Appendix B

Preparation of Test Specimens and Panels

In this appendix, specimen geometries will be summarized and suggestions for geometries and dimensions of panels for the various tests discussed in Chapters 5–14 will be presented. Note that there are many ways in which the panels could be designed. The dimensions of the panels herein should be appropriate for a laboratory-size autoclave. Dimensions of each and every test specimen and panel will not be specified. Rather, the examples provided here can be adapted to, or easily modified for, preparation of those types of specimens that are not specifically included here.

The illustrations that follow detail the specimen geometries and dimensions and show suggested panel lay-ups and dimensions (in millimeters). The lay-ups shown for the delamination beam specimens are all unidirectional $[0]_{24}$ laminates that should be appropriate for carbon/epoxy composites. Ductile-matrix composites or composites with lower modulus fibers require thicker specimens (more plies). The delamination fracture specimens (Chapter 14) incorporate a thin film at the laminate midplane to define an initial delamination. Panels for delamination testing should therefore contain an even number of plies and be manufactured with a nonadhesive Teflon or Kapton film at the laminate midplane. The film thickness should be less than 13 μm, and the film may be sprayed with a mold-release agent before it is inserted between the plies. The insert length should extend an appropriate distance from the front edge of the specimen to achieve the correct precrack length, as illustrated in the figures that follow. It is difficult to detect the thin insert film when viewed from the edge of a cut specimen. Therefore, the area covered by the insert should carefully be marked on the panel before the specimens are cut.

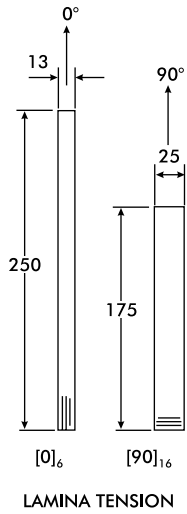

FIGURE B.1
Specimen geometries, dimensions (millimeters), and lay-ups for lamina tension experiment.

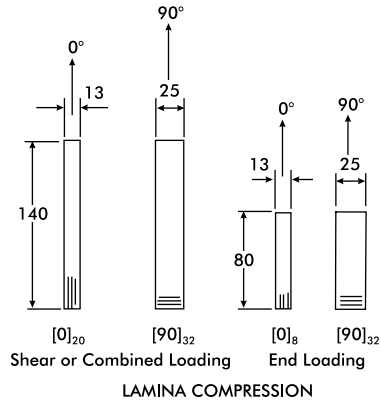

FIGURE B.2
Specimen geometries, dimensions (millimeters), and lay-ups for lamina compression experiment.

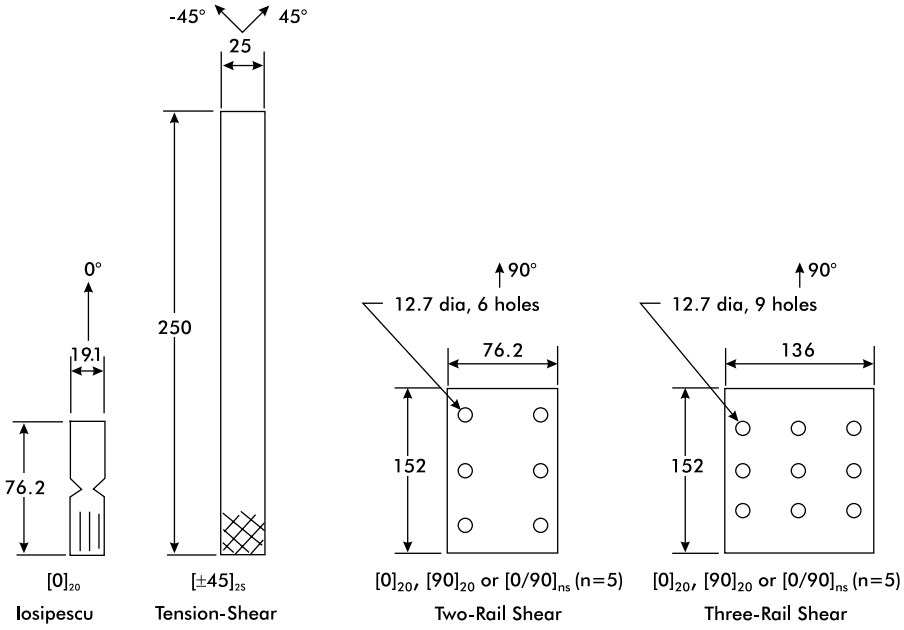

FIGURE B.3
Specimen geometries, dimensions (millimeters), and lay-ups for lamina shear experiment.

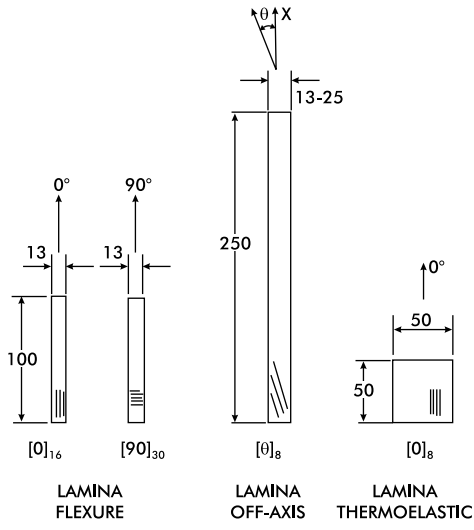

FIGURE B.4

Specimen geometries, dimensions (millimeters), and lay-ups for lamina flexure, lamina off-axis, and lamina thermoelastic experiments.

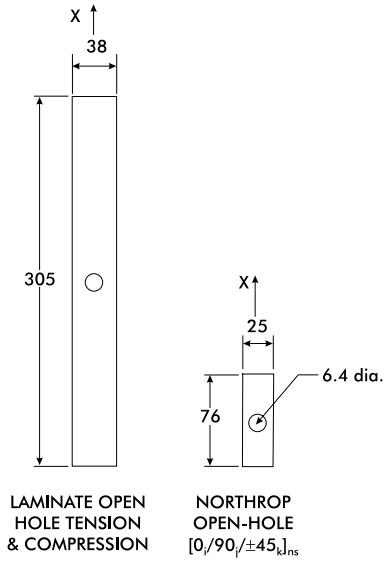

FIGURE B.5

Specimen geometries and dimensions (millimeters) for laminate open-hole tension and compression experiments.

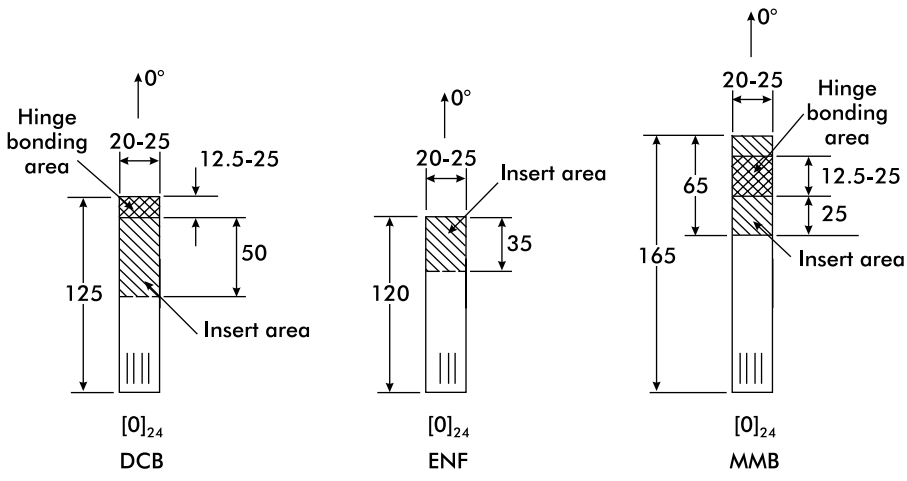

FIGURE B.6
Geometries, dimensions (millimeters), and lay-ups for DCB, ENF, and MMB specimens.

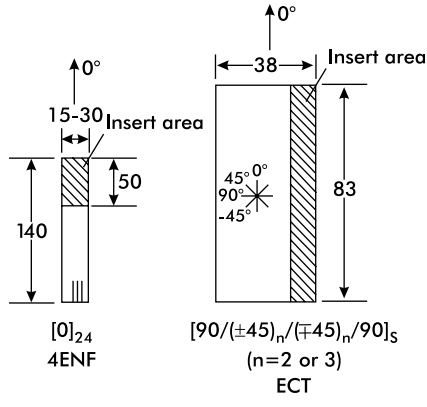

FIGURE B.7
Geometries, dimensions (millimeters), and lay-ups for 4ENF and ECT specimens.

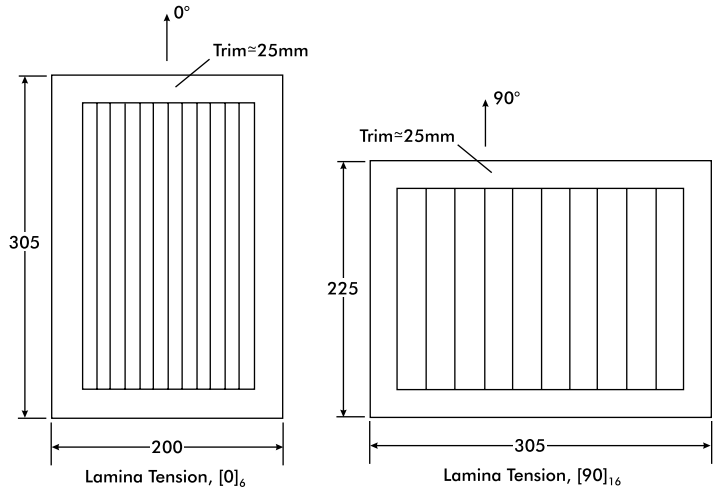

FIGURE B.8
Suggested panel dimensions (millimeters) for 0° and 90° lamina tension experiment.

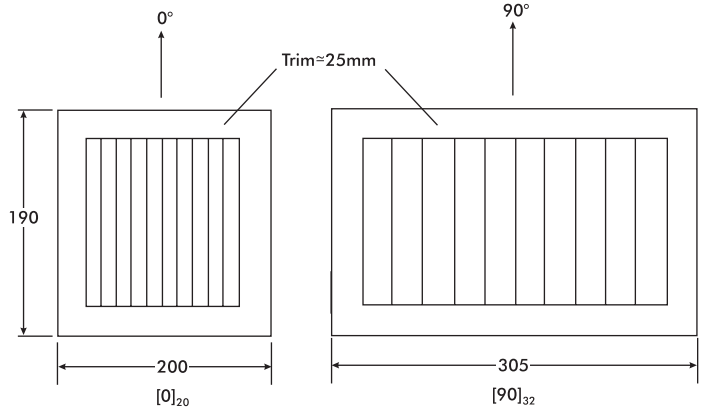

FIGURE B.9
Suggested panel dimensions (millimeters) for lamina compression experiment (shear and combined loading).

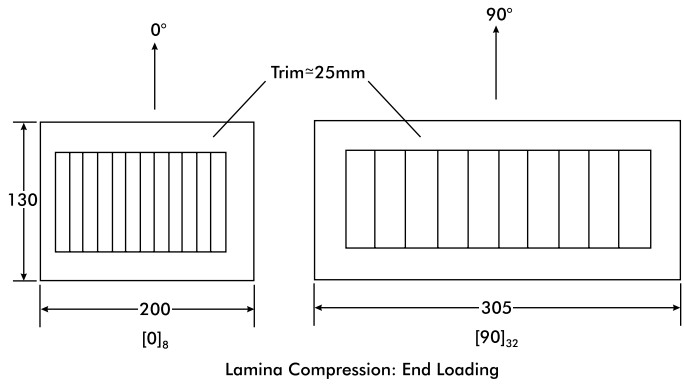

FIGURE B.10
Suggested panel dimensions (millimeters) for lamina compression experiment (end loading).

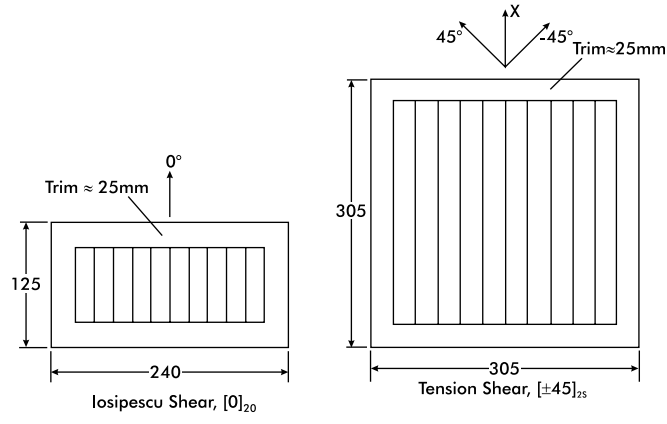

FIGURE B.11
Suggested panel dimensions (millimeters) for Iosipescu and tensile shear experiments.

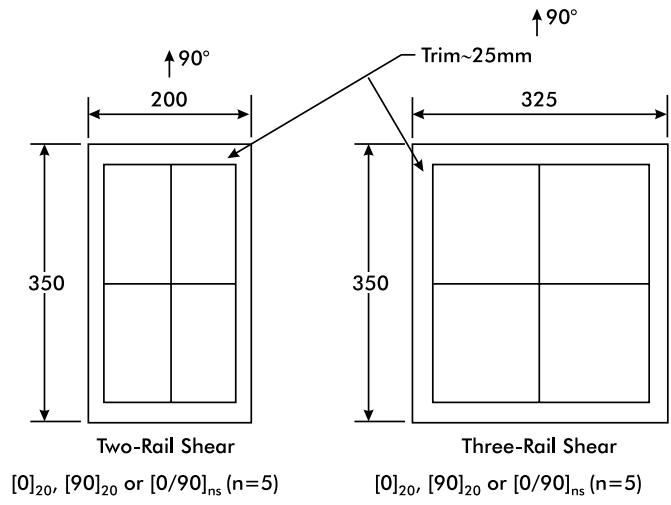

FIGURE B.12
Suggested panel dimensions (millimeters) for two-rail and three-rail shear experiments.

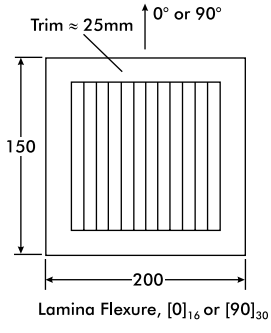

FIGURE B.13
Suggested panel dimensions (millimeters) for lamina flexure experiment.

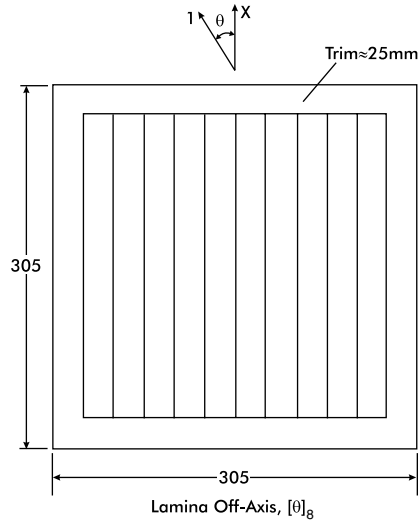

FIGURE B.14
Suggested panel dimensions (millimeters) for lamina off-axis experiment.

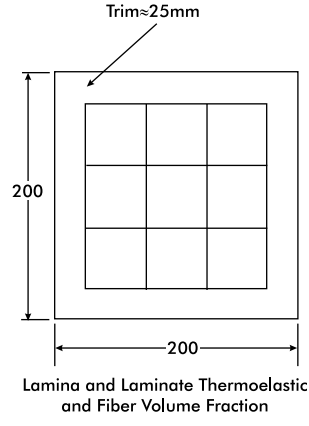

FIGURE B.15
Suggested panel dimensions (millimeters) for lamina and laminate thermoelastic and fiber volume fraction experiments.

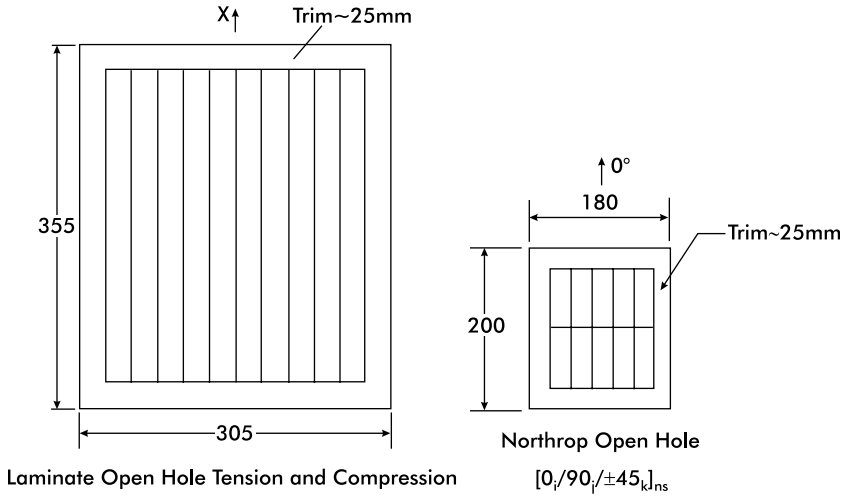

FIGURE B.16
Suggested panel dimensions (millimeters) for laminate and Northrop open-hole experiments.

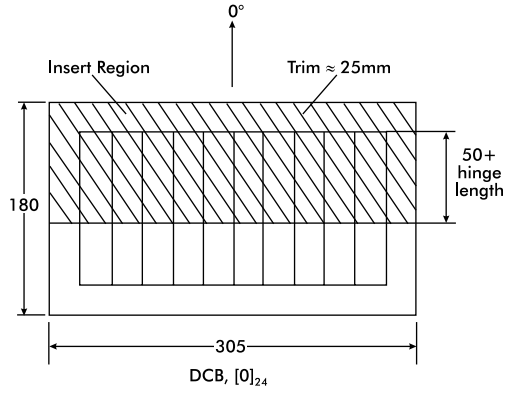

FIGURE B.17
Suggested panel dimensions (millimeters) for DCB specimen. Insert film should be placed at midplane.

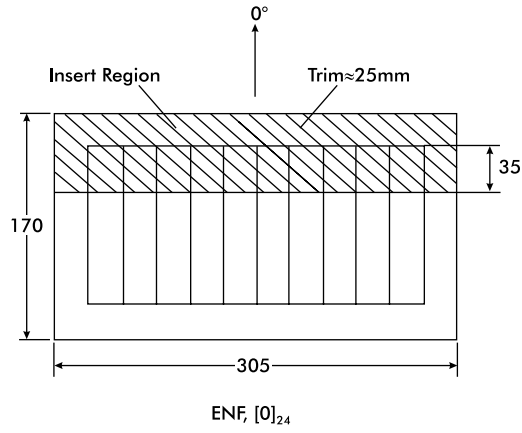

FIGURE B.18
Suggested panel dimensions (millimeters) for ENF specimen. Insert film should be placed at midplane.

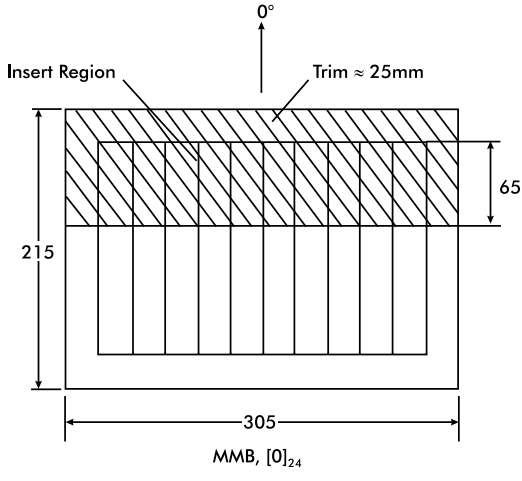

FIGURE B.19
Suggested panel dimensions (millimeters) for MMB specimen. Insert film should be placed at midplane.

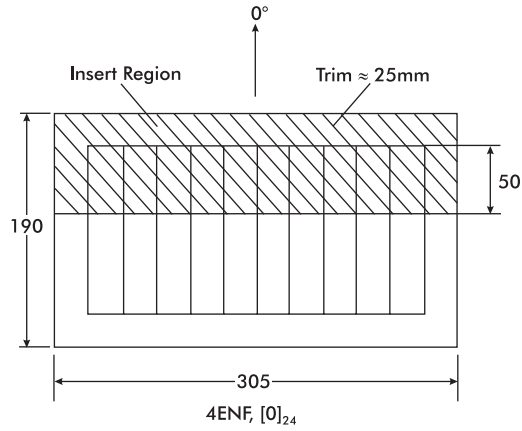

FIGURE B.20

Suggested panel dimensions (millimeters) for 4ENF specimen. Insert film should be placed at midplane.

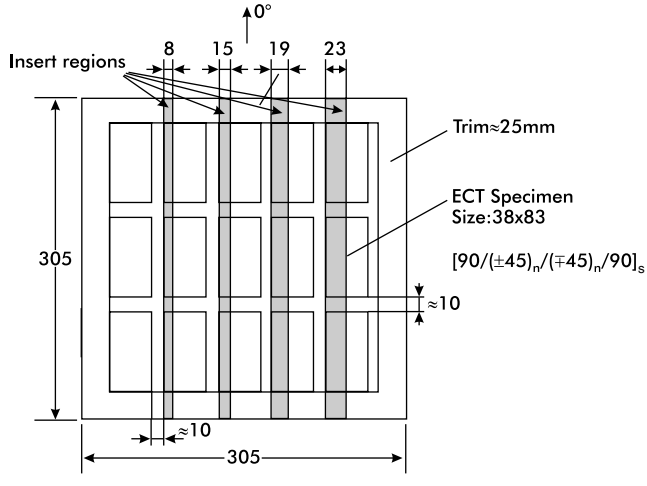

FIGURE B.21

Suggested panel dimensions (millimeters) for ECT specimen. Insert film should be placed at midplane.