be molded for the longer variant, the conditions that needed to be overcome were even more stringent than for the previous autoclave.

2 M u u u

The forward fuselage is manufactured as a composite component molded in one piece, according to the following procedure.

① Pre-preg lamination

An automated fiber placement (AFP) machine is used to lay up prepreg carbon fiber material, bundled into a certain width and in a precured pliable state, around a huge core (fuselage mold) with the same diameter as the aircraft.

② Curing

The composite layup is placed inside an autoclave to be cured by chemical reaction under high temperature and pressure. Figure 3 fixed temperature and pressure pattern so that uniform curing is achieved with even strength throughout the structure. The autoclave also must be able to perform two operations a day.

(2) D

The design specifications shown in able 1 were adopted in order to fulfill the required specifications. Inside the main unit of the autoclave, which is designed as a pressure vessel, the gas filled inside the vessel is heated and cooled using a heater and coolant, then the gas is circulated with a fan as the workpiece stored inside the muffle furnace (internal cylinder) is fired. The overall flow is shown in Fig. 4. Circulation. The gas blown out from the fan passes along the outside of the muffle furnace and reflects off the outer wall of the door. Then it is led inside the muffle furnace through a screen that regulates the flow. The gas passes through the workpiece, cooler, and heater before being drawn in by the fan and circulated.

The gas filling the autoclave was enriched with nitrogen for increased stability and safety of the molding process. For this reason, a membrane-separation nitrogen generation process was introduced.

The main unit of the autoclave is shown in Fig. 5.

(3) O u

The autoclave is operated in the following process. An example of the temperature and pressure control pattern is shown in Fig. 6.

(i) Pressurization process

The workpiece is placed inside the autoclave, and the door is closed and sealed tight. Then the circulation fan is turned on to start circulating the internal gas.

Next, pressurized nitrogen gas is supplied inside the autoclave, adjusting the pressurization rate with a control valve, until the pressure reaches a fixed level.

(ii) Heating

The heater is turned on, and the output level is adjusted to heat the circulation gas inside the autoclave at a fixed rate. During this process, a thermocouple placed at top center controls the thermocouples mounted in various places of the workpiece so that they are kept within a fixed temperature range for over a fixed length of time.

(iii) Retention and cooling

After a certain length of time has elapsed [illegible]
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4 I u u

Carbon fiber composites used for airplanes must be cured uniformly so that the strength is kept even throughout the structure. The autoclave used to cure the molded composites must ensure uniformity of temperature in a steady state, as well as in the temperature distribution during temperature rise, and the time taken to reach the prescribed temperature. In order to determine the molding conditions to achieve that capability, the optimal operating method was studied by performing thermohydraulic analysis.

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