台灣工具機暨零組件工業同業公會
Taiwan Machine Tool & Accessory Builders' Association

January 2024 Reference Template for Carbon Footprint Product Category Rules for Machine Tools (First Edition)

Document Number: TMBA PCR-001

Carbon Footprint Product Category Rules

(CFP-PCR)

綜合加工機

Machining Center

Version 1.0

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1. General Information

1.1 Purpose of the Document

In accordance with the Ministry of Environment's "Guidelines for the Management of Product Carbon Footprint promoted by the Environmental Protection Administration (EPA) of the Executive Yuan", this document outlines the requirements intended for the inventory and verification of product carbon footprints for "Machining Centers". Due to the high homogeneity of Taiwan's machine tools and the lack of a carbon footprint calculation standard, the Taiwan Machine Tool & Accessory Builders' Association (TMBA) officially announces the promotion of "Product Category Rules (PCR)" starting from Q4 2023. Based on the main categories of machine tools, the focus will be on six major categories: Machining Centers, Lathes, Drilling/Boring/ Milling/Tapping /Threading Machines, Grinding Machines, Punching Machines, and Electrical Discharge/Laser Machines. By referencing the EPA's operational guidelines for carbon footprint product category rules, and following a fair, impartial , and open process through the association's committee mechanism, the TMBA will establish a credible carbon footprint calculation frameworks and rules for machine tools as a standard for the domestic machine tool and accessory industry.

1.2 Applicable Product Categories (Including Import/Export Commodity Classification Numbers)

This document applies to the carbon footprint product category rules (hereinafter referred to as CFP-PCR) for Machining Centers. The applicable product scope includes Machining Centers for the end-face processing, turning cones, parallel milling, cylindrical turning, threading, and drilling operations of the metal or other non-combustible products. (Institute of Labor, Occupational safety and health, Ministry of Labor, SDSE060T0103 - Machine Tool Safety - Machining Centers)

The import/export commodity classification number (C.C.C Code) for Machining Centers is classified as follows: 8457.10 – Cutting Machine Tools for Machining Centers.

This PCR applies to B2B (Business to Business) applications, and when performing environmental impacts verification, must include accessories and packaging materials.

1.3 Validity Period

The validity period of this document is five years from the date of announcement by the Taiwan Machine Tool & Accessory Builders' Association.

1.4 Project Coordinator

The project coordinator for this document is General Manager Chen Bo-jia of Yongjin Machinery Industrial Co., Ltd.。

1.5 Drafting Unit

This document was drafted by Yongjin Machinery Industrial Co., Ltd. and publicly discussed with representatives from major domestic industry stakeholders and interest groups , as invited by the Taiwan Machine Tool & Accessory Builders' Association.

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2. Product Description

2.1 Product function

The function of Machining Centers is which power by motor-driven. Machining Centers is mainly suitable for metal forming processes. The principle is to use the motor power to drive the chuck and drive the rotating workpiece to contact with the embedded tool to produce a cutting effect. Machining Centers are used in a wide range of applications, such as metal processing operations in machinery manufacturing or general maintenance plants, for the completion of metal products face treatment, cones, parallel turning, cylinder turning, threading and drilling operations... and other uses. (Institute of Labor, Occupational safety and health, Ministry of Labor, SDSE060T0103 - Machine Tool Safety - Machining Centers)

2.2 Product characteristics

The product characteristics of Machining Centers include the following:

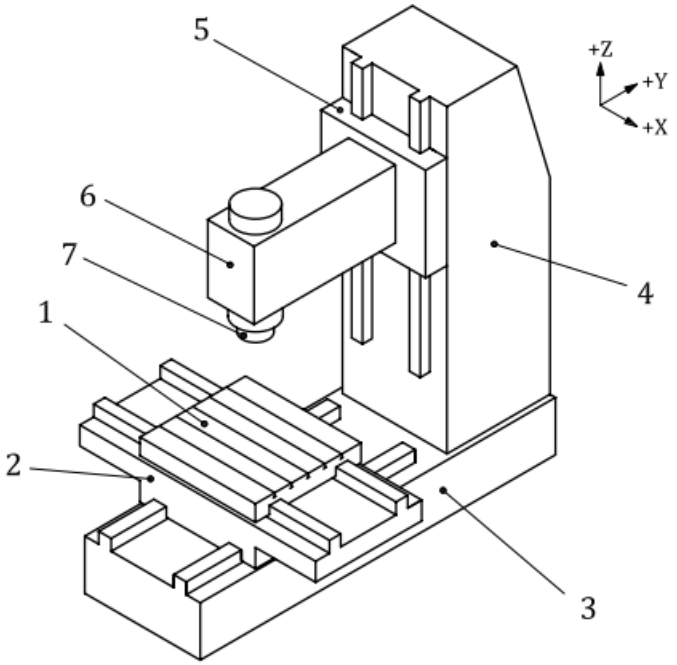
1. The main application to the forming and processing of metal or other non-combustible material products, the principle of which is to use motor power to drive the chuck and drive the rotary embedded tool to contact with the workpiece to produce a cutting effect, usually with the feed mechanism to move ~~push~~ the workpiece forward. (Institute of Labor, Occupational Safety and Health, Ministry of Labor, SDSE060T0103 - Machine Tool Safety - Machining Centers)
2. The operation of the machine tool can be mechanical, human or computer-controlled. (CNS 16130-1:2020-3.16)
3. Numerically controlled milling machines, milling and machining centers, numerically controlled machines with the ability to perform programmed multi-axis movements, such machines can be incorporated into manual control facilities to varying degrees. (CNS 16188-1:2023-3.2 Machine Group / 3.2.3 Group 3: Numerical Control Milling Machine, Milling and Cutting machine centers)
4. Milling machine: The milling cutter rotates with the spindle, and the workpiece is usually moved forward by the feed mechanism. Milling machines are divided into:
   (1) Vertical milling machine: the spindle is vertical, and the structure schematic diagram refers to Figure 1, Figure 2, Figure 3. (CNS 5391-(2.4) Milling Machine / 20400 Milling Machine)
   (2) Horizontal milling machine: the spindle is horizontal , and the structure schematic diagram refers to Figure 4, Figure 5, Figure 6. (CNS 5391-(2.4) milling machine/20400 milling machine)
   (3) Bridge milling machine: the worktable moves in the long direction on the machine tool, and has a milling machine with a milling head moving along the horizontal rail or a column, and the milling head can also rotate, and the column is distinguished as follows:
   I.Unilateral type: the column has one.

II.Double column type: the column has two ~~roots~~. (Please refer to Figure 7, Figure 8 and Figure 9 for structural schematics)

III.Gantry type: the Cross beam moves in the long direction.

(CNS 5391-(2.4) Milling Machine/20412 Gantry Milling Machine)

5. Machine tools can have a variety of peripherals for machine tool cooling/heating, process adjustment, workpiece and tool loading and unloading (excluding workpiece feeding), recyclables and waste disposal, and other tasks related to their main operations.
(CNS 16130-1-3.16 machine tool)



Key

1	table (X'-axis)	5	spindle head slide (Z-axis)
2	table saddle (Y'-axis)	6	spindle head
3	bed (b)	7	spindle [(C)]
4	column		

Figure 1:

An example of a vertical milling machine

(ISO 10791-2:2023/Figure2 shows an example of machining center with vertical spindle and a horizontal non-rotating table.)

Figure 2:
Example of a vertical milling machine
(Source: YCM official website)

Figure 3:
example of a five-axis vertical milling machine
(Source: YCM official website)

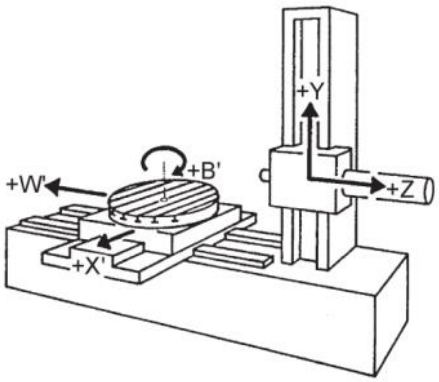


Figure 4:
Example of horizontal boring and milling machine
(CNS 16188-1:2023/Fig. C.7)

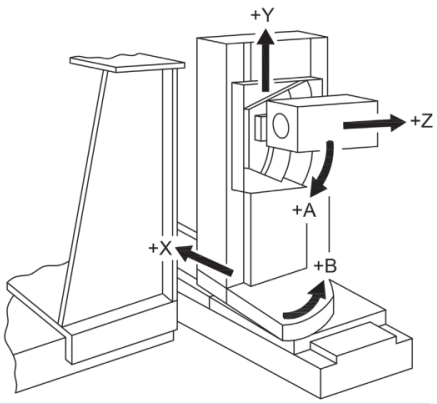


Figure 5:
Example of horizontal boring and milling machine
(CNS 16188-1:2023/Fig. C.6)

Figure 6:
Example of horizontal milling machine
(Source: YCM official website)

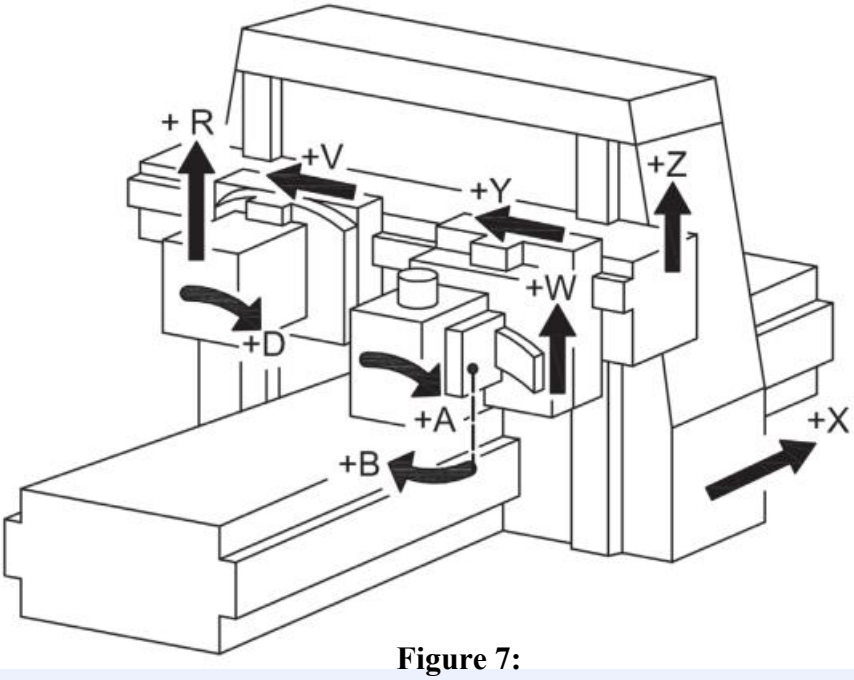


Figure 7:
Example of a gantry milling machine (double-column bed milling machine)
(CNS 16188-1:2023/Fig. C.4)

Figure 8:
Example of Double column milling machine
(Source: YCM official website)

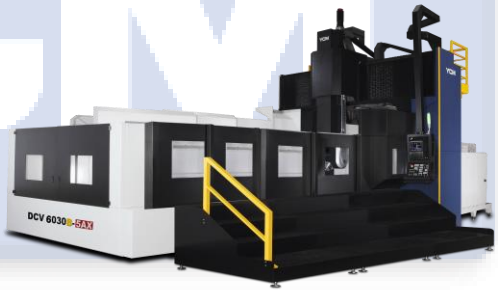


Figure 9:
an example of a five-axis Double column milling machine
(Source: YCM official website)

At the same time, the machine tools in the above product groups should meet the requirements of relevant laws and regulations or standards such as "Measures for the use and management of Taiwan's safety labels and verification of qualification marks".

3. Product Structure

The main components of the machining centers include but are not limited to the following:

1. Main components: the main components that must be used in the production line of the process, such as: main structural parts, mechanical components, motor components and servo and control units, hydraulic/pneumatic/lubrication and cooling systems, spare parts... and other major components.

First level components (Level 1)	Second level components(Level 2)
Main Structural Components	Base
	Head
	Saddle
	Column
	Fuselage
	Worktable
Mechanical Components	Gears
	Gear Reducers
	Other Gears
	Belts and Chains
	Ball Screws
	Ball Bearings
	Linear Bearings
	Linear Guides
	Other Bearings
	Clutches
	Brakes
	Other Mechanical Components and Accessories
Electrical Components, Servo, and Control Units	Electric Motors
	Industrial Fans (for supply and exhaust)
	Uninterruptible Power Supplies (UPS)
	Programmable Logic Controllers (PLC)
	Industrial Numerical Controllers
	Industrial Controller Modules
	Servo Motors
	Linear Motors
	Spindles
	Industrial Controller Enclosures
Electrical Components,Servo, and Control Units	Other Electrical Components
	Other Servo and Control Units and Parts

First level components (Level 1)	Second level components(Level 2)
Hydraulic,Pneumatic, Lubrication, and Cooling Systems	Pneumatic Components and Systems
	Hydraulic Components and Systems
	Other Hydraulic and Pneumatic Components
	Industrial Lubrication Systems
	Industrial Cooling Systems
	Other Hydraulic, Pneumatic, Lubrication, and Cooling Systems
	Lubricants
Parts and Accessories	Castings and Forgings
	Mechanical Enclosures and Sheet Metal Parts
	Metal and Non-Metal Materials and Parts
	Plastic Cases and Tool Racks

2. Secondary components: the secondary components required for the production line in addition to the main components, such as special spare parts for machine tools, testing components... and other minor components or Accessories .

First level components (Level 1)	Second level components(Level 2)
Special Accessories for Machine Tools	Chucks
	Tool Changers and Tool Magazines for Machining Centers
	Vises
	Dividing Plates
	Indexing Tables
	Workpiece Exchange Tables
	Slideway Covers
	Chip Conveyors
	Chip and Cutting Oil Treatment Systems
	Magnetic Chucks
	Standard Accessories for Milling Machines
	Oil Mist Collectors
	Other Specialized Hardware and Accessories for Machine Tools
Inspection Components	Dimensional Inspection Equipment
	Optical Scales
	Other Dimensional Inspection Equipment
	Temperature Inspection Equipment
	Sound Pressure Inspection Equipment
	Electrical Inspection Equipment
	Other Inspection Components and Equipment
Cutting Tools and Accessories for Metal processing Machinery	Tool Holders and Collet Chucks
	Other Cutting Tools and Accessories

First level components (Level 1)	Second level components (Level 2)
Auxiliary Tools, Jigs, or Accessories	Clamps, Jigs, and Accessories
	Molds
	Other Molds
	Mold Accessories
	Quick Mold Change Systems
	Other Mold Processing Machinery
	Other Tools, Cutting Tools, Jigs, Molds, and Related Equipment

3. Consumables: make a process possible but do not form part of the product entity, such as equipment consumables, equipment cleaning consumables, equipment lubrication... and other consumables.

First level components (Level 1)	Second level components (Level 2)
Consumable Materials	Lubricating Oil
	Cutting Fluid
	Coolant

4. Packaging materials: packaging materials used during the manufacture and shipment of machining centers, such as cartons, plastic bags, labels, tapes, wood, packing belts... and other packaging materials.

4. Declaration Unit

The declaration unit for this product is one "Machining Center". It must clearly specify the following product information items, such as: (using the NSV106A Vertical Machining Center from YCM Machinery Co., Ltd. as an example)

Product Information	
Model Name	
Machine Type	
Controller Type (Brand/Model)	
Spindle	Spindle Speed (rpm)
	Maximum Spindle Motor Power (kW)
	Spindle Taper
Travel	X-Axis Travel (mm)
	Y-Axis Travel (mm)
	Z-Axis Travel (mm)
Worktable	Worktable Size (mm)
	Maximum Worktable Load (kg)
Feed Rate	Rapid Feed Rate (X/Y/Z) (m/min)
	Cutting Feed Rate (mm/min)
	Motor Power (kW)
Automatic Tool Changer	Number of Tools (T)
	Tool Weight (kg/pc)
	Maximum Tool Size (without adjacent tools) (mm)
Machine Weight (kg)	

5. Definition of terms

The main terms related to the manufacturing process of this product are defined as follows.

1. B2B: Business to Business
2. B2C: Business to Consumer or Customer
3. Machine tools: Machine tools, in general, in a narrow sense, mainly refer to the machinery that removes unnecessary parts of metal workpieces from cutting, grinding, etc., to make the required shape. However, it does not include those that are hand-held or fixed with magnet holders, etc. (CNS 5391-3. (1) General. Machine tool)
4. Machining center: Cutting machining center/ Machining center , a numerical control machine tool that can do more than two kinds of machining on both sides of a variety of different workpieces in the same clamping, and is equipped with an automatic tool exchange mechanism or a device with automatic selection function. (CNS 5391-3. (4) Numerical control machine tool (NC machine tool) 42000 Machining Center)
5. Milling machine: mainly use milling cutter to perform plane cutting, groove cutting and other processing on various workpieces. (CNS 5391-(2.4) Milling Machine 20400 Milling Machine)
6. Main components: the main structural parts, mechanical components and motor components necessary for the machine, such as bases, columns, saddles, spindle heads, worktables, controllers, spindle motors... and other parts.
7. Secondary components: to improve or assist the performance/accuracy/efficiency of the machine, selected functions or customer-specific requirements, such as: optical rulers, chip conveyors, etc. and other parts.
8. Consumables: Consumables required to accompany the shipment of the product, which are part of the product body, such as: cutting fluid, lubricating oil... and other consumables.
9. Sealing and packing: mainly in the process of transportation to fix the machine and protect the steel, wood and rust bags used in the machine... and other packaging materials.

6. System Boundaries

6.1 System Boundary Setting Specification

System boundary determine which element processes should be included in the LCA. The selection of system boundaries should be consistent with the operational purpose of the LCA, and the criteria for establishing system boundaries should be identified and explained. The following is an explanation of the meaning of the setting specification of system boundaries:

1. Boundary in the life cycle

   The boundaries of the life cycle are shown in Figure 10. Buildings of production plants (e.g. factories, office buildings...etc.), infrastructure (e.g. air conditioning systems, electrical systems...etc.), provide production machinery and equipment (such as: equipment and machines... etc.) should not be included.

2. Temporal boundary

   The time boundary defines the data collection time of the LCA, as described in Section "10.1 Data Collection Period".

3. Geographical boundaries

   Geographical boundaries are the geographic boundaries that define the geographical coverage of the LCA, which should reflect the physical reality of the product under study and take into account the representativeness of technology, material inputs, and energy inputs.

4. Boundary towards nature

   (1) The boundary of nature is defined as the boundary between leaving or entering nature, which should describe the materials, energy resources and emissions and wastes generated by the product system to the natural world (air, water, soil) from nature.

   (2) In addition, if the emissions generated by the product system are generated by wastewater treatment and waste gas treatment, they must be considered into the wastewater and waste gas treatment procedures; If the waste generated by the product system is generated by treatment methods such as incineration, landfilling, recycling, etc., it must be considered to be included in the treatment procedures such as incineration, burial, recycling, etc.; If the manufacturing process of the product system is located in China, the classification and treatment of waste shall be in accordance with the relevant laws and regulations of Taiwan on waste disposal. In the case of other countries, other equivalent legal provisions must be considered.

5. Boundary towards other technical systems

   (1) The boundary of other technical systems defines the flow of materials and components into and out of the product system under study as well as other product systems.

   (2) Furthermore, if recycled material enters the product system during the manufacturing phase of the product system, the transport from the scrap plant/scrap collection site to the recycling plant, the recycling process and the transport from the recycling plant to

the place where the material is used should be covered within the system boundaries of the LCA. Similarly, if there are waste materials or components that can be recycled and reused during the manufacturing stage of the product system, the transportation of the waste materials or components to the scrap yard/scrap collection site should also be included in the system boundaries of the product carbon footprint inventory.

6.2 Life Cycle Flowchart

The life cycle of a Machining Center covers five major stages: raw material acquisition, manufacturing, distribution and sales, usage, and disposal. The life cycle flowchart is shown in Figure 10.

[Required Data Collection]: From raw material acquisition by the supplier (including transportation) to the completion of manufacturing at the door of product factory (life cycle stages: raw material acquisition, manufacturing).

[Optional Data Collection]: The process from the distribution and sale of the Machining Center product to its disposal (life cycle stages: distribution and sales, usage, disposal).

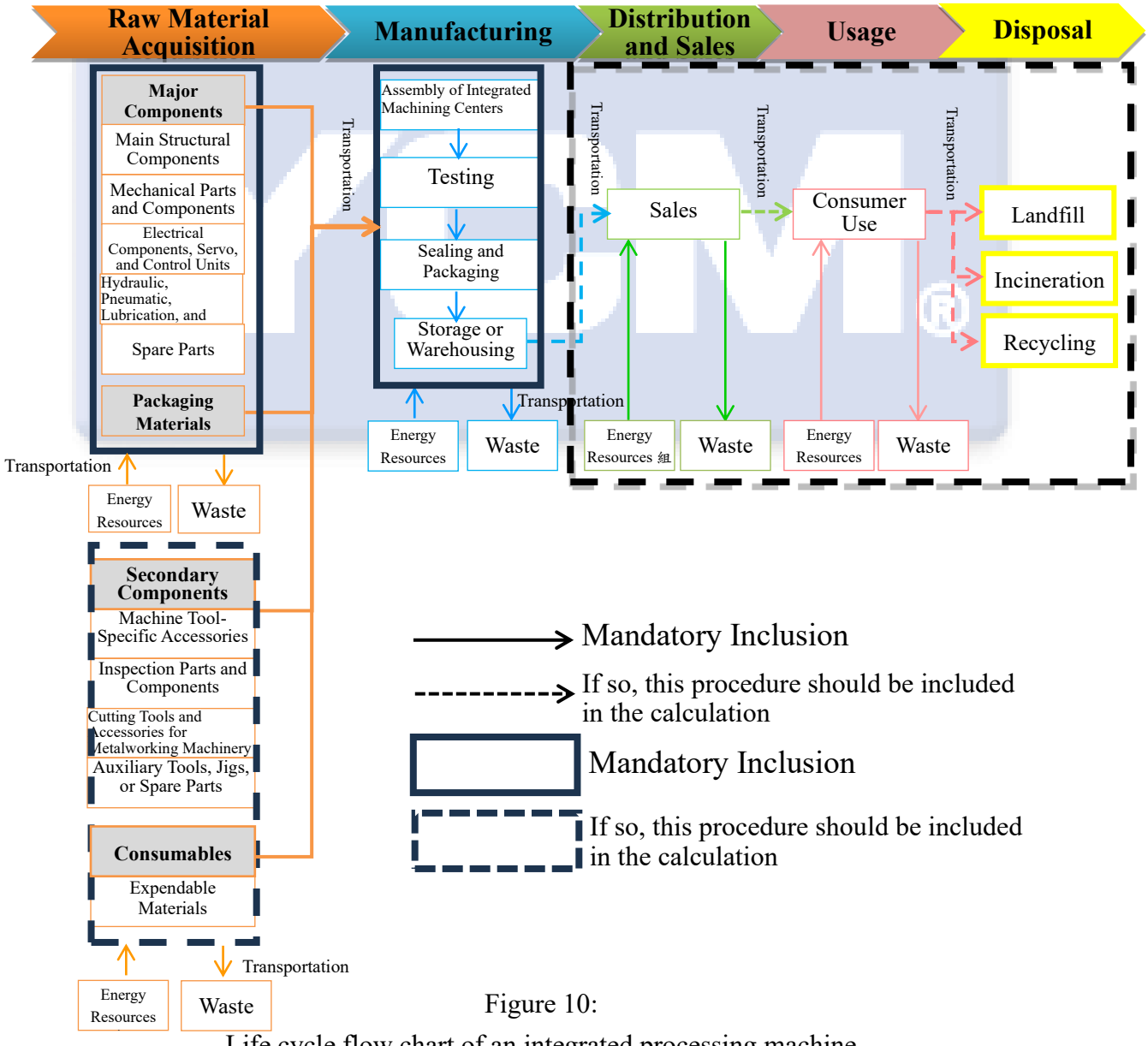


Figure 10:
Life cycle flow chart of an integrated processing machine

Life cycle phases and processes should be included in the life cycle flow diagram, and each process description is shown in Table 1 below.

Table 1:A brief description of the process at each stage of the life cycle

Life cycle stage	Brief description of the process included
Raw Material Acquisition Stage [Required Data Collection Items]	1. The process of acquiring main components (such as primary structural components, mechanical parts, electrical components, servo and control units, hydraulic/pneumatic/lubrication and cooling systems, spare parts, etc.), secondary components (such as machine tool-specific accessories, inspection components, etc.), other components (such as cutting tools and accessories for metal processing machinery, auxiliary tools or jigs or spare parts, consumables, etc.), and packaging materials. 2. Other acquisition processes related to production materials that include but are not limited to the processes mentioned above. 3. Transportation of raw materials to the production factory for manufacturing. 4. Waste disposal generated during the raw material acquisition process: Transportation and waste treatment need to be included in the assessment.
Manufacturing Stage [Required Data Collection Items]	1. The processes involved in product assembly, testing, and packaging/shipping. 2. Water supply and energy consumption related to the processes mentioned above. 3. Waste disposal generated from the processes: Transportation and waste treatment need to be included in the assessment. 4. Direct and indirect emissions during the manufacturing process.
Distribution and Sale Stage [Voluntary Data Collection Items]	1. The transportation process from the production factory to the first distribution point or distributor's designated location (e.g., from the production factory to logistics/warehouse, sales point, or customer's designated location) should be included in the assessment. 2. Processes that may be excluded from the assessment include: (1) Sales operations related processes. (2) Warehousing and transportation processes from the sales point to intermediate wholesalers or distribution centers and from consumers back to the sales points. 3. Waste disposal generated during the distribution and sales process: Transportation and waste treatment need to be included in the assessment.
Use Stage [Voluntary Data Collection Items]	1. The use stage involves processes related to the consumer's use of the product, defined as the machine's warranty period. 2. Waste disposal generated during the product's use: Transportation and waste treatment need to be included in the assessment.

Life cycle stage	Brief description of the process included
Waste Disposal Stage [Voluntary Data Collection Items]	1. Processes related to the disposal of waste generated after product use: Transportation and disposal methods. 2. The waste disposal stage should be considered based on actual conditions (e.g., recycling rates), including the following processes: (1) Transportation of waste and recyclable resources generated from product use to the first disposal location. (2) Disposal processes at the first disposal location, including landfilling, incineration, or recycling. (3) Estimation of the quantity of waste and recyclable resources generated from product use based on actual domestic disposal and recycling situations or using nationally published data.

7. Cut-off Rules

1. If the emission contribution from any single greenhouse gas source accounts for ≤1% of the product's expected greenhouse gas emissions over its lifecycle, this process/activity can be excluded from the inventory, provided that the cumulative exclusions do not exceed 5%.
2. Accordingly, the emission contributions included in the assessment must cover at least 95% of the expected greenhouse gas emissions of the functional unit.
3. Any greenhouse gas sources not included in the lifecycle assessment inventory must be documented.

8. Allocation Rules

The primary principle is to avoid allocation. If allocation is unavoidable, the allocation rules should be based on physical properties applicable to the industry, such as production volume, weight, working hours, etc., as the basic parameters for allocation. If parameters other than actual quantities, such as economic value, are used, the rationale for selecting these parameters must be explained.

9. Units

The basic principle is to use the International System of Units (SI) (the following units are for reference only; please select appropriate units for use):

1. Power and Energy:
   (1) Power units: watt (W), kilowatt (kW), etc.
   (2) Energy units: joule (J), kilojoule (kJ), etc.
   (3) Force units: newton (N), kilonewton (kN), etc.
   (4) Pressure units: bar, pascal (Pa), etc.

(5) Voltage unit: volt (V).
(6) Current unit: ampere (A).
(7) Electrical energy unit: kilowatt-hour (kWh).

2. Specifications and Dimensions:
(1) Length units: millimeter (mm), centimeter (cm), meter (m), etc.
(2) Volume units: cubic centimeter (cm^3), cubic meter (m^3), etc.
(3) Area units: square centimeter (cm^2), square meter (m^2), etc.
(4) Weight units: gram (g), kilogram (kg), etc.
(5) Spindle speed unit: revolutions per minute (rpm). (CNS4670-01 Machine Tool Specifications)
(6) Feed rate units: mm/min, m/min. (CNS4670-15 Machine Tool Specifications)。

3. Prefixes may be added to SI units as needed:

(1) 10^9 = giga，symbol G；
(2) 10^6 = mega，symbol M；
(3) 10^3 = kilo，symbol k；
(4) 10^{-2} = centi，symbol c；
(5) 10^{-3} = milli，symbol m；
(6) 10^{-6} = micro，symbol μ；
(7) 10^{-9} = nano，symbol n。

10. Data Collection for Each Stage of the Life Cycle

10.1 Data Collection Period

To ensure the completeness of data collection, the data should be representative and obtained over a period long enough to stabilize normal fluctuations. As such, it is recommended that product data collection should be based on a full year's data, which can be defined as:

1. Data from the year preceding the product carbon footprint inventory project, or
2. Data spanning 12 consecutive months, including the year of the project execution and the previous year.

If data collection does not follow the above guidelines, the reasons must be detailed, and the accuracy of the collected data must be verified.

The data collection items and rules for the carbon footprint of Machining Centers at each stage of the life cycle are as follows.

10.2 Raw Material Acquisition Stage for Machining Centers

10.2.1 Data Collection Items

Referencing Figure 10 in Section 6.2, the items to be collected during the raw material acquisition stage for Machining Centers include:

1. Major and minor components related to the production and manufacturing of Machining Centers products, with the life cycle boundary covering greenhouse gas emissions from raw material acquisition to the manufacturing stage.
2. Consumables and packaging materials related to the production and manufacturing of Machining Centers products, with the life cycle boundary covering greenhouse gas emissions from raw material acquisition to the manufacturing stage.
3. The greenhouse gas emissions generated during the transportation of the above-mentioned items from the supplier to the production factory door.
4. Waste disposal generated during the raw material acquisition process: transportation and waste treatment should be included as items to be assessed.

Other items related to the production and manufacturing of Machining Centers products that are not included in the above should be voluntarily included in the collection:

1. The life cycle boundary covers the greenhouse gas emissions from raw material acquisition to the manufacturing stage.
2. The greenhouse gas emissions generated during the transportation of these items from the supplier to the production factory door.

10.2.2 Primary Data Collection Requirements

1. To collect the greenhouse gas emissions of the items mentioned in Section 10.2.1, it is recommended to prioritize the use of primary data (e.g., supplier inventory results). However, if primary data is not available, secondary data (e.g., life cycle databases) may be used.
2. Following Article 9 of the "Guidelines for Promoting Product Carbon Footprint Management" issued by the Environmental Protection Administration, if the greenhouse gas emissions from processes owned, operated, or controlled by the organization (manufacturing stage) do not account for 10% or more of the total greenhouse gas emissions in the upstream raw material acquisition stage, the raw material acquisition stage must include primary data collection until the greenhouse gas emissions collected from the organization (manufacturing stage) and upstream suppliers exceed or are equal to 10% of the total greenhouse gas emissions in the raw material acquisition stage.

10.2.3 Primary Data Collection Method

1. According to Section 10.2.2, point 2, if the greenhouse gas emissions from processes owned, operated, or controlled by the organization (manufacturing stage) do not account for 10% or more of the total greenhouse gas emissions in the upstream raw material acquisition stage, the raw material acquisition stage must include primary data collection

until the greenhouse gas emissions collected from the organization (manufacturing stage) and upstream suppliers exceed or are equal to 10% of the total greenhouse gas emissions in the raw material acquisition stage.

2. If the raw materials included in the primary data collection are sourced from multiple suppliers, it is advisable to collect greenhouse gas emissions from all suppliers and perform a weighted average based on each supplier's supply volume. If it is not possible to collect greenhouse gas emissions from all suppliers, the main or available supplier's emissions should be requested, and the greenhouse gas emissions should be weighted and averaged according to the supplier's supply volume, then extended to cover 100% of the greenhouse gas emissions for the functional unit.

   [Note]: The main or available suppliers may be selected based on total supply volume, and their cumulative supply should exceed the adjusted rate according to industry characteristics.

3. The primary data collection method may follow ISO 14067:2018, Section 3.1.6.1, which involves quantifying unit process values or directly measuring activities to obtain data based on their original source.

10.2.4 Secondary Data Sources

Secondary data, according to ISO 14067:2018, Section 3.1.6.3, refers to data that does not meet the requirements for primary data. Sources may include databases, published literature, national inventory default emission factors, calculated data, estimated data, or other representative data verified by the competent authority. In addition to the aforementioned sources, data obtained from proxy processes or estimates may also be included.

10.2.5 Contextual Content

For greenhouse gas emissions generated during the transportation of raw materials from suppliers to the production facility, the transport scenario may be defined considering factors such as transportation mode, vehicle type, transport distance, load tonnage, or average fuel consumption.。

10.2.6 Evaluation of Recycled Materials and Reuse Products

1. If the raw materials obtained are from resource recycling or reuse, the greenhouse gas emissions related to their manufacturing and transportation must include resource recovery (recycling, pre-treatment, re-processing, etc.) or reuse processes (recycling, cleaning, etc.).
2. If the competent authority has published relevant greenhouse gas emission factors or calculation principles for these processes, they should be followed for calculation and evaluation.
3. In the absence of the aforementioned information, international standards, industry norms, or relevant literature may be referenced.

10.3 Manufacturing Stage for Machining Centers

10.3.1 Data Collection Items

The items that need to be collected during the manufacturing stage include:：

1. Inputs or incoming quantities
   (1) Major components input quantity.
   (2) Minor components input quantity.
   (3) Consumables input quantity.
   (4) Packaging materials input quantity.
   (5) Fuel and electricity consumption.
   (6) Water resource usage (e.g., tap water, groundwater, well water, river water, etc.).
   (7) Refrigerant charge or leakage quantity.
   (8) Other energy resource usage.
   (9) Transportation between production factories, intermediate transport, or waste transport, including transport distance, transport method, or transport load factor.
2. Outputs or outgoing quantities
   (1) Product production quantity.
   (2) Exhaust gas treatment quantity.
   (3) Wastewater treatment quantity.
   (4) Waste disposal quantity.

10.3.2 Primary Data Collection Requirements

1. The items mentioned in Section 10.3.1, including: actual product production quantity, raw materials (major components, minor components, consumables, packaging materials) types and input quantities, fuel and electricity types and consumption, water resource types and consumption, refrigerant types and charge or leakage quantities, direct and indirect emissions (waste, wastewater, and exhaust gas) types, waste quantities and disposal methods, must all be primary data related to the production and manufacturing process.

10.3.3 Primary Data Collection Method

1. The primary data collection method may follow ISO 14067:2018, Section 3.1.6.1, which involves quantifying unit process values or directly measuring activities to obtain data based on their original source.
2. If there is more than one production factory , all factory should be inventoried, and greenhouse gas emissions calculated according to inventory results should be weighted and averaged based on the production quantity of each factory .

10.3.4 Secondary Data Sources

Secondary data, as per ISO 14067:2018 Section 3.1.6.3, refers to data that does not meet the criteria for primary data. These sources may include data from databases, published literature, default emission factors from national inventory reports, calculated data, estimates, or other representative data confirmed by the relevant authorities. In addition to these sources, data obtained from proxy processes or estimates can also be considered.

10.3.5 Scenario Content

For greenhouse gas emissions generated by transportation between production factory, intermediate transportation, and waste transportation, various factors can be considered to define transportation scenarios. These factors include the mode of transportation, type of vehicle, transportation distance, load factor or ton-kilometer, freight charges, average fuel consumption/fuel price, and other relevant parameters.

10.4 Distribution and Sales Phase of Machining Centers

10.4.1 Data Collection Items

According to the "Table 1: Brief Description of Each Stage in the Life Cycle" in this document, the distribution and sales phase covers the transportation process from the production factory to the first-tier distribution point or a dealer-designated location (e.g., production factory to logistics/consolidation warehouse, selling site , or customer-designated location). The following processes during this phase may be excluded from evaluation: (1)Processes related to sales operations. (2)Transportation processes between wholesalers, distribution centers, warehouses, and customers traveling to and from selling site, from the selling site to the consumer.

For the distribution and sales phase, data collection should focus on the transportation activities related to delivering the product to the first-tier distribution point or the dealer-designated location, including:

1. Quantity of product distributed.
2. Mode of transportation (e.g., land, sea, or air).
3. Type of vehicle.
4. Transportation distance.
5. If the product packaging is made of recyclable materials, transportation information for returning the packaging to the production site (e.g., quantity of recyclable packaging, transportation mode, type of vehicle, and transportation distance).
6. Waste disposal generated during the distribution process: Transportation and waste disposal must be included in the inventory.

10.4.2 Primary Data Collection Requirements

This stage is part of the downstream phase of the product life cycle, involving complex scenario assumptions and data collection, and thus, collecting primary data is not mandatory. However, if conditions allow for the collection of primary data, it is recommended to gather the following items：

1. If using the "Fuel Method" to estimate greenhouse gas emissions during the distribution and sales phase, recommended primary data collection activities include:
   (1) Types of fuel consumed by the transportation vehicles.
   (2) Amount of fuel consumed by the transportation vehicles.
2. If using the "Ton-Kilometer Method" to estimate greenhouse gas emissions during the distribution and sales phase, recommended primary data collection activities include:
   (1) Quantity of product distributed.
   (2) Mode of transportation (e.g., land, sea, or air).
   (3) Transportation distance.

10.4.3 Primary Data Collection Methods

1. Primary data collection methods should follow ISO 14067:2018 Section 3.1.6.1, which pertains to quantified values for unit processes or directly measured data obtained from activities or based on their original sources.
2. If there are multiple transportation routes for a product, it is advisable to inventory all transportation routes and calculate the greenhouse gas emissions based on the inventory results, then calculate a weighted average of the greenhouse gas emissions based on the transportation volume for each route. However, if it is not possible to inventory all transportation routes, the primary transportation routes should be inventoried, and the greenhouse gas emissions calculated based on these routes should be used to calculate a weighted average that represents 100% of the greenhouse gas emissions for the functional unit.

   [Note]: If there are a large number of transportation routes, the primary transportation routes should be selected based on transportation volume, with the cumulative transportation volume for the primary routes exceeding 25%.。

10.4.4 Secondary Data Sources

For activity data, if primary data for transportation routes cannot be obtained, the ton-kilometer method may be considered. This involves estimating the distance for each transportation trip using an electronic map and estimating the total weight of each product (including packaging weight) to calculate the sum of the tonnage multiplied by the distance traveled.

For carbon footprint emission factors, if actual inventory data cannot be provided, secondary data from life cycle databases or reputable literature may be used as substitutes. If regional-specific factors are available, it is recommended to prioritize their use. This includes unit-distance greenhouse gas emissions for product transportation.

10.4.5 Scenario Content

Greenhouse gas emissions generated during the distribution and sales phase of the product can be considered using various factors to define transportation scenarios, including the mode of transportation, type of vehicle, transportation distance, load factor or ton-kilometer, freight charges, average fuel consumption/fuel price, and other relevant parameters.

10.5 Use Phase of Machining Centers

10.5.1 Data Collection Items

The use phase involves the consumer's usage of the product. This stage is evaluated based on the recommended usage method of the product. If the product use involves "the consumption of energy resources" and "the disposal of waste", the greenhouse gas emissions generated during product use should be considered, including:：

1. Energy resources consumed during product use (e.g., electricity, water resources, etc.).
2. If the product has a specific purpose, scenarios should be assumed based on the recommended usage method indicated on the packaging.
3. The quantity of consumables that must be replaced during the product's usage period, such as cutting fluids, lubricants, etc., which are optional items for inclusion in the inventory.
4. Waste disposal generated during the product use process: Transportation and waste disposal must be included in the inventory.

10.5.2 Primary Data Collection Requirements

This stage is part of the downstream phase of the product life cycle, involving complex scenario assumptions and data collection, and thus, collecting primary data is not mandatory.

10.5.3 Primary Data Collection Methods

This stage is part of the downstream phase of the product life cycle, involving complex scenario assumptions and data collection, and thus, collecting primary data is not mandatory.

10.5.4 Secondary Data Sources

Secondary data, as per ISO 14067:2018 Section 3.1.6.3, refers to data that does not meet the criteria for primary data. These sources may include data from databases, published literature, default emission factors from national inventory reports, calculated data, estimates, or other representative data confirmed by the relevant authorities. In addition to these sources, data obtained from proxy processes or estimates can also be considered.

10.5.5 Scenario Content

When using the product, energy, resources, and consumables will be consumed. Scenario assumptions should meet the following requirements or considerations:

1. Parameters set during product use:
   (1) These can be defined according to the product specification manual or other reputable energy consumption test certification standards related to comprehensive processing machines.

(2) If not available, energy consumption should be calculated based on the defined operational modes **[*Note1]** outlined in the product specification manual under normal use.

(3) Any additional energy consumption associated with ancillary equipment during operation should be considered and included in the calculation. For example, if additional power conversion or UPS systems are required for operation, this energy consumption should be included. If no additional energy consumption is required, it need not be considered.

2. Product warranty period:

(1) The product warranty period is over one year (as agreed between the manufacturer and the customer).

(2) The quantified result of this stage does not represent a product lifespan of only one year. The actual lifespan should be quantitatively assessed based on the user's usage and maintenance condition. However, since obtaining information about user maintenance conditions is challenging and difficult to evaluate, a one-year period is used as a reference for users to evaluate based on their actual usage scenarios.

[*Note1]: The various operational modes defined in the product specification manual should clearly state the built-in operating time for each mode. If specific definitions are unavailable, this guideline defines three operational modes: "continuous operation during normal working hours," "warm-up/standby time (warm-up and rest)," and "other functional modes." These modes will serve as the basis for calculating annual energy consumption, ensuring a consistent calculation framework for similar products.

10.6 End-of-Life Phase of Machining Centers

10.6.1 Data Collection Items

The end-of-life phase should be considered based on the actual situation (e.g., recycling rate). The data to be collected includes:

1. Transportation distance for waste to the disposal site after product use.。
2. Amount of waste processed through landfill, incineration, or recycling at the disposal site.

10.6.2 Primary Data Collection Requirements

This stage is part of the downstream phase of the product life cycle, involving complex scenario assumptions and data collection, and thus, collecting primary data is not mandatory.

10.6.3 Primary Data Collection Methods

This stage is part of the downstream phase of the product life cycle, involving complex scenario assumptions and data collection, and thus, collecting primary data is not mandatory.

10.6.4 Secondary Data Sources

Secondary data, as per ISO 14067:2018 Section 3.1.6.3, refers to data that does not meet the criteria for primary data. These sources may include data from databases, published literature, default emission factors from national inventory reports, calculated data, estimates, or other representative data confirmed by the relevant authorities. In addition to these sources, data obtained from proxy processes or estimates can also be considered. ◦

10.6.5 Scenario Content

For the end-of-life phase of this product, the scenario assumptions should be based on the waste classification and disposal methods in accordance with the relevant waste management regulations of our country if the product's manufacturing process takes place domestically. If the product is manufactured in other countries, equivalent legal requirements in those countries should be considered for scenario assumptions.

Based on the above, the scenario assumptions should include the following items:

1. The transportation distance of waste to the disposal site after product use.
2. The amount of waste processed through landfill, incineration, or recycling at the disposal site.

11. Consultation Feedback and Responses

Unit	Consultation Feedback	Response
Chin Fong Machine Industrial Co., Ltd._Ji Pingyang, General Manager's Office, Safety and Health Division, Senior Specialist	Suggestion: "Section 2, Product Description" should include several external images of the machining center.	1. Thank you for the suggestion; we agree with the recommendation. 2. Explanation of the adjustment: (1) We have added images to "Section 2.2, Product Features," including Figures 2, 3, 6, 8, and 9, showing the external appearance. (2) Please refer to "Section 2.2, Product Features" for the revised content.
Chin Fong Machine Industrial Co., Ltd._Ji Pingyang, General Manager's Office, Safety and Health Division, Senior Specialist	Suggestion: "Section 2, Product Description" should clearly define what is meant by a machining center and specify whether it is equivalent to the machining center (切削中心機) defined in CNS 5391.	1. Thank you for the suggestion; we agree with the recommendation. 2. Explanation of the adjustment: (1) In the "Discussion Meeting", it was decided that the sections "2.1 Product Functions" and "2.2 Product Features" should follow specific regulatory guidelines. **[Note]:** Currently, the "Import and Export Commodity Classification" by the Bureau of Foreign Trade and the "National Standards (CNS)" by the Ministry of Economic Affairs both use the term "Machining Center" in English, but there is inconsistency in the Chinese terminology. (1) Bureau of Foreign Trade, Import and Export Commodity Classification: 綜合加工機 (2) Ministry of Economic Affairs, National Standards (CNS): 切削中心機 To address this, we will use the English term "Machining Center" to connect the two.

Unit	Consultation Feedback	Response
Chin Fong Machine Industrial Co., Ltd._Ji Pingyang, General Manager's Office, Safety and Health Division, Senior Specialist	Suggestion: Remove the descriptions related to ISO 9001, ISO 14001, ISO 45001, ISO 5001, ISO 14064, and CNS 16130-1 from page 7 of "2.1 Product Functions", as they seem unrelated to the product functions.	1. Thank you for the suggestion; we agree with the recommendation. 2. Explanation of the adjustment: (1) The original conclusion from the meeting was to include regulatory requirements or standards related to "environment" and "greenhouse gases" as per the PCR. However, after reconsideration, it has been adjusted to focus on product-related aspects. The items listed will now include common and necessary items for machine tool products (to prevent hazards caused by machinery, equipment, or tools). The previously listed items are not standard practices for all manufacturers. (2) Please refer to "Section 2.2, Product Features" for the revised content.
Chin Fong Machine Industrial Co., Ltd._Ji Pingyang, General Manager's Office, Safety and Health Division, Senior Specialist	On page 12, in the "6.2 Life Cycle Flow Chart", is "Trip" the correct English term for transportation? It is suggested to remove the term "Trip" since the arrows already indicate the inclusion of transportation.	1. It is recommended to change "Trip" to the Chinese term "運輸" (transportation) for clarity. 2. The "Discussion Meeting" has decided on this "labeling".
Chin Fong Machine Industrial Co., Ltd._Ji Pingyang, General Manager's Office, Safety and Health Division, Senior Specialist	In the table on page 13, the usage stage is "set to the warranty period of the machine", which seems too short. It is suggested to refer to the Ministry of Finance's Fixed Asset Depreciation Table, item 11, "Mechanical Manufacturing Equipment," No. 31102 "CNC Machine Tools", with a useful life of 5 years, as a more appropriate duration for the usage stage. Please consider this suggestion, thank you!	1. The "Discussion Meeting" has decided not to set this at the moment, as it currently applies to B2B products, and the "usage stage" is not yet being implemented. If it is to be set, it will require an understanding of the actual usage scenario before making a more suitable determination.

Taichung Machinery Works Co., Ltd._Li Jingyun, Engineer	Suggestion: On page 7, "Machine Components," remove "Galling Post - Plastic Machine."	1. Thank you for the suggestion; we agree with the recommendation. 2. This item has been removed; please refer to "Section 3, Product Composition" for the revised content.

12. Review Comments and Responses from the Product Carbon Footprint Management Review Committee Working Group Meeting

Unit	Consultation Feedback	Response
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	The case does not involve applying for an Environmental Protection Administration PCR. The "Guidelines for Product Carbon Footprint Management" mentioned in Section 1.1 should be considered as reference or basis (the text is inconsistent).	1.Thank you for the suggestion; we agree with the proposed adjustment. 2.If necessary, we will use "based on"; if not necessary, we will use "reference". The PCR content will be revised accordingly if there are no objections from stakeholders.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	Please confirm whether the current C.C.C Code covers all relevant products and whether appropriate exclusions have been considered, for example, 84652000008 for integrated machining centers, 84659200001 for planers, milling machines, or molding (cutting) machines.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. We will adjust the text as follows: (1) Clearly specify the Machining Center not included by listing the CCC Code numbers. (2) Please refer to Section 1.2 "Applicable Product Categories (Covering Import and Export Goods Classification Codes)" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	三、For consumable materials (such as lubricating oil) in the product composition that are necessary for the manufacturing phase, it is suggested to list them separately as consumables, consistent with Sections 10.2 and 10.3. Also, if secondary and other components are optional, consider merging them into one item, or list them separately in Sections 10.2.1, 10.3.1, and 10.3.2 for consistency.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. We will revise the text as follows: (1) Adjust the categories to "Main Components", "Secondary Components", "Consumables", and "Packaging Materials", merging "Other Components" into "Secondary Components" as per the "Environmental Protection Administration PCR template". (This will also involve updating Section 6.2 "Lifecycle Flowchart".) (2) Please refer to Section 3 "Product Composition" for the revised content.

Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	四、The first paragraph of the functional unit section is an example from the Environmental Protection Administration's PCR announcement. It is recommended to define it based on the actual product situation to facilitate user compliance. According to ISO 14067:2018 Section 6.3.3, some CFPs can only be represented by the declaration unit. If the PCR boundary is decided to be adjusted to B2B in this meeting, it is suggested to revise this section to the declaration unit.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments: (1)Add boundary information for B2B to the last paragraph of Section 1.2 "Applicable Product Categories (Covering Import and Export Goods Classification Codes) ". (2) Change the functional unit to the declaration unit. (3)Please refer to Sections 1.2 "Applicable Product Categories (Covering Import and Export Goods Classification Codes) ", "4、Declaration Unit," and" 6、 System Boundaries 6.2 Lifecycle Flowchart" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	Considering the common waste treatment methods in our country, it is suggested to include landfill treatment in Section 6.1, point 4.	1. Thank you for the suggestion; we agree with the proposed adjustment.。 2. Adjustments:： (1) Include "landfill" treatment. (2) Please refer to Section 6.1 "System Boundary Setting Specifications, 4. Natural Boundaries (Boundary towards Nature)" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	This case does not involve applying for an Environmental Protection Administration PCR. It is suggested to consider whether to follow the "Guidelines for Product Carbon Footprint Management" in Section 10.2.2, point 2 and Section 10.2.3, point 1, or make adjustments.	1. Thank you for the suggestion; no adjustment is necessary。 2. Adjustments： The section already follows the "Guidelines for Product Carbon Footprint Management, Attachment 3: Product Carbon Footprint Data Quantification and Verification Specifications", Article 9, which establishes the product category rules. The section also stipulates "a contribution rate of 10% or

		more to the total greenhouse gas emissions." **Note:** In CNS 14067, Section 6.3.5 "Data and Data Quality" specifies only significant processes, which refers to processes contributing at least 80% to the CFP. When citing secondary data in CFP research reports, there must be a valid reason and the source must be indicated。
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	10.2.3 Point 2 is noted as an example from the Environmental Protection Administration's PCR announcement. It is suggested to define it based on industry characteristics to facilitate user compliance.	1. Thank you for the suggestion; we agree with the proposed adjustment。 2. Adjustments： (1) Due to the initial implementation phase, not all suppliers may comply. The principle is to extend this to all suppliers in the future, so for now, change "main suppliers" to "main or capable suppliers." (2) Please refer to Section 10.2.3 "Primary ~~First-Level~~ Data Collection Methods, Point 2" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	Section 2.1 "Product Functions" mentions “"The product should comply with our country's ISO 9001 Quality Management System", "ISO 14001 Environmental Management System", "ISO 45001 Occupational Health and Safety Management System", "ISO 50001 Energy Management System", and "ISO 14064 Greenhouse Gases".” However, there should be no specific requirements for machining centers in the ISO standards, and ISO is an international standard. It is suggested to delete or adjust the wording.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) For product-related aspects, list common and necessary items for machine tool products (to prevent hazards caused by machines, equipment, or tools). The previously listed items are not standard items promoted by all manufacturers. (2) Please refer to Section 2.2 "Product Characteristics" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	五、The term "LCA" should be defined as Life Cycle Assessment.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) Refer to PCRs for "User Network Communication

		Equipment" and "Fire Extinguishers," which do not include these five items but focus on main terms related to the product production process. (2) Please refer to Section 5 "Definitions" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	Figure 5: The transportation of raw materials should be represented by a solid line (the chosen factor should include the transportation of raw materials for production).	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) The transportation of raw materials in "Figure 10 Lifecycle Flowchart of Machining Centers" has been corrected to a solid line. (2) Added notes explaining the principle of including B2B commercial models in the assessment. (3) Please refer to Section "6. System Boundaries 6.2 Lifecycle Flowchart" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	6.2 Lifecycle Flowchart Table 1 describes sales operations during the distribution phase, which are not included in the assessment, conflicting with Figure 5, which includes resource inputs and waste outputs for this stage。	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) Added notes explaining the principle of including B2B commercial models in the assessment. (2) Added an explanation for "Landfilling." (3) Please refer to Sections "6. System Boundaries 6.2 Lifecycle Flowchart" and "Table 1, Brief Description of Processes at Each Lifecycle Stage: Waste Treatment Stage" for the revised content.
Taiwan Green Productivity	6.2 Lifecycle Flowchart Table 1: The waste treatment stage includes the transportation	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments：

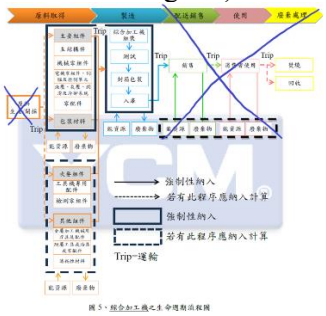
Foundation - Engineer Hong Bi-hsia	process, which is inconsistent with Figure 5. It is recommended to adjust the flowchart to use a solid line。	(1) In the lifecycle's fifth stage, "Waste Treatment Stage", transportation should still be represented by a dashed line, while waste produced at each stage should be shown with a solid line. Added an explanation for transportation. (2) Please refer to "Lifecycle Diagram 10" and "Table 1" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	10.2.1The listed figure number is incorrect and should be corrected to Figure 5.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2.Adjustments:： (1) The figure number has been corrected to Figure 10.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	10.4.1 "Delivery Point at a Certain Level" is undefined and should be consistent with Table 1.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) Initially defined as the first-level delivery point; a clear definition will be provided based on the actual situation when discussing the B2C business model. (2) Please refer to Section "10.4.1 Data Collection Items" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	If no refrigeration or thermal insulation is required during the product transportation process, it is recommended to delete point 6 in 10.4.1.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments： (1) Deleted the relevant provision. (2) Please refer to Section "10.4.1 Data Collection Items" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	10.4.3 Point 2 is noted as the Environmental Protection Administration's PCR example. It is recommended to define according to industry characteristics for user guidance.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments: (1) Reviewed recent PCRs, referring to sections in "Client Network Communication

		Equipment" (B2B) and "Fire Extinguishers" (B2C). Currently, both set at 50% (Environmental Protection Administration's template is 50%-75%). For machining centers, the initial threshold should not be too high; recommend starting at 25%, with updates or adjustments to reach the Environmental Protection Administration's suggested figures later. (2) Please refer to Section "10.4.3 Primary Data Collection Methods" for the revised content
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	10.5.1 Consideration of greenhouse gas emissions during product use needs to be consistent with Figure 5.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Added "Waste Disposal". (2) Updated Sections 10.2.1 and 10.4.1 accordingly. (3) Please refer to Sections "10.2.1 Data Collection Items (Raw Material Acquisition Stage) ", "10.4.1 Data Collection Items (Distribution and Sales Stage) ", and "10.5.1 Data Collection Items" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	If water resources are used during the product use phase, it is recommended to include this in point 1 of 10.5.1.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Added "Water Resources." (2) Please refer to Section "10.5.1 Data Collection Items" for the revised content.
Taiwan Green Productivity Foundation - Engineer	10.5.5 Point 1 is from the Environmental Protection Administration's PCR example. It is recommended to provide scenario assumptions according to industry characteristics for user guidance. Reference the Environmental	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Referenced the suggested "Client Network

Hong Bi-hsia	Protection Administration's November 17, 2023, announcement on "Client Network Communication Equipment" product environmental footprint category rules.	Communication Equipment" PCR for defining usage scenarios. (2) Please refer to Section "10.5.5 Scenario Content" for the revised content.
Taiwan Green Productivity Foundation - Engineer Hong Bi-hsia	It is recommended to add packaging material waste disposal and transportation, and consider landfilling methods in Section 10.6.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Added "Landfilling" as a waste disposal method. (2) Please refer to Sections "10.6.1 Data Collection Items" and "10.6.5 Scenario Content" for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	The Taiwan Machine Tool & Accessory Builders' Association (TMBA) is leading the development of this PCR. It is suggested that the PCR clearly define whether it applies to a B2B or B2C business model. It is recommended to initially adopt the B2B business model, which would help machine tool manufacturers focus on calculating the carbon emissions of the components they use (raw material stage) and the production, assembly, and inspection processes (production stage).	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Added B2B boundary information at the end of the clause "1.2 Applicable Product Categories (covering import and export commodity classification codes) ". (2) Changed the functional unit to a declared unit. (3) Please refer to the sections "1.2 Applicable Product Categories (covering import and export commodity classification codes) ", "Section 4: Declared Unit", and "Section 6: System Boundaries – 6.2 Life Cycle Flowchart" for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	**1.1 Document Purpose - Suggested content adjustments:** Based on the Environmental Protection Administration's (EPA) "Guidelines for Promoting Product Carbon Footprint Management", the requirements of this	1. Thank you for the suggestion; we agree with the proposed adjustment. ◦ 2. Adjustments (1) The document has been revised as suggested. Please refer to the "1.1 Document Purpose" section for the updated content.

	document aim to facilitate the assessment and verification of the product carbon footprint of machining center products. However, due to the high similarity of Taiwan's machine tool products and the lack of a carbon footprint calculation standard, the TMBA officially announced that starting from Q4 2023, it would promote the "Product Category Rules" (PCR) related work. This initiative classifies products based on the main categories of machine tools, targeting six categories: machining centers, lathes, drilling/boring/milling/tapping/threading machines, grinding machines, punching machines, and EDM/laser machines. The TMBA will reference the EPA's guidelines for establishing, citing, and revising product category rules for carbon footprints. Through the association's committee operation mechanism, it will establish credible and authoritative carbon footprint calculation frameworks ~~scopes~~ and rules for machine tools, serving as an industry standard for Taiwan's machine tool and component industry in response to carbon footprint calculations.	
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	**1.1 Document Purpose - The content mentions...** Classifying products based on the main categories of machine tools, targeting six categories: machining centers, lathes, drilling/boring/milling/tapping/threading machines, grinding machines, punching machines, and EDM/laser machines. Referencing the EPA's guidelines and through the association's committee operation mechanism, establishing credible and authoritative carbon footprint calculation frameworks ~~scopes~~ and rules as an industry standard for Taiwan's machine tool and component industry in response to carbon footprint calculations. This is inconsistent with the description in "1.2 Applicable Product Categories (covering import and export	1. Thank you for the suggestion; we agree with the proposed adjustment。 2. Suggested adjustments： (1) Clearly list the excluded cutting machine tools using their respective CCC Code numbers. (2) Please refer to the section "1.2 Applicable Product Categories (covering import and export commodity classification codes)" for the revised content.

	commodity classification codes)," which states: "The classification of import and export commodity codes (C.C.C Code) for machining centers is as follows: 1.8457.10 – Machining Centers. This document does not include cutting machine tools such as lathes, drilling machines, and other cutting machine tools." It is recommended to revise for consistency.	
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	**1.5 Establishing Unit** It is suggested to revise the four contact persons to a single point of contact to facilitate communication with stakeholders regarding this PCR.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) However, it is recommended to maintain multiple contact information to provide the best service, considering the concept of an agent mechanism. The priority order of contact points will be noted in the document. (2) Please refer to the "1.5 Establishing Unit" section for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	2.1 Product Function …. ~~The product should comply with relevant laws or standard requirements, including Taiwan's "ISO 9001 Quality Management System", "ISO 14001 Environmental Management System", "ISO 45001 Occupational Health and Safety Management System", "ISO 50001 Energy Management System", "ISO 14064 Greenhouse Gases", "CNS 5391 Terminology of Machine Tools", "CNS16130-1 Machine Tools – Environmental Evaluation – Part 1: Design Method for Energy Efficiency of Machine Tools", and "CNS 16188-1:2023 Safety of Machine Tools – Machining Centers, Milling Machines, and Combined Machines – Part 1: Safety Requirements".~~ Since this section is unrelated to the carbon footprint of machining centers, it is recommended to delete the entire paragraph.	1. Thank you for the suggestion; we agree with the proposed adjustment。 2. Adjustments (1) The raw material transportation in "Figure 10: Life Cycle Flowchart of Machining Centers" has been corrected to be represented by a solid line. (2) An explanation has been added regarding the inclusion of the B2B business model in the auditing plan for machining centers. (3) Please refer to the section "Section 6: System Boundaries – 6.2 Life Cycle Flowchart" for the revised content.
Plastics Industry	Section 4: Functional Unit is recommended to adjust to a B2B business model. According to	1. Thank you for the suggestion; we agree with the proposed adjustment.

Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	ISO 14067:2018, ~~the functional unit of this product should be defined as a unit of measurement, with a description of the specific state of the product, commonly in terms of weight, size, or functional characteristics.~~ This section can be deleted.	2. Adjustments (1) Added B2B boundary information at the end of the clause "1.2 Applicable Product Categories (covering import and export commodity classification codes) ". (2) Changed the functional unit to a declared unit. (3) Please refer to the sections "1.2 Applicable Product Categories (covering import and export commodity classification codes) ", "Section 4: Declared Unit", and "Section 6: System Boundaries – 6.2 Life Cycle Flowchart" for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	Section 5: Definition of Terms: ~~CFP: Carbon Footprint of Product.~~ ~~EPD: Environmental Product Declaration.~~ ~~ISO: International Organization for Standardization.~~ ~~LCA: Life Cycle Assessment.~~ ~~PCR: Product Category Rule.~~It is suggested to delete these five terms to help users focus on more important term definitions.	1. Thank you for the suggestion; we agree with the proposed adjustment. 2. Adjustments (1) Upon reviewing the PCRs for "Client-Side Network Communication Equipment" and "Fire Extinguishers," these five terms are not included, with the focus being on terms related to the product's production process. (2) Please refer to the "Section 5: Definition of Terms" for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	Process Map Suggested Adjustments (Please refer to Attachment 1 Diagram): 	1. It is suggested not to make changes because waste is generated during both the raw material acquisition and manufacturing stages, which naturally leads to a waste treatment stage. 2. Adjustment Directions (1) In the life cycle, the "Distribution and Sales Stage" to the "Waste Treatment Stage" will be enclosed in a dashed line.

		(2) Please refer to the "Section 6.2 Life Cycle Flow Diagram" for the revised content
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	**Section 10.2 Raw Material Acquisition Stage for Machining Centers** **10.2.1 Data Collection Items** Suggested adjustments: Referring to Figure 1 in Section 6.2, the items to be collected during the raw material acquisition stage for machining centers include: 1. The primary, secondary, and other component raw materials related to the production of machining center products, ~~with the life cycle boundary being the greenhouse gas emissions from the raw material acquisition to the manufacturing stage.~~ 2. The consumables and packaging materials related to the production of machining center products, ~~with the life cycle boundary being the greenhouse gas emissions from the raw material acquisition to the manufacturing stage.~~	1. Thank you for the suggestion; we agree with the proposed adjustment。 2. Adjustment Directions (1) The terminology has been aligned with the terms used in Figure 10 of Section 6.2. (2) Please refer to the "Section 10.2.1 Data Collection Items" for the revised content.
Plastics Industry Development Center (PIDC) - Mr. Chen Jian-Qiang, Manager	**Section 10.3 Manufacturing Stage for Machining Centers** **10.3.1 Data Collection Items** During the manufacturing stage, the items to be collected include: 1. Input or Inflow Quantities: 1. Primary component input quantity. 2. Secondary component input quantity. 3. Consumables input quantity. 4. Packaging materials input quantity. It is suggested that the above four items should belong to the raw material stage for data collection activities and should be deleted.	1. It is suggested not to make changes, considering the following: (1)During the manufacturing stage, items (1) to (4) pertain to the quantities that will be input during the assembly stage. (2)This part has also been referenced in the PCR content for "Client-Side Network Communication Equipment" and "Fire Extinguishers," where similar information is included. Given these considerations, no adjustments will be made.

13. References

1. Environmental Protection Administration, Executive Yuan, "Guidelines for Promoting Product Carbon Footprint Management," published in 2020.
2. Environmental Protection Administration, Executive Yuan, "Guidelines for Establishing, Referencing, and Revising Product Category Rules for Carbon Footprints," published in 2020.
3. Institute of Labor, Occupational Safety and Health, Ministry of Labor, SDSE060T0103 – "Machine Tool Safety: Machining Centers."
4. CNS 5391 – Terminology for Machine Tools.
5. CNS 16188-1:2023 – "Machine Tool Safety – Machining Centers, Milling Machines, and Combined Machines – Part 1: Safety Requirements."
6. CNS 16130-1 – "Machine Tools – Environmental Assessment of Machine Tools – Part 1: Design Methodology for Energy Efficiency of Machine Tools."
7. TMBA (Taiwan Machine Tool & Accessory Builders' Association) – "Technical Application Relevance Matrix for Machine Tool Standards."
8. **ISO 10791-2:2001** – "Test Conditions for Machining Centers – Part 2: Geometric Accuracy Tests for Machines with Vertical Spindle or Universal Heads with Vertical Spindle (Z-Axis)."