

**Document Change Notice (DCN)**

DOCUMENT No.	TITLE	NEW REV
D050421	NP-type ETM QUAD Penultimate Mass	A
D050420	NP-type ETM QUAD Reaction Mass	A

Rev-00 : -

- Both drawings were checked at each revision stage by M. Perreur-Lloyd and C. Cantley.
- Additional detail is included below to clearly illustrate the evolution of each design up to the point of order (October 2006).

CHANGE DESCRIPTION (FROM / TO):**D050421 (Penultimate Mass) - Release level change FROM 05 TO A****1) PENULTIMATE MASS - Physical configuration:**

- Basic dimensions as directed by T010103-05 Advanced LIGO Suspension System Conceptual Design (N. Robertson): -
 - Diameter: 340mm, Thickness: 200mm. Flat Size: 95mm x 200mm
- Tolerances on drawing chosen with close reference to the drawing D040431 (QUAD ETM Silica Test Mass, G. Billingsley / J. Romie et al)
- Material:- LITHOSIL QT [Density = 2.200 g/cc +/- 0.001]
- Blank dimensions as per drawing no. 137999999868, agreed with Material Supplier, C. Cantley/R. Jones, 23/08/06, and sent as email attachment to polishers, 19/09/06: -
 - Diameter: 340.5mm, Thickness: 200.8mm (both +/-0.5mm)
 - Chamfer size: 2.0 +/- 0.2mm x 45 degrees (+/-5degrees)
 - Cylindricity tolerance of 0.1mm on barrel of mass
- Mass of the completed piece (D050421) was predicted as 39.56kg in SolidWorks, using a density of 2.200 g/cc (Email from R. Jones to I. Wilmut et al on 27/07/07)

2) PENULTIMATE MASS -Key Features

- *Wire grooves:* -
 - Separation defined by T010103-05 (N. Robertson)
 - Shape, depth and tolerance on grooves discussed and agreed with polishers in meeting on 23/08/06 (C. Cantley, R. Jones)
- *Shielded Magnet recesses:* -
 - Geometry recommended by K. Strain (30/06/06) and agreed with J. Greenhalgh and I. Wilmut at ALUK Weekly Project Meeting (07/07/06)
 - Specification approved by polishing company in meeting on 23/08/06 (C. Cantley, R. Jones)
- *Reference Grooves* (fiducials): -
 - Size and position of grooves confirmed to R. Jones by I. Wilmut in email (19/07/06). Grooves on the barrel (at 12 o'clock and 6 o'clock) can be used for the precision clocking of the mass.
 - Grooves on the flats are to be used as reference in the precision positioning of an ear bonding jig.
- Serial numbers to be etched/ground or sandblasted (checked with G. Billingsly on 19/07/06. The response stated that, "it is my (G. Billingsly) impression that mechanical loss of the glass will not be an issue in the upper masses". C. Cantley and J. Romie agreed with this statement, (20/07/06). [Note: the sandblasting approach was adopted.]

3) PENULTIMATE MASS - Polishing

- Inspection polish on all faces, edges and chamfers
- Position and size of Lambda/10 flats agreed with polishers in meeting on 23/08/06 (C. Cantley, R. Jones)

CHANGE DESCRIPTION (FROM / TO):**D050420 REACTION MASS - Release level change FROM 06 TO A****1) REACTION MASS - Physical configuration:**

- Basic dimensions as directed by T010103-05 Advanced LIGO Suspension System Conceptual Design (N.Robertson): -
 - Diameter: 340mm, Thickness: 130mm, Flat Size: 95mm x 200mm
- Tolerances on drawing chosen with close reference to the drawing D040431 (QUAD ETM Silica Test Mass, G. Billingsley / J. Romie et al)
- Material:- Schott F2 [Density = 3.61 g/cc]
- Blank dimensions as per drawing no. "ODL-1-Z-1159-a", agreed with Material Supplier, C. Cantley/R. Jones, 23/08/06, and sent as email attachment to polishers, 19/09/06: -
 - Diameter: 340.4mm +/-0.1mm, Thickness: 131 +/-0.3mm)
 - Chamfer size: 2.0 +/- 0.2mm, x 45 degrees (+/-5degrees)
 - Cylindricity tolerance of 0.1mm on barrel of mass
- Mass of the completed piece (D050420) was predicted as 42.17kg in SolidWorks, using a density of 3.61 g/cc (Email from R. Jones to I. Wilmot et al on 27/07/07)

2) REACTION MASS - Key Features

- *Wire grooves(for Reaction test Mass wire loops):* -
 - Separation confirmed as 30mm by N. Robertson to R. Jones in email (11/07/06)
 - Shape, depth and tolerance on grooves discussed and agreed with polishers in meeting on 23/08/06 (C. Cantley, R. Jones)
- *EQ stop recesses:* -
 - Geometry recommended by K. Strain (30/06/06) and agreed with J. Greenhalgh and I. Wilmot at ALUK Weekly Project Meeting (07/07/06)
 - Specification approved by polishing company in meeting on 23/08/06 (C. Cantley, R. Jones)
- *Reference Grooves* (fiducials): -
 - (*As for penultimate mass grooves on previous page)
- Serial numbers to be etched/ground or sandblasted. [Note: the sandblasting approach was adopted.]

3) REACTION MASS - Polishing

- Commercial polish (80/50 scratch /dig) recommended for the face taking the ES drive gold coating in email from H. Armandula (06/06/06)
- Inspection polish on all faces, edges and chamfers (including bonding flats**)
 - Lambda/10 flats (previously discussed with polishers in meeting on 23/08/06) **not required** as a result of the decision to use vacseal to bond break-off prisms (See email from D. Coyne to K. Strain et al, 06/11/2006, Subject: - "Re: [Aligo_sus] vacseal it is then".)

REASON FOR CHANGE:

ACTION: Incorporate Change Attach DCN to Drawings Other Action (specify):

DISPOSITION OF HARDWARE (IDENTIFY SERIAL NUMBERS)	DCN DISTRIBUTION
<input checked="" type="checkbox"/> No hardware was affected (record change only):	LIGO/AdL management: excomm@ligo.caltech.edu AdL COC group: aligo_coc@ligo.caltech.edu AdL SUS group: aligo_sus@ligo.caltech.edu QA & Safety: tyler_w@ligo.caltech.edu
<input type="checkbox"/> List S/Ns which comply already:	
<input type="checkbox"/> List S/Ns to be reworked/scrapped:	
<input type="checkbox"/> List S/N's to be built with this change:	
<input type="checkbox"/> List S/Ns to be retested per this change:	
<input type="checkbox"/>	

SAFETY, COST, SCHEDULE, REQUIREMENTS IMPACT? NO YES (If YES, enter CR (CCB) or TCP (TRB) #)

APPROVALS:	DATE	OTHER APPROVALS (SPECIFY)	DATE
ORIGINATOR: R. Jones			
Cog Eng & group leader: RJG			
Systems Engineer: DC			
DCC RELEASE:			