Fig.3-1: Prototype measurements:
(a) The radius of a window corner is measured using a gauge with different radii.
(b) The width of a window is one of the fundamental dimensions which influence a model train's impression.
(c) The height of the model body is determined based on the measurements of the prototype, with reference to the truck specifications, wheel diameter, height of couplers, etc.

Fig.3-2: Preparation of drawings:
(a) A front view of the body, one of many drawings used for designing and making a model.
(b) Using CAD, a 3D drawing is obtained using multiple 2D designs. Viewing and modifying the 3D image in different angles is an essential procedure for balancing the dimensions of the model.

Fig.3-3: Fabrication of the mold:
(a) Manufacturing using end milling, along with lubrication and cooling using machining oil, obtains high accuracy of the mold's dimensions, which is required for plastic injections for the N-gauge models.
(b) In electrical discharge machining, arc-discharge occurs between the surfaces of a mold and an electrode immersed in dielectric oil. The penetration of the electrode gradually melts the ingot surface facing the electrode, leaving a deep crater with a shape similar to the electrode. The picture on the right shows an electrode engraving the curve of a roof.
(c) The mold finish is dependent on hand working. To enhance the transparency of the windows, the mold surface is polished by hand and requires patience and time to complete, especially for narrow and deep grooves.
(d) This pantograph-type carving machine, which has been in operation since 1959, is frequently used even today, due to its independence from programmed machinery.

Fig.3-4: Injection molding:
(a) Injection molding machine.
(b) Ejection of a part from the mold.
(c) Robots are utilized to arrange the ejected parts into trays.

Fig.3-5: Plastic material and examples of molding:
(a) Plastic pellets before they are melted.
(b) ABS (Acrylonitrile-Butadiene-Styrene) resin is usually used for body shell molding.
(c) Window glass is molded using polystyrene resin, where the molded parts are easily removed from the runner.

Fig.3-6: Process of PPS (Paint, Print and Stamp):
(a) A uniform paint is applied using a spray gun.
(b) An example of a fully-automated printer, where a white line is quickly stamped on a painted body shell.

Fig.3-7: Production of metal parts:
(a) Parts for a pantograph, formed from a thin metal sheet using a machine press.
(b) A 50 year old press machine is still active today.
(c) Metal wheels for a hollow plastic axle to ensure electric isolation are machined by the automatic lathe.

Fig.3-8: Assembly process:
(a) Various parts are prepared for assembly.
(b) The parts assembly process is performed by many hands.

Fig.3-9: Product inspection:
(a) Light is used to check for scratches on the body shell.
(b) Windows are inserted tightly from the inside in the body and are fixed by using parts that shield reflections from the headlight.

Fig.3-10: Packaging design:
(a) Different packaging designs are prepared.
(b) Package designs are carefully selected.

Fig.3-11: Packing process:
(a) The kit components are carefully packed in a box on moving conveyer belt.
(b) Finished assembly kits are ready for transportation and delivery.

Fig.3-12: The Keikyu DEHA268 delivery and assembly:
(a) Kit boxes, wrapped by transparent plastic sheets, are packed in a large corrugated cardboard case for transportation.
(b) A sample of an assembled model.

Fig.3-A1: Ballast mold for the track bed is fabricated by an electrical discharge machine, where the surface of the mold is engraved by hand, using a chisel, to reproduce surface irregularity. The molded track bed surface, unchanged from early UNITRACK products, becomes possible by the succession of hand-work technologies.

Fig.3-A2: Sleepers are painted on the convex molding surface. The dark brown and gray colors are used for wooden

sleepers and PC (Pre-stressed Concrete) ones, respectively.

Fig.3-A3: Metal rails are inserted in the molded track beds using different jigs prepared for each individual shapes of track. By eliminating the torsion and curling, two or four coiled rails (for a single or a double track, respectively), are reeled from their drums to the molded track bed, installed inside out.

Fig.3-A4: "UniJoiners" are attached to the track bed. This is the final process for the UNITRACK production process. A UniJoiner consists of a molded plastic joint that connects to the track beds and a metal joint that connects to the rails to allow for an electrical pick-up. UniJjoiners are prepared in advance by a separate process, and are supplied and assembled automatically using machines.