**Entities & Attributes**

Customer

  •  customer\_id (PK)

  •  cust\_name

  •  cust\_email

  •  cust\_phone

  •  cust\_address

Manufacturer

  •  manufacturer\_id (PK)

  •  manufacturer\_name

  •  manufacturer\_website

Product

  •  product\_id (PK)

  •  manufacturer\_id (FK)

  •  model\_type

  •  model\_price

  •  min\_order\_qty

  •  scale

  •  product\_name

Inventory

  •  product\_id (PK, FK)

  •  qoh

  •  reorder\_level

Invoice

  •  invoice\_number (PK)

  •  customer\_id (FK)

  •  invoice\_date

  •  total\_amount

  •  shipping\_charge

  •  invoice\_status

Line

  •  invoice\_number (FK)

  •  line\_number (PK)

  •  product\_id (FK)

  •  line\_units

  •  unit\_price

  •  line\_status

  •  ship\_date

Shipment

  •  shipment\_id (PK)

  •  invoice\_number (FK)

  •  line\_number (FK)

  •  qty\_shipped

  •  ship\_date

  •  tracking\_number

  •  shipment\_status

**Constraints**

  •  Each customer\_id, manufacturer\_id, product\_id, invoice\_number, shipment\_id, and line\_number must be unique, not null, and numeric.

  •  cust\_phone must have 10 digits.

  •  model\_price, unit\_price, and total\_amount must be greater than or equal to 0.

  •  line\_units, min\_order\_qty, and qty\_shipped must be positive integers.

  •  invoice\_status ∈ {Open, Partially Shipped, Closed}.

  •  line\_status ∈ {Backordered, Partial, Fulfilled}.

  •  shipment\_status ∈ {Created, Shipped, Delivered}.

  •  model\_type ∈ {Car, Aircraft, Ship, Decal}.

  •  scale must match one of the standard values (1/144, 1/100, 1/72, 1/48, 1/35, 1/32, 1/24).

  •  manufacturer\_id in Product must exist in Manufacturer.

  •  product\_id in Inventory, Line, and Shipment must exist in Product.

  •  customer\_id in Invoice must exist in Customer.

  •  invoice\_number in Line and Shipment must exist in Invoice.

  •  qty\_shipped for a line may not exceed line\_units.

  •  A shipment’s ship\_date must be on or after invoice\_date.

  •  If qoh ≤ reorder\_level, system triggers reorder of at least min\_order\_qty.

**Business Rules**

  1.  A customer may generate many invoices.

  2.  Each invoice belongs to one customer.

  3.  Each invoice can have many lines (products ordered).

  4.  Each line belongs to one invoice and references one product.

  5.  A product can appear on many lines.

  6.  A manufacturer can produce many products.

  7.  Each product has one inventory record.

  8.  Each invoice can have multiple shipments.

  9.  Each line can have multiple shipments (for partial delivery).

  10.  Backorders are handled by comparing line\_units vs. qty\_shipped.

  11.  Customers are billed only when items ship.

  12.  Line and invoice statuses update automatically based on shipments.

**Assumptions**

  •  The invoice acts as the “order header.” No separate order table is needed.

  •  Shipment table captures partial deliveries.

  •  Inventory tracks current quantity (qoh) and triggers reorder using reorder\_level and min\_order\_qty.

  •  Decals and models share the same Product table, distinguished by model\_type.

  •  Prices are snapshotted in the Line table and do not change with later price updates.

  •  CC Bank (credit card processor) is external and not part of this model.

  •  One-to-one: Product ↔ Inventory

  •  One-to-many: Customer ↔ Invoice, Manufacturer ↔ Product, Invoice ↔ Line, Line ↔ Shipment