

ENVIRONMENTAL PRODUCT DECLARATION

SINAMICS V90

Single-axis Servo Drive

Type II according to ISO 14021 / based on ISO 14025
including life cycle impact assessment (LCIA)



General information

This environmental product declaration (EPD) is based on the international standard ISO 14025 (“Environmental labels and declarations — Type II environmental declarations”). The data in this EPD has been evaluated on a full-scale life cycle assessment (LCA) study according to ISO 14040/44, taking into account the product category rules (PCR) for electronic and electrotechnical products and systems defined in EN 50693.

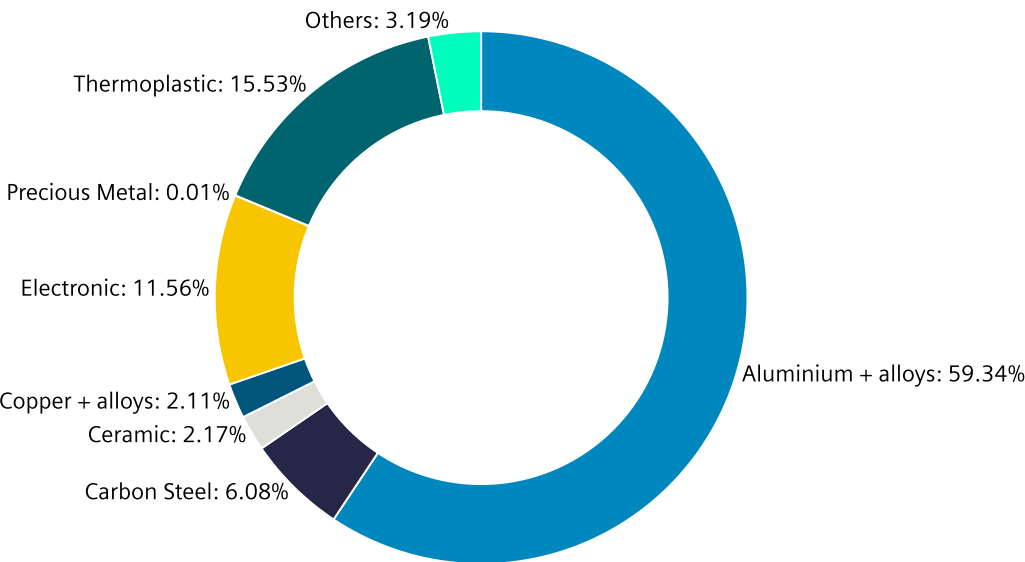
Siemens is dedicated to an environmentally conscious design of its products in line with IEC 62430 and has implemented an integrated management system according to ISO 9001, ISO 14001 and ISO 45001.

Products	SINAMICS V90 servo drives, power range 0.1 to 0.75 kW at 200 ... 240 V 1/3 AC , 1 kW to 2 kW at 200 ... 240 V 3 AC and 0.4 to 7 kW at 380 ... 480 V 3 AC
Represented by	6SL3210-5FB11-0UF1, 1kW, 3AC 200V...240V IP20, PROFINET
Product Description	SINAMICS V90 servo drives, STO safety integrated, IP20, digital I/Os, PROFINET/Pulse train input
Functional Unit	Speed, torque and position control of SIMOTICS S-1FL6 servo motor. Calculation of the environmental impacts is based on 15 years of product service lifetime. This value cannot be equated with the minimum, average or individual life time.
Production Site	Manufactured in the Motion Control Factory in Nanjing, China

Material composition

The product weight of 2.3 kg combined with the packaging weight of 0.22 kg results in a total weight of 2.52 kg. The following chart outlines the overall material composition of the reference product, excluding packaging. Packaging consists of: PE film, Graphic paper, Corrugated box (average composition).

Product Weight 2.3 kg



Substance assessment

At Siemens, we are committed to the development and production of environmentally sound and sustainably produced equipment. This includes avoiding hazardous substances in our products without compromising their benefits for our customers.

Please visit the following website to learn more about how we comply with product-related environmental regulations like RoHS, REACH, WEEE and others: [V90 catalogue list](#)

System boundaries and scenarios

The EPD covers the cradle to grave of the product including the following stages.

Manufacturing stage			Distribution	Installation	Use stage							End-of-Life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Production	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-Installation	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	0	0	0	0	0	X	0	0	X	X	X	X

Temporal and geographical scope and representativeness

Primary data of 2024; Secondary data: LCA tool: Green Digital Twin Version 4.4, Database: One Siemens LCA Database (based on Sphera MLC CUP 2024.1). The materials and components used in production are globally sourced and have been selected from Sphera data sets according to the global or regional representativeness.

Data quality

Both primary and secondary data are used. To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. The main sources for primary data are the bill of materials and the bill of processes. Site specific data are provided by Siemens reporting system. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered. Generic data originating from the LCA tool: Green Digital Twin Version 4.4, Database: One Siemens LCA Database (based on Sphera MLC CUP 2024.1).

Allocation	Amount of resources used and waste generated in production at Siemens is allocated based on annual production volume. For the end-of-life allocation, the “Polluter Pays” principle is adopted. Waste treatment processes are allocated to the product system that generates the waste until the end-of-waste state is reached. The environmental burdens of recycling and energy recovery processes are therefore allocated to the product system that generates the waste, while the product system that uses the exported energy and recycled materials receives it burden-free. Potential benefits and avoided loads from recovery and recycling processes are considered in separate Benefits & Loads beyond system boundary section.
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Cut-off	According to EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts. In this LCA, stickers, labels, tape, and staples used in the packaging have been excluded as their weights are negligible below 1%.
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Scenarios:

The following information describes the scenarios in the different modules of the EPD.

Manufacturing	This stage covers the extraction of natural resources, production of raw materials, manufacturing, packaging, and upstream transportation.
Transportation to production site	Road Truck (7.5 t-12 t)
Production energy model used	China (standard mix), China (Thermal energy from natural gas), China (renewable mix)
Distribution	This stage covers the product’s distribution.
Distribution: Transport model use	Truck (7.5 t-12 t) 1000 km
Installation	This stage covers the End-of-Life treatment of transport packaging.
Installation: Energy model used	Not relevant

Use	This stage covers the operational energy use. All other modules do not apply for this product. Different operating conditions can lead to deviations from the reference scenario.
Use: Energy model used and use scenario	Europe (standard mix); Operation profile is defined by 4 operational points (OP): OP1 : 10% of time at 50% speed and 200% torque OP2: 5% of time at 100% speed and 50% torque OP3: 60% of time at 50% speed and 50% torque OP4: 25% of time at 0% speed and 0% torque Lifetime 15 years and 5000h/year
EoL	This stage covers the disassembly, material recycling in addition to thermal treatment of all recoverable materials and the disposal of all other materials.
EoL: Transport model use	Road Truck, 7.5 t - 12t gross weight 1000.0 km
EoL: Energy model used	EMEA, APAC

Life cycle assessment - results

The following impact categories characterize the product's environmental footprint. They have been calculated with LCIA methodology EN15804+A2 (EF 3.1); LCA tool: Green Digital Twin Version 4.4, Database: One Siemens LCA Database (based on Sphera MLC CUP 2024.1).

To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered.

For products belonging to the same homogeneous product family range the following extrapolation criteria (Appendix) can be used to module their climate change impact in kg CO₂ eq. The rest of the listed impacts will be determined in the following version of the EPD.

Environmental performance indicators

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
CC - total	kg CO ₂ eq	7.73E+2	8.27E+1	5.44E-1	1.95E-2	6.89E+2	1.40E+0	-1.28E+1
CC - fossil	kg CO ₂ eq	7.62E+2	7.73E+1	5.33E-1	7.93E-3	6.82E+2	1.39E+0	-1.28E+1
CC - biogenic	kg CO ₂ eq	1.14E+1	5.26E+0	1.28E-3	1.16E-2	6.14E+0	8.99E-3	-1.93E-2
CC - luluc	kg CO ₂ eq	2.02E-1	8.05E-2	9.01E-3	3.06E-7	1.04E-1	9.07E-3	-9.21E-3
ODP	kg CFC-11 eq	1.68E-8	1.27E-9	7.90E-14	2.02E-15	1.55E-8	7.86E-13	-7.60E-11
AP	Mole of H ⁺ eq	2.02E+0	7.01E-1	8.19E-4	4.12E-6	1.32E+0	1.11E-3	-2.29E-1
EP - freshwater	kg P eq	3.09E-3	2.43E-4	2.29E-6	1.19E-8	2.85E-3	3.21E-6	-1.29E-5
EP - marine	kg N eq	4.15E-1	8.53E-2	3.09E-4	1.46E-6	3.29E-1	4.06E-4	-1.39E-2
EP - terrestrial	Mole of N eq	4.38E+0	9.28E-1	3.65E-3	1.86E-5	3.44E+0	4.85E-3	-1.52E-1
POCP	kg NMVOC eq	1.14E+0	2.68E-1	8.11E-4	4.11E-6	8.69E-1	1.08E-3	-4.97E-2
ADP - M & M	kg Sb eq	2.11E-2	2.10E-2	4.67E-8	2.28E-11	1.28E-4	5.31E-8	-3.04E-3
ADP - fossil	MJ	1.53E+4	1.02E+3	7.06E+0	5.22E-3	1.43E+4	7.95E+0	-1.57E+2
WDP	m ³ world eq deprived water	2.10E+2	2.44E+1	8.30E-3	2.05E-3	1.86E+2	9.45E-2	-3.24E+0
PM	Disease incidences	1.91E-5	8.08E-6	8.99E-9	2.44E-11	1.10E-5	1.10E-8	-1.89E-6
IRP	kBq U235 eq	3.79E+2	3.95E+0	1.87E-3	3.64E-5	3.75E+2	1.79E-2	-1.37E+0
ETP - fw	CTUe	4.59E+3	4.33E+2	5.24E+0	2.75E-3	4.14E+3	5.61E+0	-5.17E+1
HTP - c	CTUh	2.66E-7	3.32E-8	1.06E-10	1.55E-13	2.33E-7	1.24E-10	-4.11E-9
HTP - nc	CTUh	4.17E-6	5.95E-7	4.75E-9	3.81E-12	3.57E-6	5.12E-9	-1.24E-7
SQP	dimensionless (pt)	6.32E+3	2.57E+2	3.47E+0	1.41E-3	6.05E+3	3.79E+0	-9.46E+0

CC-total: Climate change; **CC-fossil:** Climate change fossil; **CC-biogenic:** Climate change biogenic; **CC-LULUC:** Climate change land use and land use change; **ODP:** Depletion potential of the stratospheric ozone layer; **AP:** Acidification potential, accumulated exceedance; **EP-freshwater:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-marine:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestrial:** Eutrophication potential, accumulated exceedance; **POCP:** Formation potential of tropospheric ozone; **ADP-M&M:** Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil:** Abiotic depletion potential for fossil resources; **WDP:** Water deprivation potential, deprivation weighted water consumption; **PM:** Particulate matter emissions; **IRP:** Ionizing radiation, human health; **ETP-fw:** Ecotoxicity freshwater; **HTP-c:** Human toxicity, cancer effects; **HTP-nc:** Human toxicity, non-cancer effects; **SQP:** Land use related impacts / soil quality

Resource use indicators and biogenic carbon content

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
PERE	MJ	1.06E+4	3.05E+2	6.08E-1	1.27E-3	1.03E+4	1.08E+0	-5.96E+1
PERM	MJ	3.10E+0	3.31E+0	0.00E+0	-1.28E-1	0.00E+0	-8.24E-2	0.00E+0
PERT	MJ	1.06E+4	3.08E+2	6.08E-1	-1.27E-1	1.03E+4	9.97E-1	-5.96E+1
PENRE	MJ	1.53E+4	1.02E+3	7.06E+0	5.22E-3	1.43E+4	7.95E+0	-1.58E+2
PENRM	MJ	1.33E-1	6.56E+0	0.00E+0	-1.17E-1	0.00E+0	-6.31E+0	0.00E+0
PENRT	MJ	1.53E+4	1.03E+3	7.06E+0	-1.12E-1	1.43E+4	1.64E+0	-1.58E+2
SM	kg	2.15E-2	2.15E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m3	8.61E+0	7.23E-1	6.78E-4	4.82E-5	7.88E+0	2.84E-3	-2.39E-1
BIOGCPRODUCT	kg of C	2.67E-3	2.67E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
BIOGCPACKAGING	kg of C	9.38E-2	9.38E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

PERE: Use of renewable primary energy; **PERM:** Use of renewable primary energy resources used as raw material; **PERT:** Total use of renewable primary energy resources; **PENRE:** Use of non-renewable primary energy; **PENRM:** Use of non-renewable primary energy resources used as raw material; **PENRT:** Total use of non-renewable primary energy resources; **SM:** Use of secondary materials; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Use of net fresh water; **BIOGCPRODUCT:** Biogenic carbon content of the Product; **BIOGCPACKAGING:** Biogenic carbon content of the Packaging

End-of-Life - Waste and output flows

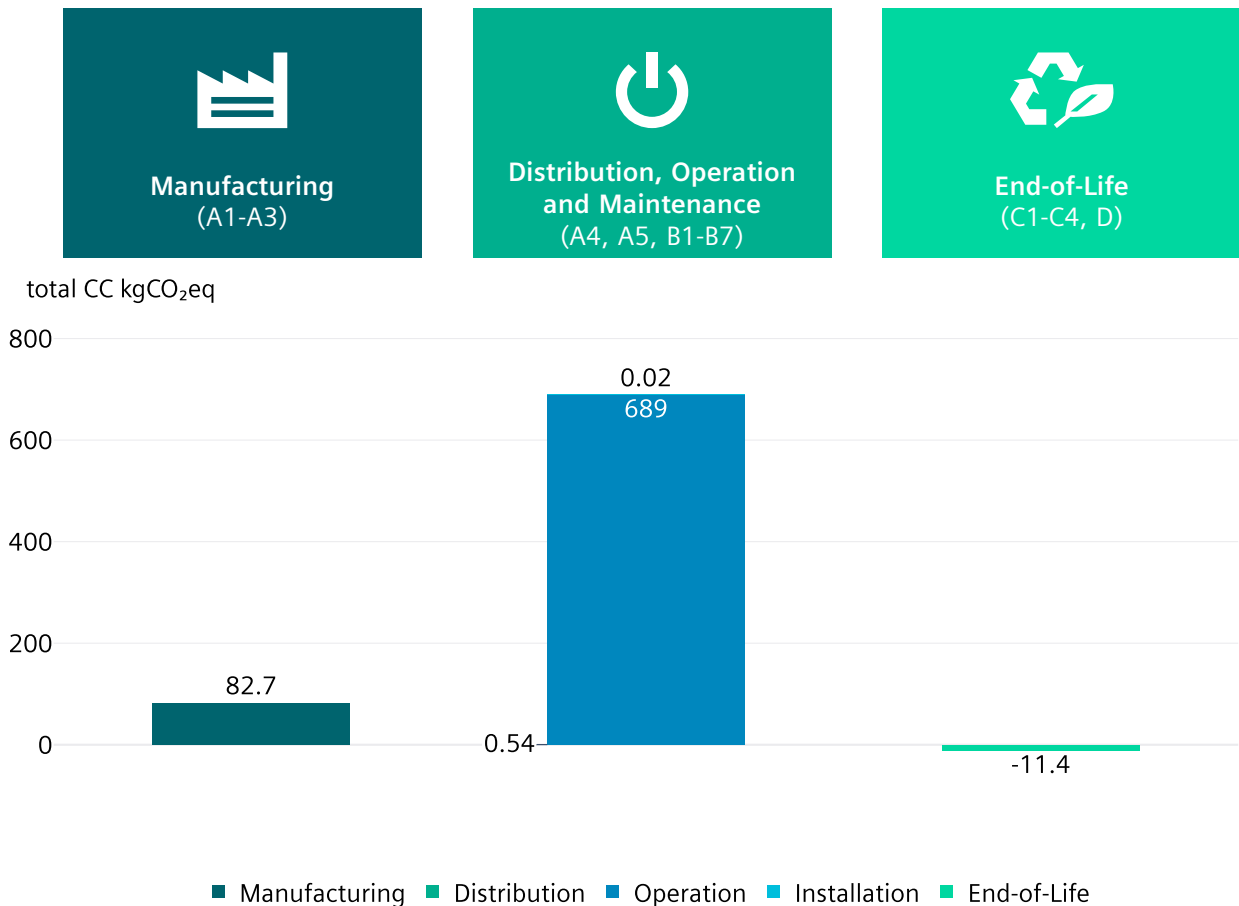
Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
HWD	kg	3.90E-5	1.84E-5	2.70E-10	2.62E-12	2.06E-5	1.21E-9	-3.29E-7
NHWD	kg	1.59E+1	3.52E+0	1.15E-3	1.27E-3	1.18E+1	5.47E-1	-2.73E+0
RWD	kg	2.32E+0	3.68E-2	1.29E-5	2.31E-7	2.28E+0	1.11E-4	-7.99E-3
MER	kg	3.97E-1	0.00E+0	0.00E+0	2.43E-3	0.00E+0	3.95E-1	0.00E+0
MFR	kg	1.23E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.23E+0	0.00E+0
CRU	kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
ETE	MJ	2.06E+0	0.00E+0	0.00E+0	5.86E-2	0.00E+0	2.00E+0	2.50E-1
EEE	MJ	1.15E+0	0.00E+0	0.00E+0	3.26E-2	0.00E+0	1.12E+0	1.40E-1

HWD: Hazardous waste disposed; **NHWD:** Non-hazardous waste disposed; **RWD:** Radioactive waste disposed; **MER:** Materials for energy recovery; **MFR:** Material for recycling; **CRU:** Components for reuse; **ETE:** Exported thermal energy; **EEE:** Exported electric energy.

Additional environmental information

Climate change

This chart shows the overall impact of the product on climate change – total. The operations phase is the life cycle phase with the biggest overall impact. Different operating conditions can lead to deviations from the reference scenario.



End-of-Life results

The end-of-life stage was modelled by shredding of the device, followed by sorting and material separation process. The end-of-life parameters are calculated according to IEC TR 62635.



It leads to:

- an overall **product recyclability of up to 67%** mainly due to metal content
- an **energy recoverability of up to 17%** from plastic materials
- a **minimum disposal rate of 16%**

The exact final values depend on the used recycling process and add up to 100%.

Note: The device should not be disposed of as unsorted municipal waste. Special treatment for specific components may be mandated by law or recommended for environmental reasons. Observe all local and applicable laws.

References

EN 50598-3: 2015	Ecodesign for power drive systems, motor starters, power electronics & their driven applications
EN 50693	Product category rules for life cycle assessments of electronic and electrical products and systems
ISO 14025:2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040/44	Lifecycle Assessment – Principles and framework



The GreenDigitalTwin is under regular surveillance by TÜV Rheinland®. In accordance with the standards ISO 14040:2006 + A1:2020 / ISO 14044:2006 + A1:2018 + A2:2020 the reviewer concludes that the LCA methodology developed by Siemens AG is scientifically based and reflects the state of the art.

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Appendix

For other MLFBs covered by this EPD under SINAMICS V90 homogenous product family, the climate change impact (CC) in kg CO₂ eq. can be calculated for the manufacturing and end of life phases using linear regression based on the Mass in kg(x) of the assessed product.

The following equation based on linear regression is defined as:

$$y = m \times x + b$$

where,

y climate change in kg CO₂eq.

m.... scaling factor in kg CO₂eq./kg of product

x mass of the product in kg without packaging

b intercept (offset) in kg CO₂eq.

Thus, the factors for the **manufacturing phase** are:

m = 21.58 kgCO₂eq./kg of converter, b= 34.25 kg CO₂eq

For **End of Life**:

m = -4 kgCO₂eq./kg of converter, b=-2.13 kg CO₂eq

For the operation phase, the climate change in kgCO₂eq was derived for 230V/400 V and rated power P_R (LO) in kW for European standard energy mix, lifetime of 15 years, annual operation 5000h/year and 4 operational points. The climate change values for the operation phase and the mass of SINAMICS V90 are listed in Table 1.

Operation profile is defined by 4 operational points (OP):

OP1: 10% of time at 50% speed and 200% torque.

OP2: 5% of time at 100% speed and 50% torque.

OP3: 60% of time at 50% speed and 50% torque.

OP4: 25% of time at 0% speed and 0% torque.

Table. 1 Climate change results of use phase and Mass of modules

Type	Voltage(V)	MLFB	Power Rating(kW)	Mass(kg)	Climate change (kg CO ₂ eq)
PN	200	6SL3210-5FB10-1UF2	0.1	1.1	224
		6SL3210-5FB10-2UF2	0.2	1.1	235
		6SL3210-5FB10-4UF1	0.4	1.2	348
		6SL3210-5FB10-8UF0	0.75	2	516
		6SL3210-5FB11-0UF1	1	2.3	689
		6SL3210-5FB11-5UF0	1.5	2.3	1094
		6SL3210-5FB12-0UF0	2	2.3	1180
	400	6SL3210-5FE10-4UF0	0.4	1.5	714
		6SL3210-5FE10-8UF0	0.75	2.1	722
		6SL3210-5FE11-0UF0	1	2.1	706
		6SL3210-5FE11-5UF0	1.5	2.7	720
		6SL3210-5FE12-0UF0	2	2.5	728
		6SL3210-5FE13-5UF0	3.5	5	841
		6SL3210-5FE15-0UF0	5	5.5	827
		6SL3210-5FE17-0UF0	7	5.8	837
PTI	200	6SL3210-5FB10-1UA2	0.1	1.1	294
		6SL3210-5FB10-2UA2	0.2	1.1	306
		6SL3210-5FB10-4UA1	0.4	1.2	420
		6SL3210-5FB10-8UA0	0.75	2	594
		6SL3210-5FB11-0UA1	1	2.3	685
		6SL3210-5FB11-5UA0	1.5	2.3	739
		6SL3210-5FB12-0UA0	2	2.3	741
	400	6SL3210-5FE10-4UA0	0.4	1.5	714
		6SL3210-5FE10-8UA0	0.75	2.1	722
		6SL3210-5FE11-0UA0	1	2.1	706
		6SL3210-5FE11-5UA0	1.5	2.7	720
		6SL3210-5FE12-0UA0	2	2.7	728
		6SL3210-5FE13-5UA0	3.5	5.8	841
		6SL3210-5FE15-0UA0	5	5.9	827
		6SL3210-5FE17-0UA0	7	5.8	837

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