLUNGER.
 1. VISUALLY CENTERING SHOULD BE SUFFICIENT. COUNTING TURNS MAY ASSIST IN CENTERING MORE PRECISELY.
 2. IN THE CASE OF THE PZT MOUNT, THE ORDER OF CENTERING IS UP TO THE PREFERENCE OF THE USER (AT THE TIME OF THE WRITING OF V1, THIS HAD NEVER BEEN ATTEMPTED DUE TO AVAILABILITY OF PARTS).
 3. DURING CENTERING, PLUNGER SHOULD BE TIGHTENED TO SAME TORQUE AS SET SCREWS.
 4. ONCE A COMPONENT HAS BEEN CENTERED, BACK OFF THE PLUNGER 1/4 TURN TO PREVENT RADIAL OVERCONSTRAINING AND TO ALLOW REPEATABLE INTERCHANGE OF COMPONENTS AS NEEDED.
15. REPEAT PROCEDURE UNTIL ALL MOUNTS HAVE BEEN AFFIXED TO BODY.

Revisions to the "work in progress" v2 procedure were requested by Garilynn and Rick on 28 Nov 2016. These steps of the procedure were removed, due to the preference for a stacked approach (rather than a sub-assembled approach). They are included here as an appendix, in case there is any desire to explore the subassembled option.

1. CREATE MIRROR SUB ASSEMBLIES (D1600269, D1600243, D1600244)
 1. BOLT THE SPRING PLATE TO THE MIRROR MOUNT, WITH CONTACT SURFACES BENT IN TOWARD THE MIRROR MOUNT.
 2. PLACE THE SPRING PLATE WITH FLAT SIDE DOWN ON A TABLE AND CONTACT SURFACES POINTING UP
 3. PLACE THE MIRROR ONTO THE CONTACT SURFACES OF THE SPRING PLATE, VISUALLY CENTERED WITH RESPECT TO THE INNER DIAMETER OF THE MIRROR MOUNT.
 4. DRIVE THE SET SCREWS AND PLUNGER FORWARD INTO THE BARREL OF THE OPTIC. IT MAY BE HELPFUL TO COUNT REVOLUTIONS TO ASSIST IN THE CENTERING OF THE OPTIC, WHERE EQUAL REVOLUTIONS WILL ENACT EXACT CENTERING. ALTERNATIVELY, SET SCREW AND PLUNGER SIZE AND DEPTH MAY BE MEASURED AND USED TO ESTABLISH A TRUE CENTER.
 1. THE FINAL POSITION OF THE PLUNGER THAT GIVES GOOD HOLD IS APPROXIMATELY 1/4 TURN FROM THE FIRST CONTACT. (THIS IS AN INITIAL FINDING, AND THERE MAY BE A SUPERIOR POSITION FOR THE PLUNGER)
 5. (IN THE CASE OF THE D1600244 PZT MOUNT ONLY) PLACE THE PZT INTO CONTACT WITH THE {MIRROR OR CONTACT ELEMENT} AND CENTER WITH RESPECT TO THE OPTIC, USING THE TECHNIQUE DESCRIBED IN THE PRECEDEING STEP.
2. INSTALL OPTIC MOUNT
 1. PLACE THE HARDENED SSSL BALLS [ITEM 4] IN THE BORES OF THE BODY [ITEM 1]. IT MAY BE NECESSARY TO PROP UP THE BODY AT A SLIGHT INCLINE TO ENSURE THAT THE BALLS REMAIN IN THE BORES.
 2. CAREFULLY BRING THE ASSEMBLY [2, 3, OR 5] WITH INTO POSITION NEXT TO THE SPACER, WITH THE MIRROR SUPPORTED UNDERNEATH BY THE SPRING PLATE.
 3. TILT THE ASSEMBLY [2, 3, OR 5] INTO THE SPACER, FROM FLAT TO VERTICAL, WITH THE SET SCREWS SUPPORTING THE WEIGHT OF THE MIRROR THROUGHOUT. PROCEED UNTIL THE FACE OF THE MIRROR (OR PZT, WHERE APPLICABLE) CONTACTS THE HARDENED SSSL BALLS [4].
 4. WHEN THE MIRROR HAS BEEN PLACED INTO CONTACT WITH ALL THREE HARDENED SSSL BALLS [4], USE ONE HAND TO HOLD THE ASSEMBLY [2, 3, OR 5] IN PLACE. WITH THE OTHER HAND, BOLT THE MIRROR MOUNT TO THE BODY [1] WITH THE M2.5 SCREWS [ITEM 7].

D1600270 dLIGO, PSL, PreMode Cleaner, SPACER ASSY., PART PDM REV: X-003, DRAWING PDM REV: X-001

 CALIFORNIA INSTITUTE OF TECHNOLOGY MASSACHUSETTS INSTITUTE OF TECHNOLOGY	
SIZE B	DWG. NO. D1600270
SCALE: 1:4	PROJECTION:  SHEET 2 OF 2
REV. v2	