Supply Chain Management System

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Project Description:

Supply chain database management system aims to streamline and optimize the flow of information and raw materials between suppliers, manufacturers, wholesalers, and retailers to consumers. It focuses on effectively managing and coordinating critical parts in the chain of operations including planning, sourcing, manufacturing, delivering, and returns. With the help of it, businesses can have more control over costs and production time while still be able to main high-quality products and reduce wastes. Because supply chain database management system is not industry specific, a wide range of industries like manufacturing, retail and E-commerce, logistics and transportation, pharmaceutical and healthcare, etc. that involves in supply chain operations can greatly benefit from the database. In essence, the system helps companies make accurate production plans from demand planning and forecasting which helps optimizing inventory levels and minimizing stockouts or excess inventory. On the supplier side, the system helps facilitate effective supplier management by maintaining supplier information, managing contracts, tracking supplier performance, and streamlining order purchases. This ensures that the whole process is reliable and efficient time management. In addition, the system support order management where it keeps track of order processing, tracking, and fulfillment by maintaining customer information, managing inventory levels leading companies meet customer demands, reduce order lead time, and enhance customer satisfaction. Overall, the supply chain database management system helps companies overcome various challenges, such as inefficient inventory management, poor demand forecasting, supplier reliability issues, order fulfillment delays. It provides end-to-end visibility, collaboration, and control over the supply chain. Two current systems that can benefit from this database are the Blue Ridge software company where their focus of the database system is on pricing and planning optimization but lack in the emphasis on

the quick turnover of products with a short life cycle and Descartes Systems Group where they focus on logistics and collaboration across the supply chain but weak in efficient management.

Functional Database Requirements:

1. Supplier
    - 1.1 A supplier shall supply many types of materials at a time.
    - 1.2 A supplier shall have many contacts.
    - 1.3 A supplier shall have many contracts with the company.
    - 1.4 A supplier shall have many purchase orders with company.
    - 1.5 A supplier shall provide delivery information for each purchase order.
    - 1.6 A supplier shall be a manufacturer.
2. Material:
    - 2.1 A material shall be provided by multiple suppliers.
    - 2.2 A material shall be used by multiple products.
    - 2.3 A material shall be stored in multiple inventories.
    - 2.4 A material shall have many product categories.
3. Product
    - 3.1 A product shall be created by multiple materials.
    - 3.2 A product shall be created for multiple product orders.
    - 3.3 A product shall be stored in multiple inventories.
    - 3.4 A product shall be undergone multiple inspections.
    - 3.5 A product shall have one product category.

4. Customer
    - 4.1 A customer shall buy multiple products.
    - 4.2 A customer shall have at least one contact information
    - 4.3 A customer shall be a supplier.
    - 4.4 A customer shall have many contacts.
    - 4.5 A customer shall have many payments.
    - 4.6 A customer shall have many invoices.
5. Inventory
    - 5.1 An inventory shall store multiple materials.
    - 5.2 An inventory shall store multiple products.
    - 5.3 An inventory shall be stored in one warehouse.
6. Warehouse
    - 6.1 A warehouse shall have many inventories.
    - 6.2 A warehouse shall have many deliveries.
7. Product category
    - 7.1 A product category shall have many products.
    - 7.2 A product category shall have many materials.
8. Supply order
    - 8.1 A supply order can come from many suppliers.
    - 8.2 A supply order can include at least one material.
    - 8.3 A supply order shall need one payment.
9. Sale order
    - 9.1 A sale order shall be made by one customer.

9.2 A sale order shall include at least one product.

9.3 A sale order shall need one invoice.

9.4 A sale order shall have a delivery.

10. Payment

10.1 A payment shall be associated with one sale order.

10.2 A payment shall be associated with one supply order.

10.3 A payment shall be made to one supplier.

10.4 A payment shall be received from one customer.

10.5 A payment shall be associated with one invoice.

11. Invoice

11.1 An invoice shall be associated with one sale order.

11.2 An invoice shall be associated with one supply order.

11.3 An invoice shall be associated with many payments.

11.4 An invoice shall be associated with one delivery.

11.5 An invoice shall be associated with one customer.

12. Delivery

12.1 A delivery can have many products.

12.2 A deliver can be made to one customer.

12.3 A deliver can come from one warehouse.

12.4 A deliver can be associated with one sale order.

13. Pricing

13.1 A price can be associated with one product.

13.2 A price can be associated with many customers.

13.3 A price can be associated with many sale orders.

13.4 A price can have many discounts.

13.5 A price can be expressed in many currencies.

Non-functional Database Requirements:

1. Performance

   1.1 The database system shall support concurrent transactions.

2. Storage

   2.1 The database system shall assign 10 MB of memory per table.

   2.2 The database system shall support persistent storage.

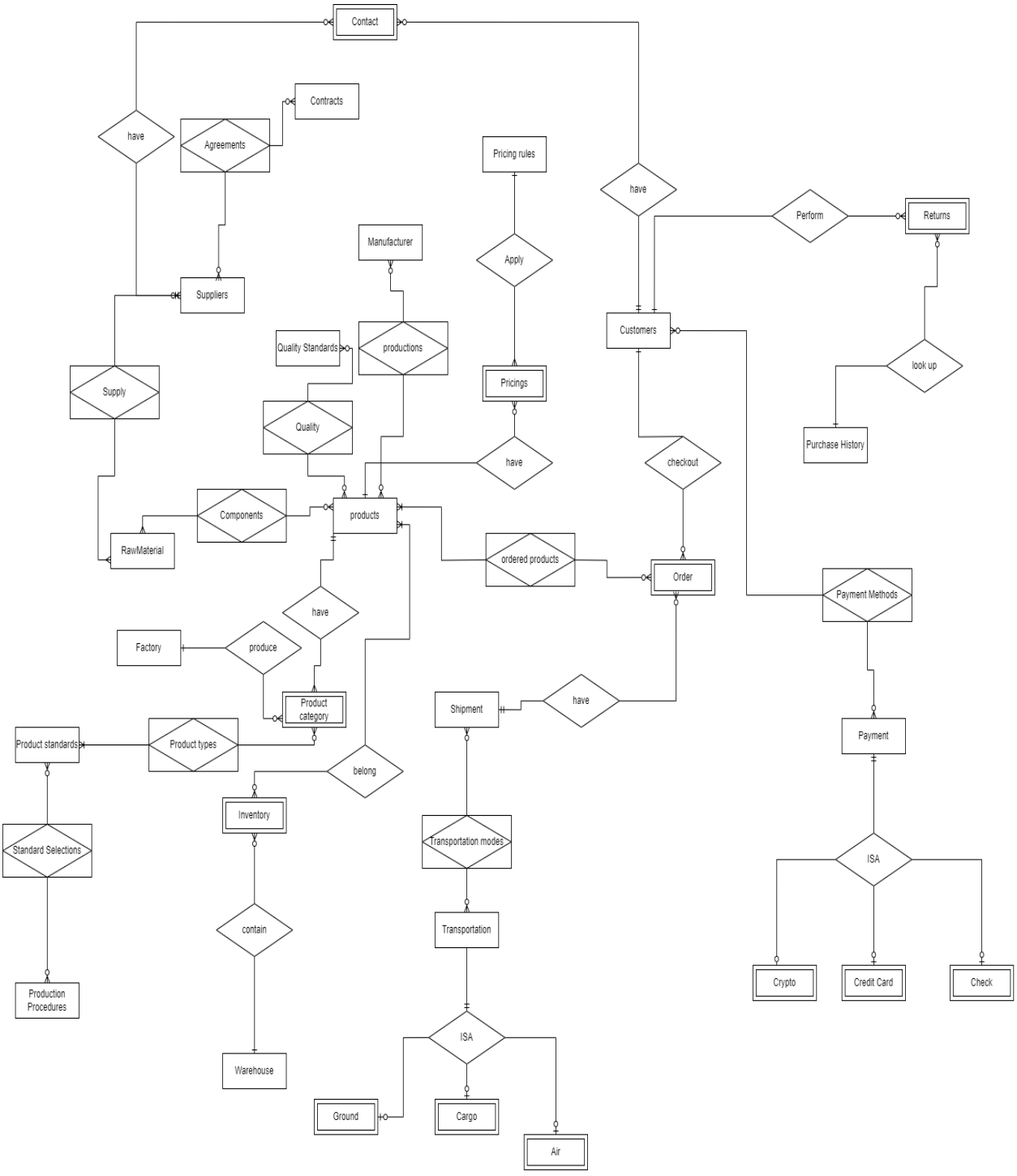
3. Compatibility

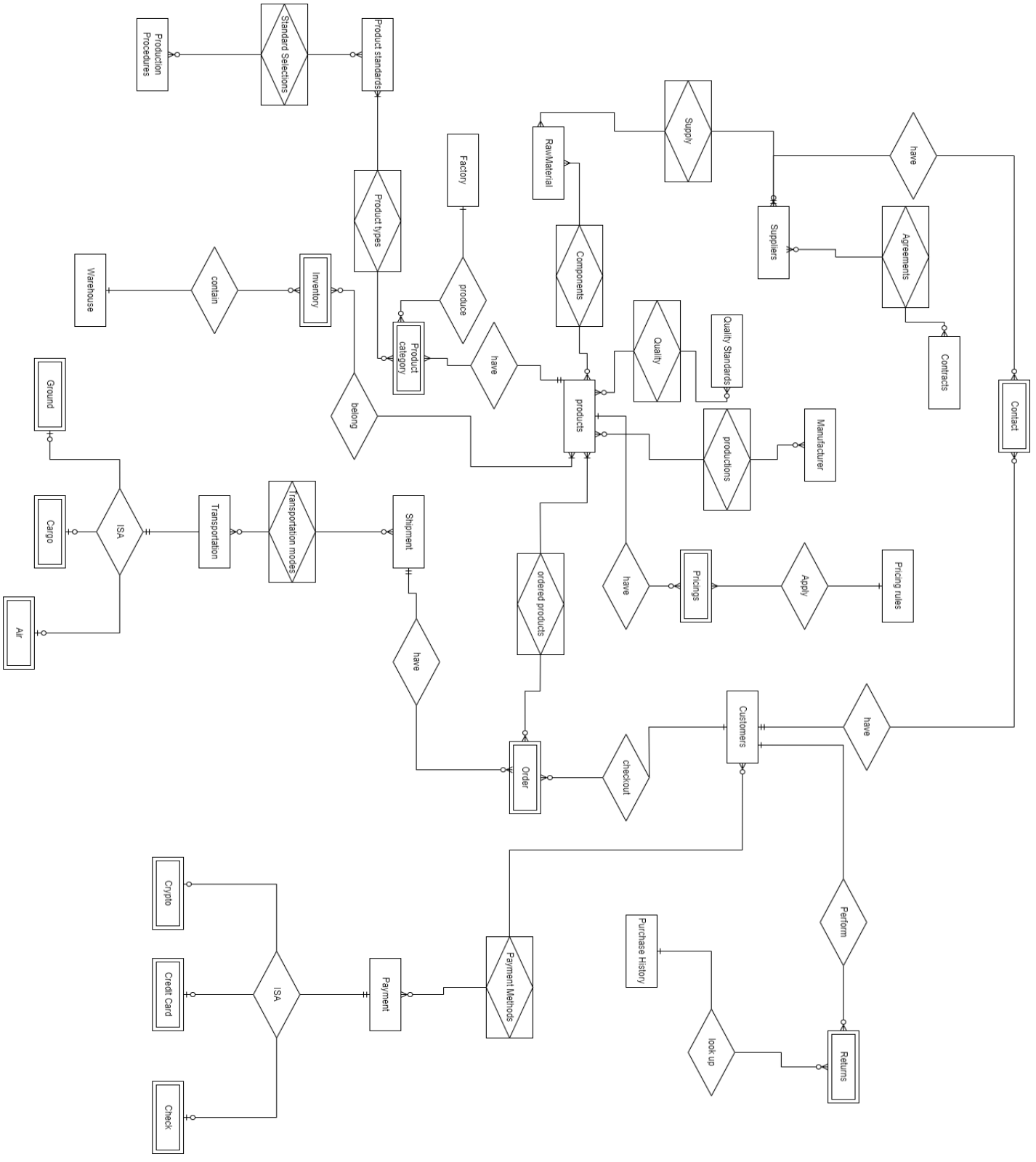
   3.1 The database system shall be compatible with MySQL 8.0.33

4. Compliance

   4.1 The database system shall comply with relevant industry standards.

Entity Relationship Diagram(ERD):


Contact
Contracts
have
Agreements
Pricing rules
have
Perform
Returns
Manufacturer
Apply
Suppliers
Customers
Quality Standards
productions
look up
Supply
Pricings
Quality
Purchase History
have
checkout
Components
products
RawMaterial
ordered products
Order
Payment Methods
have
Factory
produce
Product category
Shipment
have
Payment
Product standards
Product types
belong
Inventory
Transportation modes
ISA
Standard Selections
contain
Transportation
Crypto
Credit Card
Check
Production Procedures
ISA
Warehouse
Ground
Cargo
Air


Production Procedures
Standard Selections
Product standards
Supply
RawMaterial
have
Factory
Product types
Components
Suppliers
Agreements
Warehouse
contain
Inventory
produce
Product category
have
Quality
Quality Standards
Contracts
Contact
Ground
belong
products
productions
Manufacturer
Cargo
ISA
Transportation
Transportation modes
Shipment
ordered products
have
Pricings
Apply
Pricing rules
Air
have
Customers
have
Order
checkout
Crypto
Credit Card
Check
ISA
Payment
Payment Methods
Perform
Purchase History
look up
Returns

Entity Description:

1. Supplier (strong):
    - Supplier_id: key, numeric
    - Name: composite, alphanumeric
    - Certification: multivalue, alphanumeric
2. Contact (weak):
    - Id: key, numeric
    - Supplier: key, numeric
    - Customer: key, numeric
3. Contract (strong):
    - Contract_id: key, numeric
    - Start_date: composite, alphanumeric
    - end_date: composite, alphanumeric
4. Agreement (weak):
    - Agreement_id: key, numeric
    - Contract: key, numeric
    - Supplier: key, numeric
5. Manufacturer (strong):
    - Manufacturer_id: key, numeric
    - Name: composite, alphanumeric
    - Production_capability: key, numeric
6. Productions (weak):

- Production_id: key, numeric
- Manufacturer: key, numeric
- Product: key, numeric

7. Product (strong):
    - Product_id: key, numeric
    - Name: composite, alphanumeric
    - Description: composite, alphanumeric
8. Quality Standards (strong):
    - Quality_standard_id: key, numeric
    - Criteria:
    - Description: composite, alphanumeric
9. Quality (weak):
    - Quality_id: key, numeric
    - Quality_standard: key, numeric
    - Product: key, numeric
10. Raw materials (strong):
    - Material_id: key, numeric
    - Description: composite, alphanumeric
    - Specification: multivalue, alphanumeric
11. Components (weak):
    - Component_id:key, numeric
    - Rawmaterial : key, numeric
    - Product: key, numeric

12. Pricing Rules (strong):
    - Rules_id: key, numeric
    - Pricing_tier: key, numeric
    - Description: composite, alphanumeric
13. Pricings (weak):
    - Pricing_id: key, numeric
    - Pricing_rule:key, numeric
    - Product: key, numeric
14. Factory (strong):
    - Factory_id: key, numeric
    - Name: composite, alphanumeric
    - Location: multivalue, alphanumeric
15. Product Category (weak):
    - Product_category_id: key, numeric
    - Factory:key, numeric
    - Product:key, numeric
16. Product Types (weak):
    - Product_type_id: key, numeric
    - Product_standard: key, numeric
    - Product_category: key, numeric
17. Product Standards (strong):
    - Product_standards_id: key, numeric
    - Description: composite, alphanumeric

- Certification: multivalue, alphanumeric

18. Standard Selections (weak):
    - Standard_selection_id: key, numeric
    - Product_standard: key, numeric
    - Production_procedure: key, numeric
19. Production procedures (strong):
    - Procedure_id: key, numeric
    - Description: composite, alphanumeric
    - Instructions: multivalue, alphanumeric
20. Inventory (weak):
    - Inventory_id : key, numeric
    - Warehouse: key, numeric
    - Product: key, numeric
21. Warehouse (strong) :
    - Warehouse_id: key, numeric
    - Location: multivalue, alphanumeric
    - Capacity: key, numeric
22. Transportation (strong):
    - Transportation_id: key, numeric
    - Carrier_info: composite, alphanumeric
    - Types: key, numeric
23. Transportation modes (weak):
    - Transportation_mode_id: key, numeric

- Transportation: key, numeric
- Shipment: key, numeric

24. Shipment (strong):
    - Shipment_id: key, numeric
    - Tracking_number: key, alphanumeric
    - Delivery_status: key, numeric
25. Orders (weak):
    - Order_id: key, numeric
    - Customer: key, numeric
    - Order_status: key, numeric
26. Ordered Products (weak):
    - Ordered_product_id: key, numeric
    - Product: key, numeric
    - Order: key, numeric
27. Customers (strong):
    - Customer_id: key, numeric
    - Name: composite, alphanumeric
    - Dob: multivalue, timestamp
28. Returns (weak):

    Return_id: key, numeric

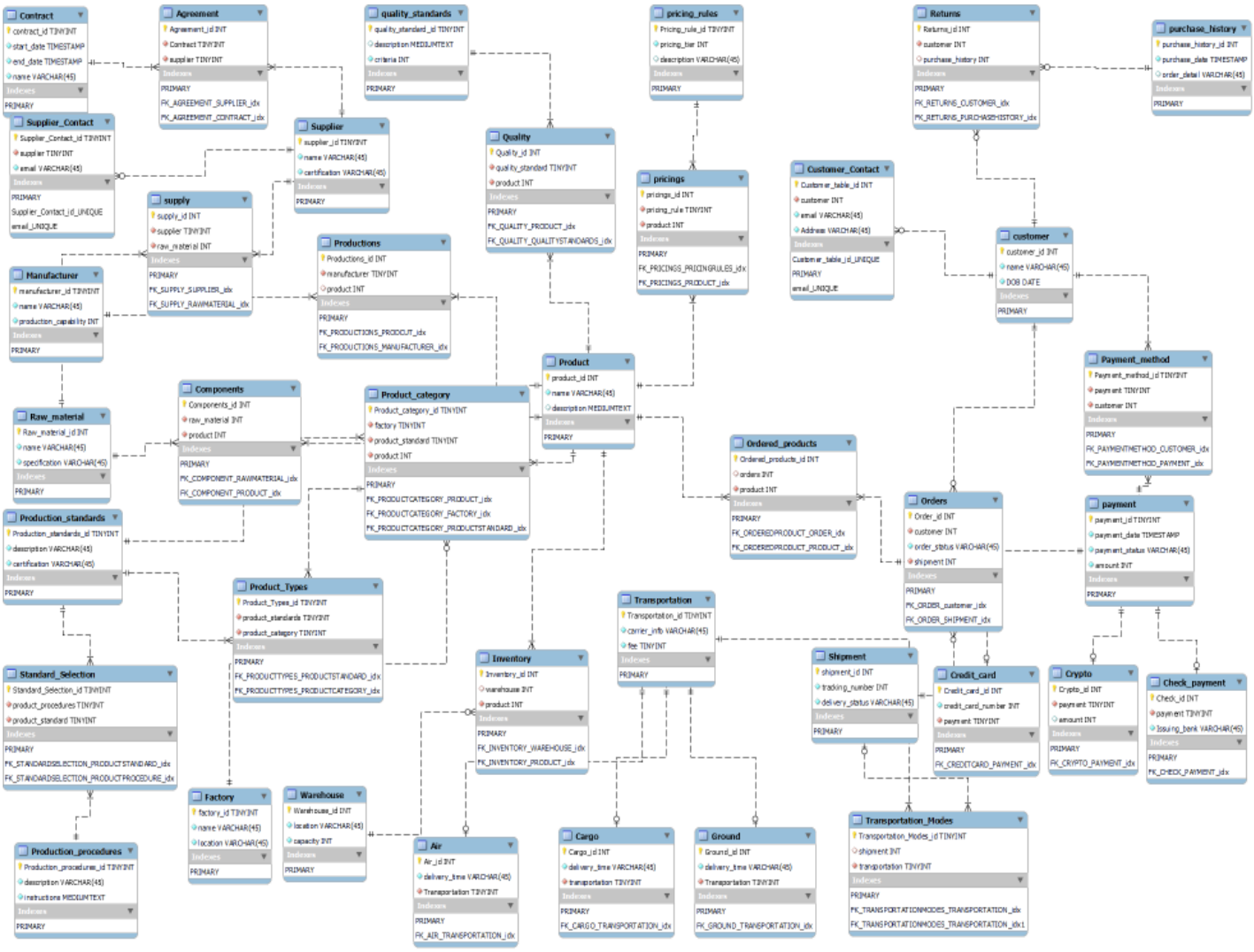
    Customer: key, numeric

    Purchase_history: key, numeric
29. Purchase History (strong):

- Purchase_history_id: key, numeric
- Purchase_date: multivalue, timestamp
- Order_detail: composite, alphanumeric

30. Payment Methods (weak):
    - Payment_method_id: key, numeric
    - Customer: key, numeric
    - Payment: key, numeric
31. Payment (strong):
    - Payment_id: key, numeric
    - Payment_date: multivalue, timestamp
    - Payment_status: key, numeric

Entity Establishment Relationship Diagram(EER):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end_date TIMESTAMP
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Agreement
Agreement_id INT
Contract TINYINT
supplier TINYINT
Indexes
PRIMARY
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FK_AGREEMENT_CONTRACT_idx
quality_standards
quality_standard_id TINYINT
description MEDIUMTEXT
criteria INT
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Indexes
PRIMARY
Returns
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quality_standard TINYINT
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FK_QUALITY_QUALITYSTANDARDS_idx
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product_standard TINYINT
product INT
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product INT
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FK_ORDEREDPRODUCT_PRODUCT_idx
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certification VARCHAR(45)
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Indexes
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FK_STANDARDSELECTION_PRODUCTPROCEDURE_idx
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FK_INVENTORY_WAREHOUSE_idx
FK_INVENTORY_PRODUCT_idx
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name VARCHAR(45)
location VARCHAR(45)
Indexes
PRIMARY
Warehouse
Warehouse_id INT
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Indexes
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Air_id INT
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Ground_id INT
delivery_time VARCHAR(45)
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Transportation_Modes
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shipment INT
transportation TINYINT
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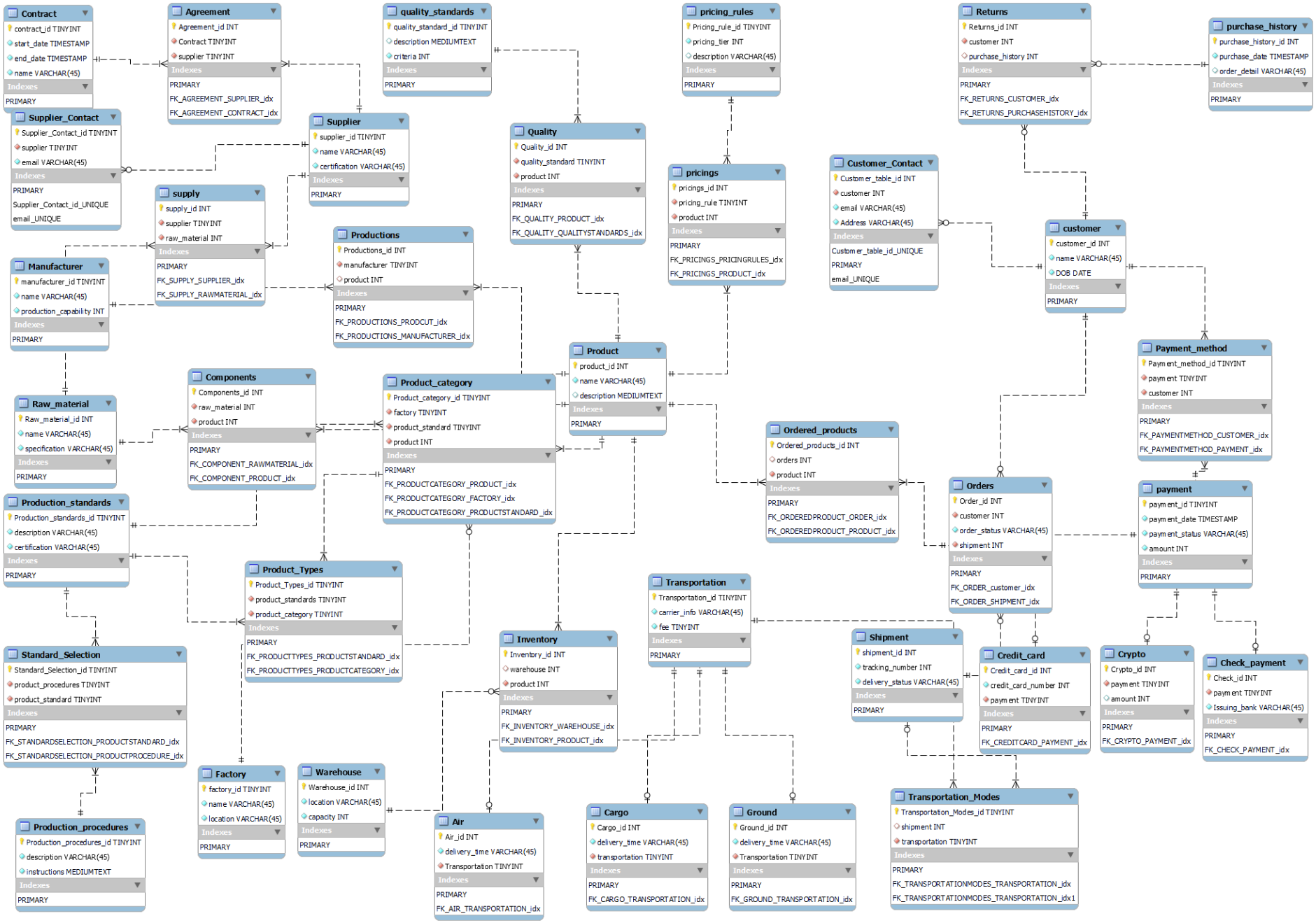
Production_procedures_id TINYINT
description VARCHAR(45)
instructions MEDIUMTEXT
Indexes
PRIMARY


Contract
contract_id TINYINT
start_date TIMESTAMP
end_date TIMESTAMP
name VARCHAR(45)
Indexes
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Agreement
Agreement_id INT
Contract TINYINT
supplier TINYINT
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FK_AGREEMENT_CONTRACT_idx
quality_standards
quality_standard_id TINYINT
description MEDIUMTEXT
criteria INT
Indexes
PRIMARY
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Pricing_rule_id TINYINT
pricing_tier INT
description VARCHAR(45)
Indexes
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Returns
Returns_id INT
customer INT
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FK_RETURNS_PURCHASEHISTORY_idx
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purchase_history_id INT
purchase_date TIMESTAMP
order_detail VARCHAR(45)
Indexes
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Supplier_Contact
Supplier_Contact_id TINYINT
supplier TINYINT
email VARCHAR(45)
Indexes
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Supplier_Contact_id_UNIQUE
email_UNIQUE
Supplier
supplier_id TINYINT
name VARCHAR(45)
certification VARCHAR(45)
Indexes
PRIMARY
Quality
Quality_id INT
quality_standard TINYINT
product INT
Indexes
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FK_QUALITY_PRODUCT_idx
FK_QUALITY_QUALITYSTANDARDS_idx
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pricings_id INT
pricing_rule TINYINT
product INT
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FK_PRICINGS_PRODUCT_idx
Customer_Contact
Customer_table_id INT
customer INT
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Address VARCHAR(45)
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Customer_table_id_UNIQUE
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email_UNIQUE
customer
customer_id INT
name VARCHAR(45)
DOB DATE
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supplier TINYINT
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Productions
Productions_id INT
manufacturer TINYINT
product INT
Indexes
PRIMARY
FK_PRODUCTIONS_PRODCUT_idx
FK_PRODUCTIONS_MANUFACTURER_idx
Manufacturer
manufacturer_id TINYINT
name VARCHAR(45)
production_capability INT
Indexes
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Product
product_id INT
name VARCHAR(45)
description MEDIUMTEXT
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PRIMARY
Payment_method
Payment_method_id TINYINT
payment TINYINT
customer INT
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FK_PAYMENTMETHOD_PAYMENT_idx
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Components_id INT
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product INT
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FK_COMPONENT_PRODUCT_idx
Product_category
Product_category_id TINYINT
factory TINYINT
product_standard TINYINT
product INT
Indexes
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FK_PRODUCTCATEGORY_FACTORY_idx
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Ordered_products
Ordered_products_id INT
orders INT
product INT
Indexes
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FK_ORDEREDPRODUCT_ORDER_idx
FK_ORDEREDPRODUCT_PRODUCT_idx
Raw_material
Raw_material_id INT
name VARCHAR(45)
specification VARCHAR(45)
Indexes
PRIMARY
Orders
Order_id INT
customer INT
order_status VARCHAR(45)
shipment INT
Indexes
PRIMARY
FK_ORDER_customer_idx
FK_ORDER_SHIPMENT_idx
payment
payment_id TINYINT
payment_date TIMESTAMP
payment_status VARCHAR(45)
amount INT
Indexes
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Production_standards
Production_standards_id TINYINT
description VARCHAR(45)
certification VARCHAR(45)
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Product_Types
Product_Types_id TINYINT
product_standards TINYINT
product_category TINYINT
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FK_PRODUCTTYPES_PRODUCTCATEGORY_idx
Transportation
Transportation_id TINYINT
carrier_info VARCHAR(45)
fee TINYINT
Indexes
PRIMARY
Inventory
Inventory_id INT
warehouse INT
product INT
Indexes
PRIMARY
FK_INVENTORY_WAREHOUSE_idx
FK_INVENTORY_PRODUCT_idx
Shipment
shipment_id INT
tracking_number INT
delivery_status VARCHAR(45)
Indexes
PRIMARY
Credit_card
Credit_card_id INT
credit_card_number INT
payment TINYINT
Indexes
PRIMARY
FK_CREDITCARD_PAYMENT_idx
Crypto
Crypto_id INT
payment TINYINT
amount INT
Indexes
PRIMARY
FK_CRYPTO_PAYMENT_idx
Check_payment
Check_id INT
payment TINYINT
Issuing_bank VARCHAR(45)
Indexes
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FK_CHECK_PAYMENT_idx
Standard_Selection
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product_procedures TINYINT
product_standard TINYINT
Indexes
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FK_STANDARDSELECTION_PRODUCTSTANDARD_idx
FK_STANDARDSELECTION_PRODUCTPROCEDURE_idx
Factory
factory_id TINYINT
name VARCHAR(45)
location VARCHAR(45)
Indexes
PRIMARY
Warehouse
Warehouse_id INT
location VARCHAR(45)
capacity INT
Indexes
PRIMARY
Air
Air_id INT
delivery_time VARCHAR(45)
Transportation TINYINT
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FK_AIR_TRANSPORTATION_idx
Cargo
Cargo_id INT
delivery_time VARCHAR(45)
transportation TINYINT
Indexes
PRIMARY
FK_CARGO_TRANSPORTATION_idx
Ground
Ground_id INT
delivery_time VARCHAR(45)
Transportation TINYINT
Indexes
PRIMARY
FK_GROUND_TRANSPORTATION_idx
Transportation_Modes
Transportation_Modes_id TINYINT
shipment INT
transportation TINYINT
Indexes
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FK_TRANSPORTATIONMODES_TRANSPORTATION_idx
FK_TRANSPORTATIONMODES_TRANSPORTATION_idx1
Production_procedures
Production_procedures_id TINYINT
description VARCHAR(45)
instructions MEDIUMTEXT
Indexes
PRIMARY

Constraints Description:

Table	FK	ON DELETE	ON UPDATE	Comment
Supplier_Contact	Supplier	CASCADE	CASCADE	
Agreements	Supplier	CASCADE	CASCADE	
Agreements	Contract	CASCADE	CASCADE	
Supply	Supplier	CASCADE	CASCADE	
Supply	Raw_material	CASCADE	CASCADE	
Components	Raw_material	CASCADE	CASCADE	
Components	Product	CASCADE	CASCADE	
Quality	Quality_standard	CASCADE	CASCADE	
Quality	Product	CASCADE	CASCADE	
Productions	Product	NO ACTION	CASCADE	
Productions	Manufacturer	CASCADE	CASCADE	
Pricings	Pricing_rule	CASCADE	CASCADE	
Pricings	Product	CASCADE	CASCADE	
Customer_Contact	Customer	CASCADE	CASCADE	
Returns	Customer	NO ACTION	CASCADE	
Returns	Purchase_history	SET NULL	SET NULL	

Order	Customer	CASCADE	CASCADE	
Order	Shipment	NO ACTION	NO ACTION	
Ordered_products	Product	CASCADE	CASCADE	
Ordered_products	Order	SET NULL	CASCADE	
Payment_methods	Customer	CASCADE	CASCADE	
Payment_methods	Payment	CASCADE	CASCADE	
Crypto	Payment	CASCADE	CASCADE	
Credit_card	Payment	CASCADE	CASCADE	
Check	Payment	CASCADE	CASCADE	
Transportation_modes	Transportation	CASCADE	CASCADE	
Transportation_modes	Shipment	CASCADE	SET NULL	
Ground	Transportation	CASCADE	CASCADE	
Cargo	Transportation	CASCADE	CASCADE	
Air	Transportation	CASCADE	CASCADE	
Standard_Selection	Product_standard	CASCADE	CASCADE	
Standard_Selection	Production_procedures	CASCADE	CASCADE	
Product_types	Production_standard	CASCADE	CASCADE	
Product_types	Product_category	CASCADE	CASCADE	
Inventory	Warehouse	CASCADE	SET NULL	
Inventory	Product	CASCADE	CASCADE	
Product_category	Product	CASCADE	CASCADE	

Product_Category	Factory	CASCADE	CASCADE	
Product_Category	Production_standard	CASCADE	CASCADE	