

New Folder Name Thermal Insulation

LIGO-T940015-00-B



FACSIMILE MESSAGE

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Page 1 of 1

To: Larry Jones
LIGO Project Caltech Pasadena, California

February 4, 1994

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From: M. L. Tellalian Phone (815)439-6517
Plainfield Engineering - NOE-C

RE: Support Thermal Insulation and Analysis
LIGO Design & Qualification Test - Caltech Contract C146

Larry,

As we discussed earlier this week, the tube wall can not be maintained within the specified temperature range with any practical insulated support configuration. As stated in the specification, the supports shall be provided with "adequate thermal insulation to points of support to limit calculated tube wall temperature difference to less than 10° C with a bulk tube wall temperature of 140° C". Based on an ambient temperature of 21° C and a two inch thickness of load bearing insulation (thermal conductivity $K = 1.5 \text{ BTU-in/hr-ft}^2\text{-}^\circ\text{F}$), CBI estimates a tube wall temperature of approximately 102° C. The insulation thickness must be increased to approximately 15" to reduce the temperature differential to 10° C. The magnitude of the fixed support loads require a significant area of load carrying insulation.

The tube / support interface was modelled as a two-dimensional, axisymmetric finite element heat transfer model using the program ADINA-T. Although the support was modelled as uninsulated, the thermal losses due to free convection from exposed steel to the atmosphere are very negligible - rather, it is the thermal loss due to conduction between the support and the 21° C "heat sink" that affects the wall temperature.

The current specification must be revised to either increase the allowable thermal differential, to remove the need for insulation by inputting heat to the supports, or some combination of the two. We will provide a more detailed summary of the ADINA-T thermal analysis results to you no later than Thursday morning so that this topic can be addressed at the meeting. Thanks.

Regards,

M. L. Tellalian
Plainfield Engineering

cc: LIGO File 2.2.2

N. Bacon / M. Such - NOEC / R. Fairlamb - ROA
G. Soules - CBITS Houston
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