MT-Frix™ Low-Friction Ball Screws
Carbon Footprint Assessment Report

September 17, 2025
NSK Ltd.

CCR-25002

1 Purpose of CFP Assessment

NSK is moving forward with the development of environmentally friendly products and technologies in pursuit of the goals of "Contributes to a Safer, Smoother Society" and "Helps Protect the Global Environment" as outlined in our corporate philosophy.

NSK's products are designed to reduce energy consumption to the utmost limit by making them smaller, lighter, and with lower torque while also promoting waste reduction and the effective use of resources by extended product life and recycling.

By visualizing our carbon footprint of products (CFP), we hope to maximize our environmental contribution and minimize our customers' environmental impact by reducing resource use and GHG emissions over the entire lifecycle of our products.

* This assessment is not intended to be a comparison with other companies' products.

2 Target Product

Product Name

MT-Frix™ low friction ball screw

Functional Unit (Declaration Unit)

Application:	Machine Tool
Ball screw type:	Offset lead preload ball screw
Screw shaft outer diameter:	Ø40mm
Lead:	10mm
Overall length:	1400mm
Calculation unit:	per ball screw

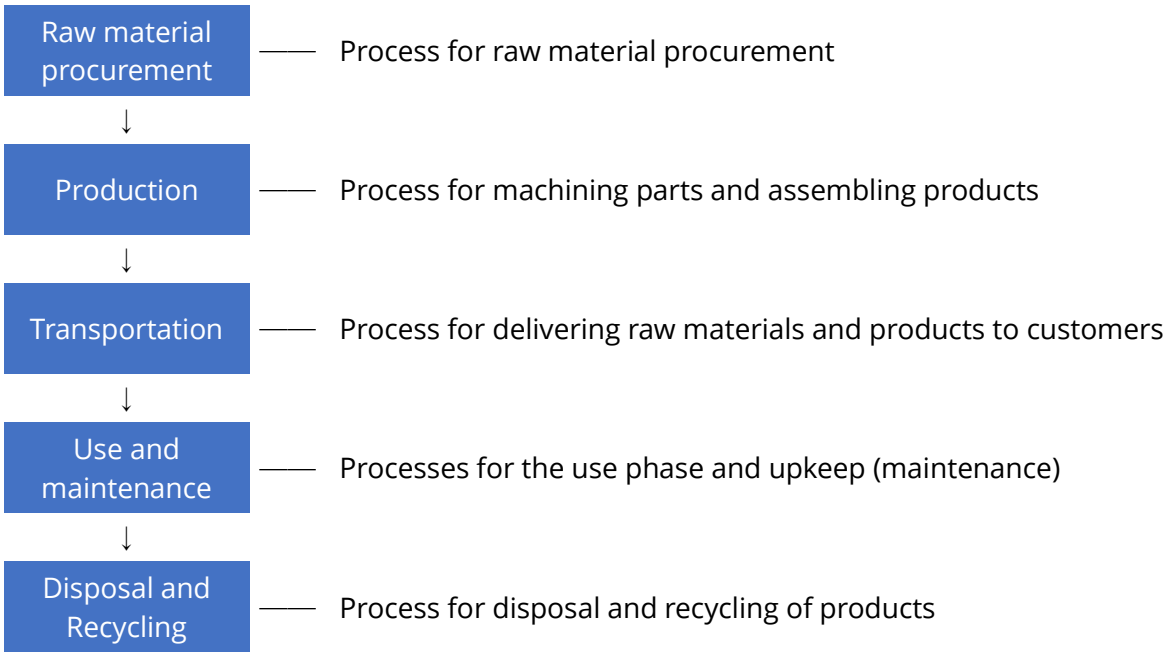
3 Target GHG Types/Lifecycle

Types of GHG

GHGs (CO_2, CH_4, etc.) included in intensity data from IDEA and Ministry of the Environment (Government of Japan) databases are considered.

Lifecycle

From raw material procurement to disposal (cradle to grave)



4 Cutoff Criteria and Scenarios

Cutoff criteria and objects

- Components accounting for 5% or less of product weight: Packaging materials
- Low impact on CFP and difficult to understand details: Supplier waste

Scenario setting

Scenarios are set for the following processes:

- Transportation: Mode and distance of transportation of raw materials and products
- Use: Period of use, average rotational speed

5 Information on data used

Activity data

Based on acquisition of primary data (actual measurements and distribution of actual measurements); scenarios are used when acquisition is difficult.

Emission factor data

Based on the acquisition of primary data (measured values, distribution of measured values); secondary databases are used when acquisition is difficult.

Database

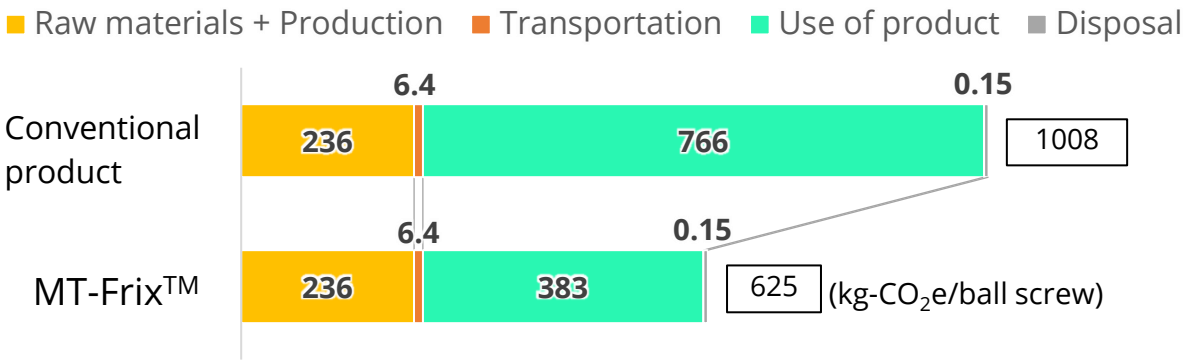
- “Carbon Footprint of Products (CFP) Communication Program Basic Database” (Ministry of the Environment, Government of Japan).
- “Embodied Energy and Emission Intensity Data for Japan Using Input-Output Tables" (Center for Global Environmental Research, Japan)
- “Inventory Database for Environmental Analysis” Ver. 3.3 Table 3[D] (Ministry of the Environment, Government of Japan)
- “Inventory Database for Environmental Analysis” Ver. 3.3 Table 3[Reference] (Ministry of the Environment, Government of Japan)
- “Inventory Database for Environmental Analysis” Ver. 3.3 Table 8.3 (Ministry of the Environment, Government of Japan)

- “Emission factors 2023” (IEA) - Electricity only / world total 2021 factors

6 Referenced rules

- “Carbon Footprint Guidelines” (METI, Ministry of the Environment, March 2023)
- ISO 14067: 2018

7 Calculation



◆ Reduction of 383 kg-CO_2e per ball screw

Background information

- Assuming that ball screws are manufactured and delivered by our group company (Kyushu region) to users in the Kanto region in Japan.
- Emissions during the use phase are calculated from energy consumption due to dynamic frictional torque of ball screws under the specifications and conditions of use shown in Table 1.
- Comparison of calculation results using the same rules of our company.
- Electricity CO_2 emission factor: 0.4641 kg-CO_2/kWh (applied to the use phase) (Electricity only / world total 2021 factor from IEA (2023) emission factors)

Table 1: Ball screw specifications and operating conditions used in the calculation

Ball screw specifications					
Shaft diameter	d	(mm)	Ø40		
Lead	*l*	(mm)	10		
Overall shaft length	L_0	(mm)	1,400		
Dynamic load rating	Ca	(N)	61,200		
Operating conditions					
Axial load	Fa	(N)	3,060		5% Ca
Average speed	Nm	(min^{-1})	400		
Period of operation			5 years		
CO_2 emissions during use phase			Conventional product	MT-Frix™	
Dynamic friction torque	Tp	(N-cm)	90	45	
Energy consumption	Pw	(kWh)	1,651	826	5 years
CO_2 emissions		(kg-CO_2e)	766	383	

8 Limitations of the study and future directions

Limitations of the study

- Scenarios are set and calculations are performed
- Calculation results may differ depending on ball screw usage conditions, etc.
- Calculation results may differ depending on location of production and use, etc.

Future direction

- Acquisition of data reflecting actual conditions

9 Reference

Press release on October 04, 2024
NSK Develops MT-Frix™ Low-Friction Ball Screws for Machine Tools
https://www.nsk.com/company/news/2024/nsk-develops-mt-frix--low-friction-ball-screws-for-machine-tools/