NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

March 20, 2006

MATERIALS LABORATORY FACTUAL REPORT Report No. 06-020

A. ACCIDENT

Place	: Mancos, Colorado
Date	: June 30, 2005
Vehicle	: Agusta A119, N403CF
NTSB No.	: DEN05FA103
Investigator	: Arnold Scott

B. COMPONENTS EXAMINED

Instruments and annunciators.

C. DETAILS OF THE EXAMINATION

The components submitted for examination are shown in figure 1. The instruments and annunciators are identified in the figure caption. The layout of each annunciator panel is shown in figures 2 to 4. The Rotor RPM annunciator and the annunciators in the Caution Panel and the Advisory Panel each contained two light bulbs. The Master Caution annunciator and the annunciators in the Warning Panel each contained four light bulbs.

Only the needles in the Engine/Rotor Tachometer appeared to be fixed in place; these needles indicated an engine rotation of 7 percent and a rotor rotation of 39 percent. The needles of the other instruments were found to move when the instruments themselves were moved. As received, the Fuel Pressure gauge indicated 24 psi and the left needle in the Dual Hydraulic Pressure gauge indicated 1350 psi. The positions of the other needles indicated approximately zero. The glass was missing from the Fuel Pressure gauge, the Temperature Indicator and the Dual Hydraulic Pressure gauge. The glass was cracked in the Engine/Rotor Tachometer, the Gas Producer Tachometer, the Torque Indicator, and the Transmission Oil Temperature/Pressure Indicator. The glass was intact in the Airspeed Indicator and the Engine Oil Temperature/Pressure Indicator. No impact marks were observed on any of the instruments to indicate the positions of the needles at the time of the accident.

The filaments of the light bulbs in each annunciator were examined for evidence of stretching caused by impact loading while the filament was hot, which would indicate that the annunciator was illuminated at the time of the accident [M.R. Poole and M. Vermij, “A Guide to Light Bulb Analysis In Support of Aircraft Accident Investigation,” TP 6255E,

Transportation Safety Board of Canada, February, 1991]. The results are listed in Tables 1 to 4. Photographs of bulbs with filaments from that were identified as stretched with localized stretching are shown in figures 5 to 9.

Carl R. Schultheisz
Materials Research Engineer

Table 1. Status of Master Caution and Rotor RPM annunciators.		
Annunciator	**Filament Status**	**Filament Status**
MASTER CAUTION	Top Left Bulb: Localized stretching.	Top Right Bulb: Aged. Localized stretching.
	Bottom Left Bulb: Localized stretching	Bottom Right Bulb: Aged. Localized stretching.
ROTOR RPM	Left Bulb: Aged. Not Stretched.	Right Bulb: Aged. Not Stretched.

Table 2. Status of Advisory Panel annunciators.		
Annunciator	**Left Bulb Filament Status**	**Right Bulb Filament Status**
HEATER ON	Not stretched.	Not stretched.
ECS ON	Not stretched.	Not stretched.
EAPS ON	Not stretched.	Not stretched.
PITOT HEAT	Not stretched.	Not stretched.
LANDING LT ON	Aged. Not stretched.	Aged. Not stretched.
OXY CLSD	Locally stretched.	Broken. Not stretched.
----------	Not stretched.	Not stretched.
ENG START	Aged. Not stretched.	Broken. Not stretched.
EEC OPN	Locally stretched.	Broken. Not stretched.
FT OFF	Aged. Not stretched.	Aged. Not stretched.

Table 3. Status of Caution Panel annunciators.		
Annunciator	**Left Bulb Filament Status**	**Right Bulb Filament Status**
FUEL LOW	Not stretched.	Not stretched.
#1 FUEL PUMP	Not stretched.	Not stretched.
#2 FUEL PUMP	Not stretched.	Not stretched.
XFER PUMP	Not stretched.	Not stretched.
EXT PWR ON	Not stretched.	Not stretched.
ROTOR BRK	Not stretched.	Not stretched. (Filament locally flattened at support posts.)
HOOK ARMED	Not stretched.	Not stretched.
DC GEN	Not stretched.	Not stretched.
GEN CONTR	Not stretched.	Not stretched.
INV #1 OFF	Not stretched.	Not stretched.
INV #2 OFF	Not stretched.	Not stretched.
SAS #1	Not stretched.	Not stretched.
SAS #2	Not stretched.	Not stretched.
ATT OFF	Not stretched.	Not stretched.
VG #1	Not stretched.	Not stretched.
VG #2	Not stretched.	Not stretched.
#1 SERVO	Not stretched.	Not stretched.
#2 SERVO	Not stretched.	Not stretched.
ENG OIL PRESS	Not stretched.	Not stretched.
ENG OIL HOT	Not stretched.	Not stretched.
FUEL FILTER	Not stretched.	Not stretched.
EEC FAIL	Not stretched.	Not stretched.
EEC DEGRADED	Not stretched.	Not stretched.
MEC OPN	Not stretched.	Not stretched.
ENG AGB CHIPS	Not stretched.	Not stretched.
ENG RGB CHIPS	Not stretched.	Not stretched.
XMSN OIL CHIPS	Not stretched.	Not stretched.
T/R BOX CHIPS	Not stretched.	Not stretched.
DOORS OPEN	Not stretched.	Not stretched.

Table 4. Status of Warning Panel annunciators.		
Annunciator	**Filament Status**	**Filament Status**
XMSN OIL HOT	Top Left Bulb: Broken. Not stretched.	Top Right Bulb: Broken. Not stretched.
	Bottom Left Bulb: Not stretched.	Bottom Right Bulb: Not stretched.
XMSN OIL PRESS	Top Left Bulb: Stretched.	Top Right Bulb: Stretched.
	Bottom Left Bulb: Stretched.	Bottom Right Bulb: Stretched.
BAT HOT	Top Left Bulb: No bulb.	Top Right Bulb: No bulb.
	Bottom Left Bulb: No bulb.	Bottom Right Bulb: No bulb.
ENG OUT	Top Left Bulb: Aged. Localized stretching.	Top Right Bulb: Aged. Localized stretching.
	Bottom Left Bulb: Stretched.	Bottom Right Bulb: Aged. Localized stretching.
ENG FIRE	Top Left Bulb: Not stretched.	Top Right Bulb: Not stretched.
	Bottom Left Bulb: Not stretched.	Bottom Right Bulb: Not stretched.

ImageNo:0512A00724, Project No:2005100015

Figure 1. Instruments and annunciators submitted for examination.

Top row, left to right:

- Rotor RPM annunciator, Agusta P/N 109-0729-11-1
- Master Caution annunciator, Agusta P/N 109-0900-10-1
- Advisory annunciator panel, Agusta P/N 109-0900-08-109
- Caution annunciator panel, Agusta P/N 109-0729-20
- Warning annunciator panel, Agusta P/N 109-0729-21

Center row, left to right:

- Torque Indicator, Agusta P/N 109-0900-52-103
- Engine/Rotor Tachometer, Agusta P/N 109-0900-51-103
- Airspeed Indicator, Agusta P/N 109-0729-09-111

Bottom row, left to right:

- Engine Oil Temperature/Pressure Indicator, Agusta P/N 109-0729-26-3
- Dual Hydraulic Pressure Gauge, Agusta P/N 109-0729-87-101
- Fuel Pressure Gauge, Agusta P/N 109-0729-28-1
- Transmission Oil Temperature/Pressure Indicator, Agusta P/N 109-0729-27-113
- Temperature Indicator, Agusta P/N 109-0729-32-117
- Tachometer (gas producer), Agusta P/N 109-0729-08-111

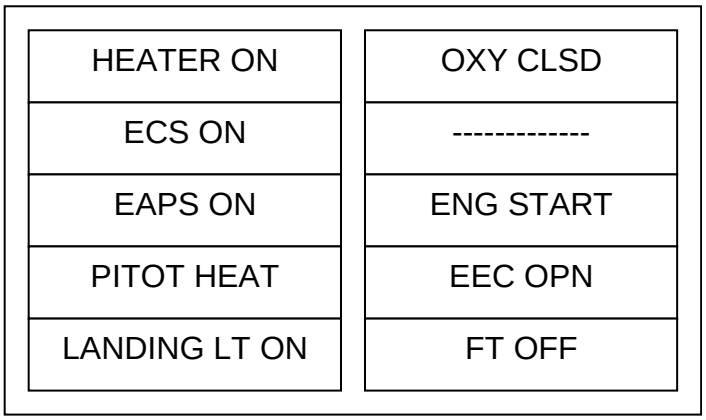

Figure 2. The arrangement of the annunciators in the Advisory Panel.

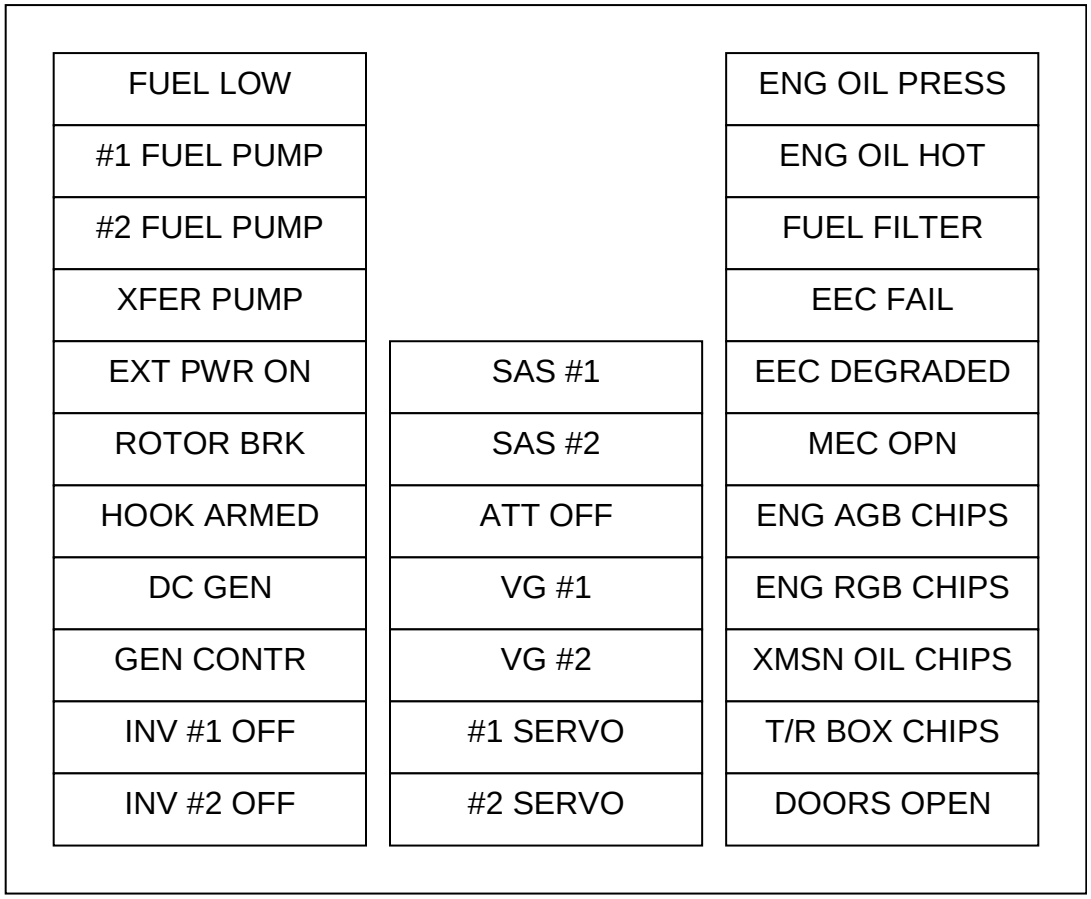

Figure 3. The arrangement of the annunciators in the Caution Panel.

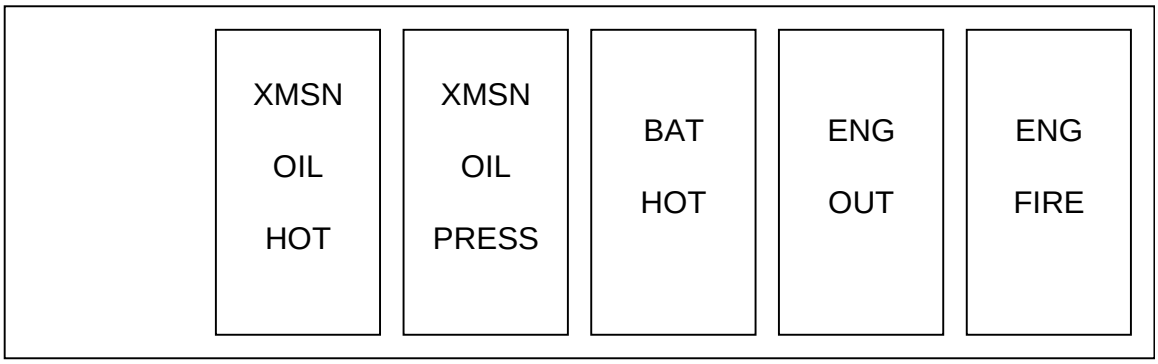

Figure 4. The arrangement of the annunciators in the Warning Panel.

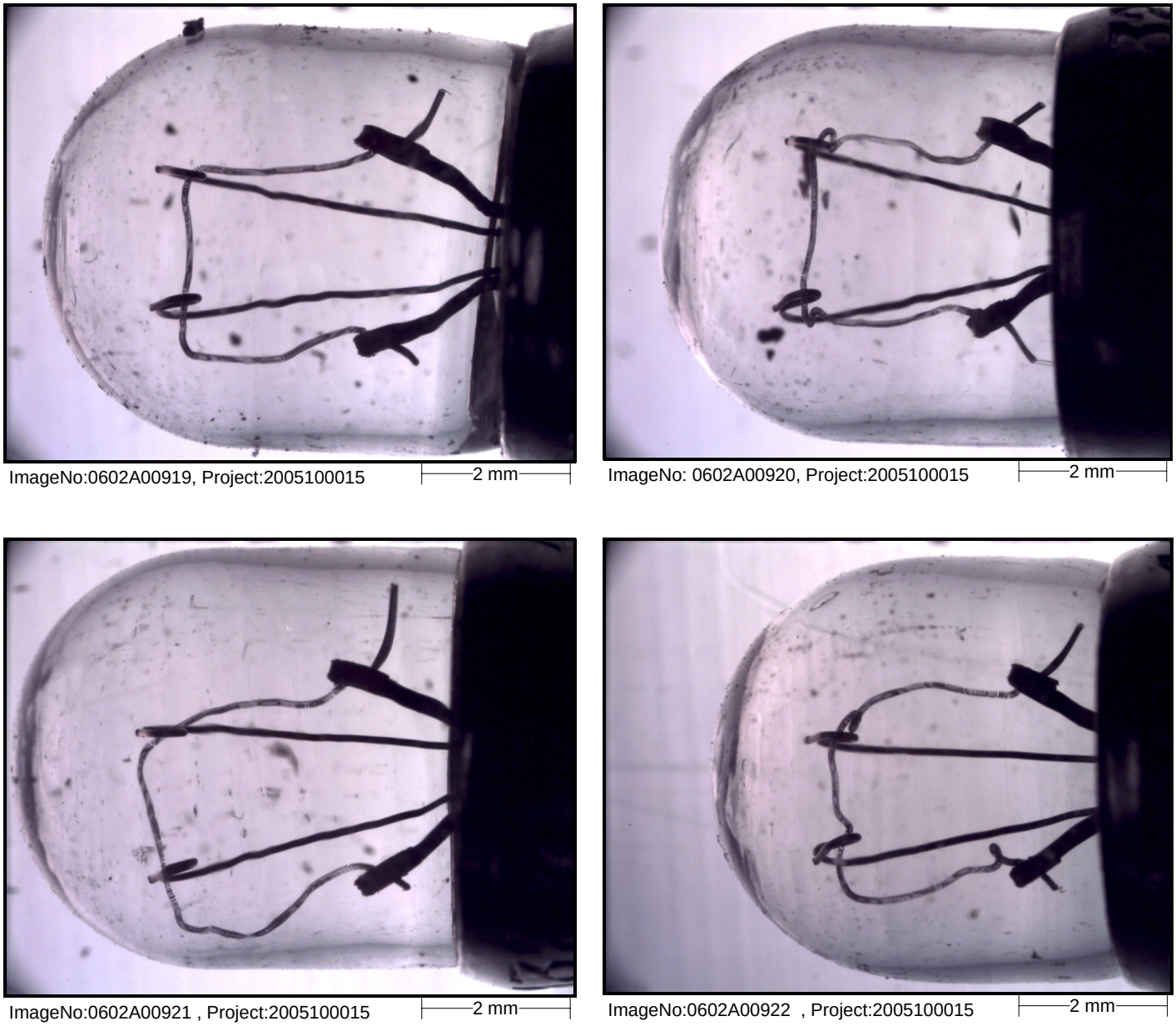

Figure 5. Bulbs from the MASTER CAUTION annunciator. The filaments show some motion with respect to their support posts along with some slight localized stretching. The filaments in the bulbs on the right show curling deformation near the support posts associated with aging.

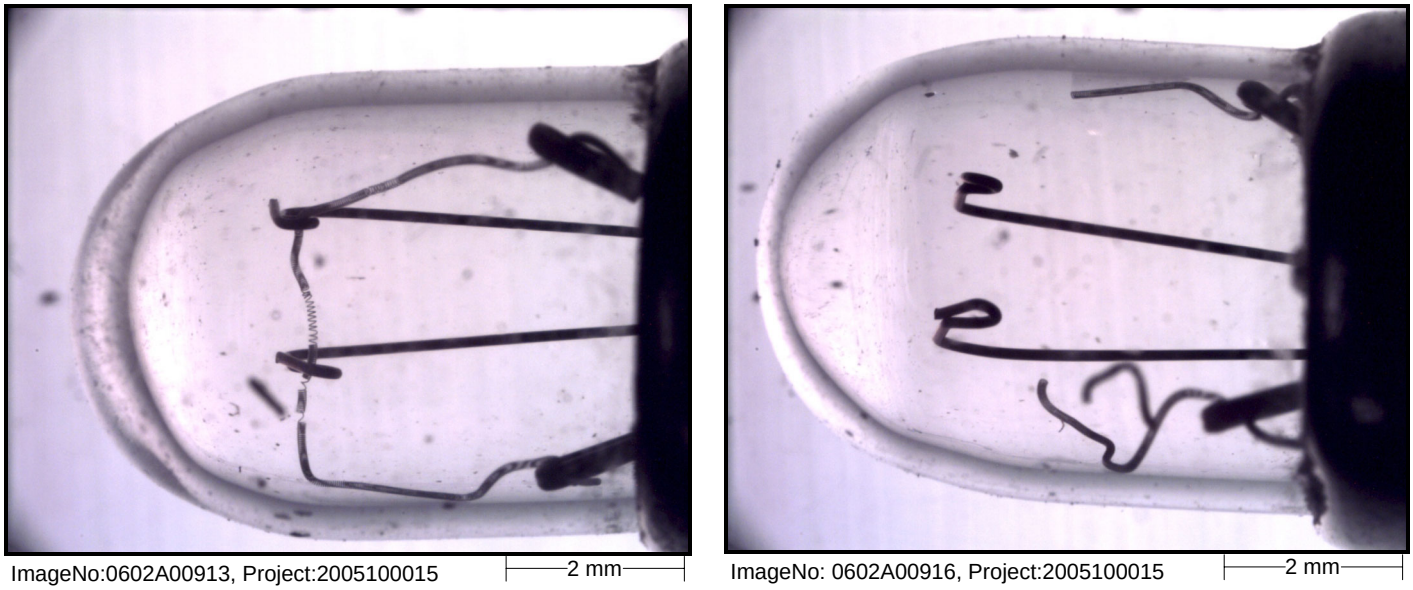

Figure 6. Bulbs from the OXY CLSD annunciator from the Advisory Panel. The filament in the bulb on the left shows some localized stretching. The filament in the bulb on the right is broken but not stretched.

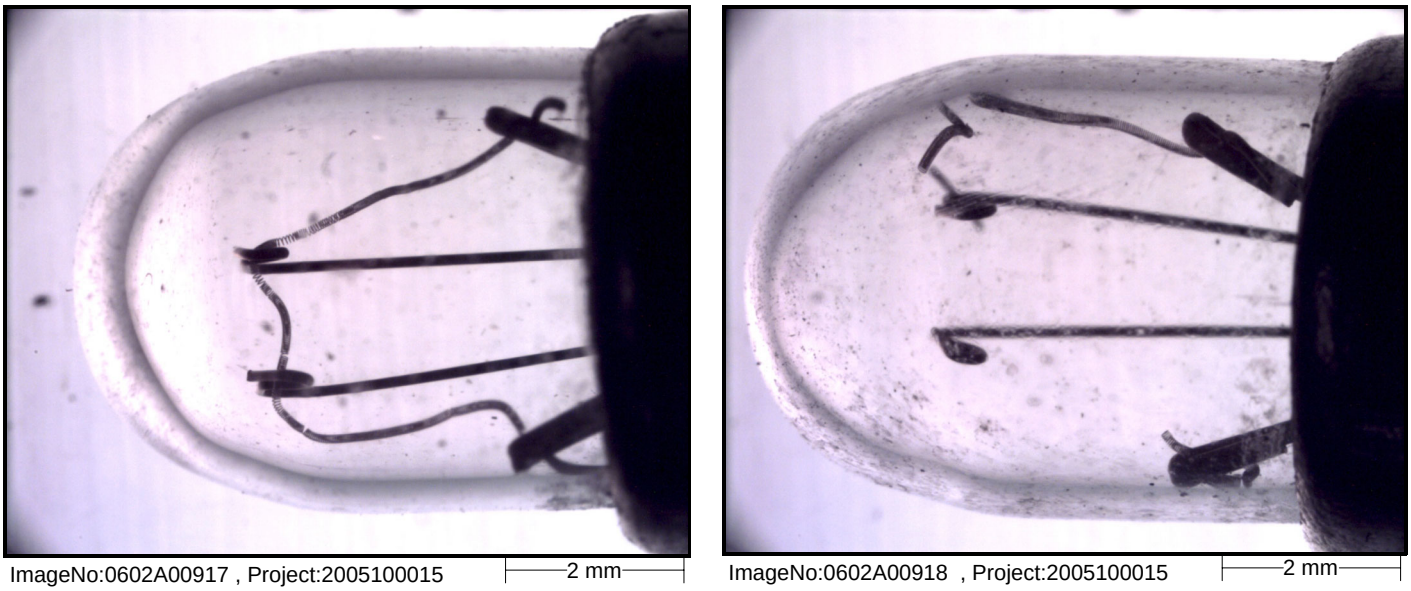

Figure 7. Bulbs from the EEC OPN annunciator from the Advisory Panel. The filament in the bulb on the left shows some localized stretching. The filament in the bulb on the right is broken but not stretched.

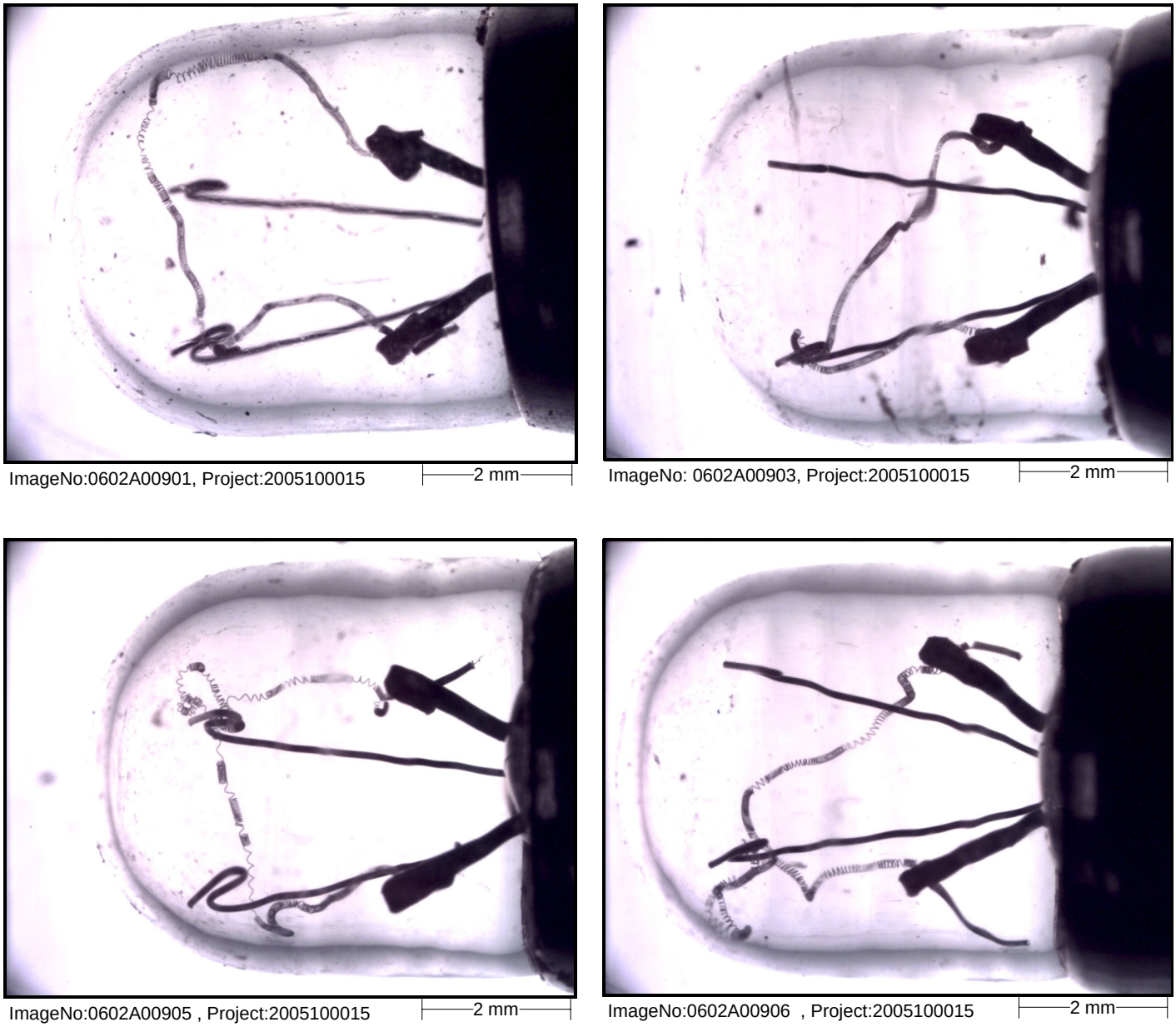

Figure 8. Bulbs from the XMSN OIL PRESS annunciator from the Warning Panel. The filaments show substantial stretching associated with impact loading while the bulbs were illuminated.

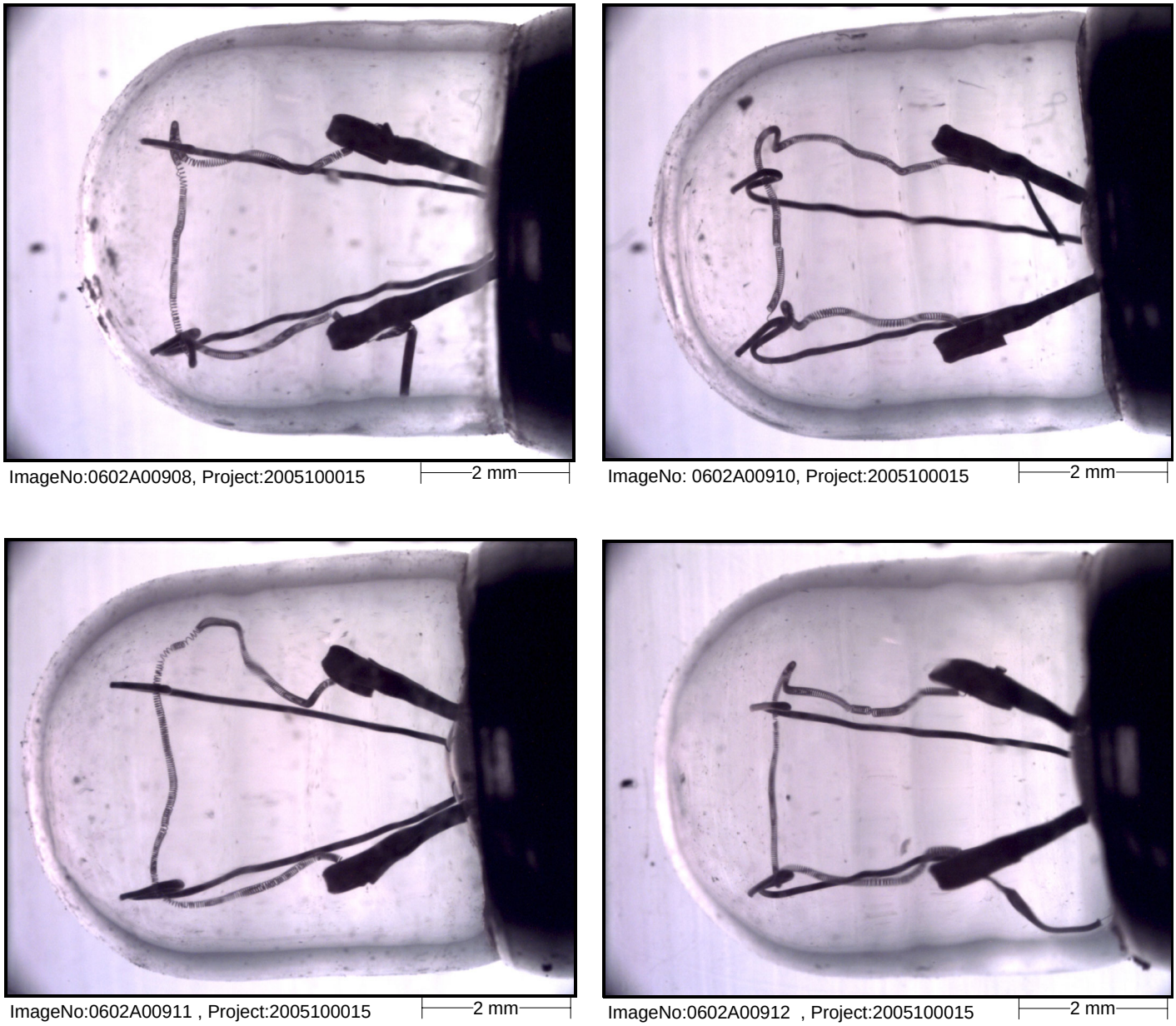

Figure 9. Bulbs from the ENG OUT annunciator from the Warning Panel. The filaments show slight localized stretching. The filaments in the top left bulb and in the bulbs on the right show curling deformation near the support posts associated with aging.