

Questions and e-mail chains with decisions relevant for the procedure for attaching wire break-off prisms and earthquake stops to the ERM and TCP for aLIGO

Will first contact be used to protect the ERM and TCP during handling before installation into the quad structure?

Answer: YES on the central part of surface S1 not on the gold ESD pattern. See e-mail from Margot Phelps on 6th December 2010.

Will the ERM and/or TCP have gold barrel coatings?

Answer: The TCP does have a gold barrel coating, the ERM does not. See e-mail from Margot Phelps on 6th December 2010.

For the gold ESD pattern and possible barrel coatings, are there any particular handling requirements? E.g. are wipes with solvents permitted? E.g. should we only get close with optical wipes instead of cleanroom wipes?

Answer: wiping with methanol and isopropanol with either cleanroom wipes or optical wipes are permitted. Not sure about acetone, but do not see a problem. See e-mail from Margot Phelps on 06/12/2010.

Check with Calum/Margot/Dennis/Betsy: Are these optics going to be vacuum baked after gluing?

Answer: No, see e-mail chain between Betsy Bland and Dennis Coyne forwarded to Marielle van Veggel by Margot Phelps on 06/12/2010.

Back-up procedure. Which detergents can we use to debond the prism if we need to, considering we have gold coatings nearby.

Answer: do not know. Tests with gold coated things needed.

How is the EP30-2 mixed and dispensed?

Answer: more details in E1000386

Which actual parameters do we take into account when calculating the jig settings?

Will prisms have unique serial numbers?

Answer: Only the mass width will be used as an actually measured dimension in calculating the jig settings. Nominal jig and prism sizes will be used, meaning that the prisms will not have unique serial numbering. See E-mail Norna Robertson to Marielle van Veggel on 28/06/2010

How will we lift the TCP once the earthquake stop mount plates have been glued on?

Answer: there is a fixture (D1000812) that can do this. See e-mail between Margot Phelps and Marielle van Veggel on 08/12/2010.

How will the TCP be stored once the earthquake stop mount plates have been glued on. Will we still be able to use the storage container as it has been designed?

Answer: The optic needs to be transportable like all other optics when the necessary parts have been glued on. There is interference with the new earthquake stop design, which needs to be solved. Suggested solution: make

changes to the storage container. Can the earthquake stop design be altered?

See e-mail between Margot Phelps and Marielle van Veggel on 09/12/2010.

Subject: Re: For on agenda for technical meeting

From: Margot Phelps <mphelps@ligo.caltech.edu>

Date: Mon, 6 Dec 2010 13:03:56 -0800

To: marielle.vanveggel@glasgow.ac.uk

CC: Mark Barton <mbarton@ligo.caltech.edu>, Norna Robertson <nroberts@ligo.caltech.edu>,

Calum Torrie <ctorrie@ligo.caltech.edu>, Betsy Bland <bland_b@ligo-wa.caltech.edu>,

russell.jones@glasgow.ac.uk

Hi Marielle,

I looked at your questions, I have a couple answers for you, also I will join in on the technical meeting telecon tomorrow morning.

Yes, we will be using First Contact to protect the ERM and TCP during handling before, and hopefully during, installation into the quad structure. It does not have to extend out past the inner edge of the gold traces on the face, so it won't interfere with the jig placement. The TCP does have a gold barrel coating, the ERM does not. D0900931 is the CP barrel coating drawing, it doesn't say it is the Thin CP, but it is. D0900958 is the ERM barrel coating.

The gold coatings can be cleaned with a cloth cleanroom wipe, or a lens wipe, lens wipes are a bit nicer. Either isopropyl alcohol or methanol can be used to clean them, I'm not sure if acetone is recommended although I have used it on gold coated samples and it seemed ok. Remember methanol and first contact leave residue if they are mixed together in large quantities.

Note on using the CP caketins for the ERMs. They are in fact the same container, however there are 2 different o-rings and o-ring grooves in the baseplate, the larger diameter o-ring is meant to be used with the CPs, the smaller diameter with the ERMs.

The large diameter o-ring WILL hit the ESD gold if it is used with the ERM. Let me know if spare o-rings are needed, I am ordering some ERM size ones right now.

The optics will not be vacuum baked after gluing the prisms, I will fwd an email from Dennis to the group about this.

I'm asking Bob Taylor what he thinks about detergents, hopefully I will know something by tomorrow morning on this..

Cheers,

Margot

On Dec 6, 2010, at 11:20 AM, Marielle van Veggel wrote:

Hi Mark,

Can you put a link to E1000752 on the technical meeting page?

This is a draft procedure for gluing prisms onto the ERM and TCP and also for gluing the earthquake stops.

Norna, Margot, Calum, Betsy, I've To'd you in this e-mail, because in the introduction of this document I have put a number of specific question I'd like to go through tomorrow. I think you can answer these questions and I thought it might be useful to give you heads up. I don't think it is necessary for you to read any further than the introduction as depending on the answers on the questions I will have to amend the content of the procedure.

Other documents related and in first draft are: E1000753 (procedure for gluing prisms onto the BS/FM), E1000828 (jig setting calculations sheet for the ERM/TCP) and E1000829 (jig settings calculations sheet for the BS/FM; not a draft online yet. Will get that done before the meeting tomorrow).

Thanks,

Marielle

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Subject: Fwd: heat lamp cured EP30-2 epoxy
From: Margot Phelps <mphelps@ligo.caltech.edu>
Date: Mon, 6 Dec 2010 13:29:37 -0800
To: Mark Barton <mbarton@ligo.caltech.edu>, Norna Robertson <nroberts@ligo.caltech.edu>, Margot Phelps <mphelps@ligo.caltech.edu>, Calum Torrie <ctorrie@ligo.caltech.edu>, Betsy Bland <bland_b@ligo-wa.caltech.edu>, russell.jones@glasgow.ac.uk, Marielle van Veggel <m.veggel@physics.gla.ac.uk>, GariLynn Billingsley <gari@ligo.caltech.edu>

Hi All,

Nearly everyone on this list has already seen this email chain, I was re-sending for Marielle's benefit, in response to one of her question on vacuum baking optics. This exchange is a bit convoluted but the short summary is that the fused silica optics will not be vacuum baked. Metal masses can be vacuum baked.

Margot

Begin forwarded message:

From: Betsy Bland <bland_b@ligo-wa.caltech.edu>
Date: November 22, 2010 5:05:46 PM PST
To: Norna Robertson <nroberts@ligo.caltech.edu>
Cc: Dennis Coyne <coyne@ligo.caltech.edu>, Margot Phelps <mphelps_m@ligo.caltech.edu>, Calum Torrie <torrie_c@ligo.caltech.edu>, Janeen Romie <janeen@ligo-la.caltech.edu>, Gerardo Moreno <moreno_g@ligo-wa.caltech.edu>

Subject: Re: heat lamp cured EP30-2 epoxy

Good - that makes sense. So, we will presumably vacuum bake anything all metal component that is glued. Thanks for clarifying.

-Betsy

Norna Robertson wrote:

Hi Betsy

Just to clarify -there are no HL and HS uncoated optics with magnets (by which I assume you mean HAM large triple and HAM small triple suspensions - correct me if wrong). The upper stages are all metal in those suspensions. Only the bottom mass, which is coated, is made of silica.

Norna

On 11/22/2010 4:52 PM, Betsy Bland wrote:

Hi Dennis -

While I have talked to people about what I would *guess* our procedure for processing EP30 glued masses will be like based on conversations with you, I have not assumed to do anything without something more official from you or VRB. I was hoping we/COC (exclusive we, of course) would collect the parameters for the various glass/EP30 glue joints and determine procedures sometime very soon for inclusion in the 22 document. For example, it would be possible to bake (although COC may gasp) Penultimate dummy masses since I believe they are uncoated, but maybe I'm wrong. The penultimates have the additional flag disc bond so have a higher EP30 "count". Also, while we may not bake the test masses, will we carry this rule over to other optic needs which might have magnets glued to them (HL or HS's have a set of glued magnets in an uncoated stage, I believe)? Do you want to itemize things or are you thinking of just waiving all optical components with EP30 off the list? If we can just capture the rules on paper, I'll be happy to update the 22 doc.

I'm not sure where Margot picked up on our heat lamp curing duration (maybe I mis-spoke), but we have been using a heat lamp on glued items for an overnight duration, not just a few hours. I have not taken any measurements directly off of parts under a heat lamp to

determine what temperature increase the part actually sees. I will work on a thermo-couple setup with Kyle and make some measurements of something.

-Betsy

Dennis Coyne wrote:

Betsy,

I understand that you/SUS are planning to heat lamp cure EP30-2 as part of the process for bonding the prisms to optics/masses and not perform an vacuum bake and RGA. I basically concur with this approach since heating the epoxy in vacuum tends to cause deposition on the optic. However, we have never evaluated the adequacy of any proposed heat lamp cure cycle. Since the EP30-2 epoxy can be cured at room temperature, I suspect that it will be OK. However, the EP30-2 material was qualified after a 24 hr room temperature cure followed by 50C for 12 hr. (see E1000386 <<https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=15133>>-v1). I heard from Margot that you were planning for 40C for a few hrs. Can you use the heat lamp to achieve 50C for 12 hrs?

Dennis

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Subject: Re: More on Masterbond EP 30-2

From: Betsy Bland <bland_b@ligo-wa.caltech.edu>

Date: Wed, 01 Dec 2010 07:10:01 -0800

To: marielle.vanveggel@glasgow.ac.uk

Ah - yes, these details are not exactly written down anywhere. I believe the 3) copper wire applicator bit is written in the iLIGO LOS suspension procedure when we used VacSeal, D970154 see section 5.2.1 for example:

<https://dcc.ligo.org/DocDB/0024/E970154/000/E970154-D.pdf>

I have just added to the EP30 DCC page a link to the mixing/expensing gun we use for EP30. It is the gunkit link in the 7th bullet under Other Files. It works quite well. I have actually not order the bipack cartridges, as Bob Taylor placed our first order for 6 and we are still using them.

-Betsy

Marielle van Veggel wrote:

Hi Betsy,

That is very useful information, though I'm also looking for more basic information like:

- 1) How is the EP30-2 adhesive packaged for aLIGO (bipacs, dual tubes)?
- 2) How are the components mixed (mixing gun, stirring, mixing inside package)?
- 3) What tooling is used to apply the adhesive to the surface? (We used uncoated copper wire before with the VacSeal. We'd dip it into the adhesive that we had dispensed into a UHV aluminum boat. Is this still the case?).

Thanks,

Marielle

On 01/12/2010 14:46, Betsy Bland wrote:

Hi Marielle -

The following link is the DCC sheet which is collecting the LIGO known facts and procedures related to EP30-2. I am intending to run a heat lamp vs. temperature set of measurements in the next week to verify that we in-fact can heat an object to 40 deg C when we do the 16-24 hour heat lamp cure (our typical practice so far). Most of it is related to the qualification process of EP30, but the notes are

what we have been using as a procedure to date. It is the bullet 2) that we need to clarify what does and does not get vacuum baked. (My little all metal flags get vacuum baked.)

<https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=15133>

I would be happy to review your procedure when you have it.

Thanks!

-Betsy

Marielle van Veggel wrote:

Hi Betsy,

I'm currently working on the procedures for gluing the prisms onto the ERM/TCP and the BS/FM using EP30-2.

I'd like to make sure procedures I write are based on methods already established and match up with procedures for other parts of the aLIGO suspensions.

Can you send me some DCC numbers of procedure documents in which you use EP30-2?

Can I let you check the procedure once written?

Thanks,

Marielle

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Subject: Re: Update on prisms

From: Norna Robertson <nroberts@ligo.caltech.edu>

Date: Mon, 28 Jun 2010 16:58:05 -0700

To: Mariëlle van Veggel <m.veggel@physics.gla.ac.uk>

CC: Calum Torrie <ctorrie@ligo.caltech.edu>, Janeen Romie <janeen@ligo-la.caltech.edu>, Mark Barton <mbarton@ligo.caltech.edu>

Hi Marielle

Apologies for taking a while to get back to you on this. Thanks for doing all these measurements.

1) ERM/CP prisms.

I believe we can accept these, except for the 3 you note, without keeping track of individual serial numbers. These are all for reaction chains where the requirements on isolation etc are significantly less demanding than for the main chains. So if a slight deviation from say vertical parallel wires results from the b-a being out by 0.1 mm we may get a little more coupling than expected but not a problem.

2) BS/FM prisms.

a) I did not follow your comments on marking "the side flats" with a groove to indicate the surface which should be referenced. Is it that you will mark the end from which you measured the "a" value so that we know how far away to put that from the edge of the optic? Or is it something to do with the "d" value which is also undersized? Maybe a drawing would help.

b) What concerns me more is that the depths of the grooves are not very consistent - and some of them look to me so shallow that the wire will "bottom out" in the groove. So I didn't understand your comment that they are all in spec. Take the bottom image on page 3 for example. It is wider than 0.30 mm and considerably shallower than 0.15 mm. Am I missing something - can you clarify?

Thanks and regards

Norna

On 6/24/2010 9:40 AM, Mariëlle van Veggel wrote:

Hi Norna,

I have finished measuring the wire break-off prisms for the ERM/CP

[https://dcc.ligo.org/DocDB/0012/Q1000009/001/Q1000009-](https://dcc.ligo.org/DocDB/0012/Q1000009/001/Q1000009-v1_Inspection_document_for_the_wire_break-off_prisms_for_the_ERM.pdf)

[v1_Inspection_document_for_the_wire_break-off_prisms_for_the_ERM.pdf](https://dcc.ligo.org/DocDB/0012/Q1000009/001/Q1000009-v1_Inspection_document_for_the_wire_break-off_prisms_for_the_ERM.pdf)

Measurements were made with digital calipers. Measurement accuracy is ± 0.05 mm.

22 off (36 total) meet spec within a ± 0.10 mm tolerance.
11 off are 0.11 to 0.14 out from spec, so meet spec within the specified 0.1 mm tolerance (without the added 0) in the drawings. Also one has to take into account the measurement error.
3 off are out more than 0.15 mm (prisms 1, 5 and 34).
Bearing in mind these are steel prisms I would like your opinion if you would accept these prisms (except the 3 that are out of spec) like this if we would not keep track of them using a unique serial number for this application. I am not clear enough on the dynamics requirements to make that judgement sensibly.
I also have finished measuring the sapphire wire break-off prisms for the BS/FM.

https://dcc.ligo.org/DocDB/0012/Q1000008/001/Q1000008-v1_Inspection_document_for_the_primary_wire_break-off_prisms_for_the_FMBS.pdf

Measurements of a, b, c, d, and e have been taken with digital calipers. Measurement accuracy is estimated to be ± 0.05 mm (due to reading errors)

The prisms are generally undersized in width but the distance between the grooves is within spec for all.

Because the prisms are undersized in width and will be referenced on the side flats the prisms will be marked with a small fiducial groove to indicate the surface that should be referenced during gluing on the prism, such that any positioning error on the BS/FM can be minimized as much as possible.

Also each prism will be packed separately with a unique serial number to allow for this precise alignment.

The groove depth and width has been measured with a table top Hitachi SEM (Scanning Electron Microscope)

The groove depth and width is within spec for all.

No cracks have been observed. Any features seen are dirt specs as images have been taken before cleaning to make focussing easier.

The file size is rather large for this one. This is because I have images all grooves with the SEM. My apologies.

Can you to look over these measurements whenever you find time and see if you agree with my conclusions?

Actions still on these prisms:

- 1) Marking the sapphire prisms
- 2) Wire break-off prisms for the PM are being laser ablated as we speak. They will be measured as soon as they come back.
- 3) Basic cleaning all prisms and packing and labelling them before sending to Bob Taylor.

Thanks,
Marielle

Subject: Re: For on agenda for technical meeting

From: Margot Phelps <mphelps@ligo.caltech.edu>

Date: Wed, 8 Dec 2010 10:28:34 -0800

To: marielle.vanveggel@glasgow.ac.uk

CC: Norna Robertson <nroberts@ligo.caltech.edu>, Calum Torrie <ctorrie@ligo.caltech.edu>, russell.jones@glasgow.ac.uk, "Joe O'Dell" <joe.odell@stfc.ac.uk>, GariLynn Billingsley <Billingsley_G@ligo.caltech.edu>, Mark Barton <mbarton@ligo.caltech.edu>

Hi Marielle,

This is a really good point. I have attached a pdf of a flipping fixture that was developed here by Kurt and Calum, that I think would remove the need to pick up the optics from the ESD side.

This fixture was designed to screw into the baseplate of the optic container, allowing the user (usually 2 people) to flip the optic over

using the handles. It's bevel then rests on the teflon ring at the top of the fixture.

CP flipping fixture drawing link:

<https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=10662>

We have found these fixtures to be really useful in a number of different handling scenarios, I would like to talk to you about it over the phone, let me know how you want to do this.

Remember how sometimes when the ergo-arm releases it then drags vertically downwards a bit when you are setting an optic down in the vertical position? In this case, the problem with lifting from the ESD side would be that the gold traces on the face could be scratched if the ergo-arm releases like this. If it is being released in the horizontal position I don't think there would be a problem. I think the combination of being able to lift and set the optic down horizontally with the ergo-arm, and using the flipping fixtures would give you the safest and easiest solution.

Margot

On Dec 8, 2010, at 7:13 AM, Marielle van Veggel wrote:

Hi all,

I am currently making the changes to the procedure for the ERM and TCP and discovered there is an issue with lifting the TCP once the earthquake stop mount plates have been glued on using the ergo-arm: I realised that we will need to lift the optic with the ergo-arm on the gold ESD patterned side, because we will need to put it flat on its back to glue the earthquake stop bases on:

I then thought; will this be possible? Will the ergo-arm interfere with the earthquake stop mount plates or will the mount plates fall inside the deeper bit of the vacuum plate?

Answer: I think this is a real issue with the TCP after the earthquake stop mount plates have been glued on as these will be glued on top of the optic face. They are 13 mm high and extend 147.5 mm out from the centre of the mass. I think this is further out than where the deeper bit of the vacuum plate gets to (look at the picture <https://dcc.ligo.org/DocDB/0022/D1002746/001/vacuum%20plates.jpg>), so therefore we will not be able to lift the optic up using the ergo-arm from that position once the earthquake stop mount plates have been glued on.

I don't think it is a problem for the ERM, as the bases are only 5 mm high and the holes are 6 mm deep, so the bases don't stick out of the holes in the ERM. The holes for the stops are far enough in so that the vacuum plate can achieve a seal without any problem.

If we look at a solution for the TCP lifting issue, I think we could lift the optic on the ESD side off the V-block after gluing the prisms and put it into a Teflon plate similar to what we used at LASTI (see the right picture in figure 6.8 of T080245). We can then glue the earthquake stops. We can make another teflon plate that has spaces for the earthquake stop bases and attach it to the first, so that we can manually turn the optic over and then lift it up with the ergo-arm so that we can insert it into the structure. The optic is quite a bit lighter than the ETM or ITM, so manually lifting maybe acceptable. At LASTI we lifted the TCP using the Teflon plate in which the optic had been transported as we were not keen to lift the optic with the ergo-arm on the ESD side. Other ideas are welcome. This brings me to the next questions; is it acceptable to lift the ERM (and TCP before gluing the earthquake stop mount plates) up on the ESD surface using the ergo-arm? Should we apply first contact also over the ESD pattern on both the ERM and TCP, so that we do not have to touch the ESD pattern directly with the ergo-arm when we are lifting the ERM on that surface both before and after gluing the earthquake stop mount plates and the TCP before gluing?

Please let me know if you'd like to discuss this on the phone and I'll give you a phone.

Thanks for your help,
Marielle

Subject: Logistics of coating COC optics with First Contact
From: Margot Phelps <mphelps@ligo.caltech.edu>
Date: Wed, 8 Dec 2010 17:28:18 -0800
To: Marielle van Veggel <m.veggel@physics.gla.ac.uk>, Betsy Bland <bland_b@ligo-wa.caltech.edu>,
Norna Robertson <nroberts@ligo.caltech.edu>, GariLynn Billingsley <Billingsley_G@ligo.caltech.edu>,
Calum Torrie <ctorrie@ligo.caltech.edu>

Hi All,

In tuesday's tech meeting Marielle asked me if they would be receiving the optics coated with First Contact. I talked it over with GariLynn and as the shipping schedule is right now most of the optics will pass through Caltech on the way to the sites, with the exception of the first two ITMs and the first two ETMs. So we will coat the optics that come through here with First Contact, but there will have to be an alternative plan for coating those four.

Margot Phelps
326A Downs
Core Optical Components
California Institute of Technology / LIGO
Pasadena, CA 91125
Phone: 626-395-2973

Subject: Ergo-arm and bumper stop interface issues
From: Margot Phelps <mphelps@ligo.caltech.edu>
Date: Thu, 9 Dec 2010 15:03:44 -0800
To: Mariëlle van Veggel <marielle.vanveggel@glasgow.ac.uk>
CC: Norna Robertson <nroberts@ligo.caltech.edu>, GariLynn Billingsley <gari@ligo.caltech.edu>

Hi Marielle,

This morning I discussed a couple of the interface issues you brought up with GariLynn and Calum. So, with respect to the TCP earthquake stop bumpers, it was as I thought, Calum/Kurt had designed them to allow for the shorter stops, but this larger size(stick out by 13mm) will not fit. A retrofit to the caketin is possible though. Leaving the TCP in the caketin without the wedge plate in place is really more risky than we would want. Plus since it sounds like it hasn't been decided yet if all the bonding will be done at LHO, or at both LLO and LHO, in which case they might have to be shipped after bonding the bumpers, and we would definitely need a retrofit. On the installation fixtures, since the bonding process will be done for sure at LHO and possibly at LLO, I think it would be a good idea to get at least one set to have at LHO. Question for GariLynn and Norna, since the installation fixtures would be holding the optics, but used in the prism/ear bonding process, what account would this be charged to?

As far as lifting the FM/BS with the Test Mass ergo-arm vacuum plate I think COC is going to veto that. The o-rings are just too far in. Even lifting it by hand would be preferable to this. If you DO lift it by hand, GariLynn asks that you grip it ± 90 degrees from the arrow since the beam will not hit in these areas as much(say the arrow is at the 12 o'clock position, then grip it at the 3 o'clock and 9 o'clock positions)

Cheers,
Margot Phelps
326A Downs

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