Environmental Product Declaration

according to ISO 14025 and EN 15804:2012+A1

Declaration owner:	Silikal GmbH
Publisher:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Programme holder:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Declaration number:	EPD-Silikal-108-EN
Issue date:	02.02.2021
Valid until:	01.02.2026

System B Quartz TA

This EPD is based on the life cycle assessment of the flooring system B Quartz TA by the Silikal GmbH in Mainhausen, Germany.

1. General information

Silikal GmbH	System B Quartz TA
Programme holder: Kiwa BCS Öko-Garantie GmbH - Ecobility Experts Marientorbogen 3-5 90402 Nuremberg Germany	**Declaration owner:** Silikal GmbH Ostring 23 63533 Mainhausen Germany
Declaration number: EPD-Silikal-108-EN	**Declared product / declared unit:** 1 m^2 flooring system
Issue date: 02.02.2021	**Valid until:** 01.02.2026
Scope: The System B Quartz TA is a flooring system of the Silikal GmbH. The declaration is valid for 1 m^2 flooring system. The owner of the declaration shall be liable for the underlying information and evidence. Kiwa BCS Öko-Garantie GmbH – Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.	**Product category rules:** EN 16810:2017 - Resilient, textile and laminate floor coverings – Environmental product declarations – Product category rules **Verification:** The CEN Norm EN 15804+A1 serves as the core PCR. Independent verification oft he declaration and data according to ISO 14025:2011-10 ☐internally ☒externally
Frank Huppertz (President of Kiwa BCS Öko-Garantie GmbH - Ecobility Experts GmbH)	Max Sonnen (Extern verfifier of Ecomatters B.V.)
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2. Product

2.1 Product description

Silikal MMA Floor Coatings can even be used at temperatures as low as -10 °C (special grade -25 °C). They can easily withstand heavy loads and are wear and tear resistant, as well as resistant to alkalis, acids, greases, oils, salts and other aggressive media.

Silikal System B Quartz TA is a fast curing, decorative, hard wearing, methyl methacrylate coating. The mix of resin and Coloured Quartz is compressed and levelled by trowel. This mix creates an extra compact screed which can withstand highest mechanical and chemical loads. Silikal System B Quartz TA is ideal for renovations and new projects because it reduces downtime to the minimum.

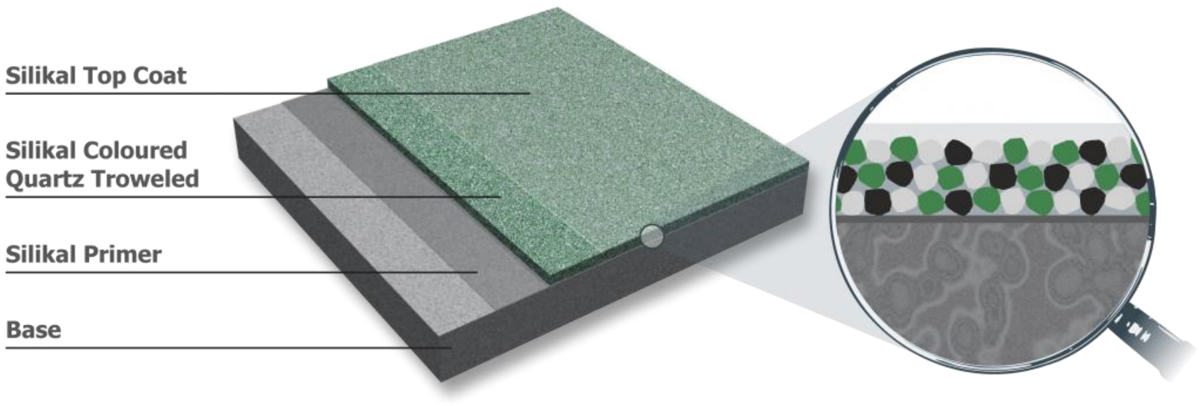

Figure 1: Composition System B Quartz TA

2.2 Application

- For areas with moderate to high mechanical stresses
- Dry and wet production areas
- Industrial kitchen
- For areas with high chemical load

2.3 Technical data

The technical properties of the Silikal flooring systems are evaluated to DIN or ISO standards and the results are average values, delivered under proper installation procedures and recommended conditions. The specific technical data are shown in Table 1.

Table 1: Technical Data

Characteristics	Data
Curing Time	1 hour
Slip Resistance	R11 to R13 (DIN 51130) depending on the client's requirements
Compressive Strength	45 N/mm² (EN ISO 604)
Tensile Strength	13 N/mm² (EN ISO 527-2)
Flexual Strength	24 N/mm² (EN ISO 527-2)
Abrasion Resistance	Class AR 1 – Heavy duty
Temperature Resistance	0 °C to +60 °C (+80 °C for short periods, e.g. for cleaning purposes)
Water Vapour Permeability	Class II (EN ISO 7783-2)
Fire Behavior	E_{fl} (EN ISO 13501)
Thickness	3 – 6 mm

2.4 Application rules

Silikal resins and hardening powder are subject to the following transport regulations:

- GGVSE / ADR (roads)
- GGVBinsch / ADNR (inland waterways)
- GGVSee / IMDG (open seas)
- ICAO-Ti / IATA-DGR (air)

They must be packed, labelled, loaded, conveyed and unloaded in accordance with these regulations (Germany).

2.5 Raw materials

Main component of the Silikal flooring systems is methyl methacrylate, as well as additional co-monomers from the group of methacrylates and/or acrylates. Curing of the product takes place after the installation on site. For data protection reasons, only the rough composition with intervals is shown in Table 2.

Table 2: Mass percentages of the raw materials

Raw material	Value	Unit
Filler	50 - 80	m%
Acrylate monomer	15 - 35	m%
Polyacrylates	5 - 15	m%
Others	< 10	m%

2.6 Manufacture

The production takes place by mechanical mixing and homogenization of the constituents of the materials. The product components are usually mixed together from the ingredients in batch mode.

2.7 Installation

The flooring systems are applied by troweling/knife-coating, rolling or pouring. During the procedure, health and safety measures in accordance with the information on the safety data sheet, such as hand and eye protection as well as ventilation, are essential. After mixing, the resin and hardener react with heat generation (exothermic) and must be processed quickly. All liquid components cure during the use phase. After the reaction the material is inert.

2.8 Reference service life

According to the manufacture the reference service life is more than 15 years, subject to correct installation conditions and substrate preparation. Life expectancy is generally influenced by the use of the system and maintenance regime.

2.9 Disposal

According to the manufacturer Silikal GmbH, the flooring system is demolished with an electric milling machine and landfilled after its use phase.

3. LCA: Calculation rules

3.1 Declared unit

According to DIN EN 16810:2017, the EPD refers to the declared unit of 1 m² flooring.

Table 3: Declared unit

	Value	Unit
Declared unit	1	m²
Grammage	10.95	kg m^{-2}
Conversion factor to 1 kg	0.091	m^2 kg^{-1}

3.2 System boundary

This EPD was created in accordance with DIN EN 15804 and monitors the production, the construction process and the end of life stage as well as the benefits and loads beyond the system boundary. According to DIN EN 15804 this corresponds to the product phases A1-A5, C1-C4 and D. Therefore, the type of the EPD is “cradle to gate with options”.

All inputs including raw materials, primary products, energy and auxiliary materials as well as the accumulated waste are considered in the assessment.

The following production steps are considered:

- A1: Raw material extraction and processing and processing of secondary materials serving as input (e.g. recycling processes)
- A2: Transport to manufacturer
- A3: Production
- A4: Transport to construction site
- A5: Installation in the building
- C1: Dismantling, demolition
- C2: Transport for waste treatment
- C3: Waste treatment for reuse, recovery and/or recycling
- C4: Disposal
- D: Re-use, recovery and/or recycling potentials, expressed as net flows and benefits

The use stage B1 - B7 is not considered.

3.3 Estimates and assumptions

The infrastructure of the production facilities is not considered due to the high mass flow. In addition, only the production-related energy consumption (excluding the administration and social areas) is considered and the energy consumption was averaged over the annual production volume.

According to the Silikal GmbH, the raw and auxiliary materials are mainly delivered in tanks, which are re-used and, thus, hardly any waste is produced. Therefore, the packaging of the raw and auxiliary materials is not considered.

The products are mainly transported in sheet metal barrels to the construction site. For smaller quantities or at the request of the customer, also so-called hobbocks, which consist of metal sheet as well, are used. The Silikal GmbH is participating in the circulation system for sheet metal packaging and steel

“Kreislaufsystem Blechverpackungen Stahl GmbH (KBS)” and, thus, the packaging is primarily recycled afterwards. This is considered in the selected waste scenario “Steel, light”. Some other materials, like wooden pallets, are used as well for the packaging and, thus, considered.

Since the amount of gear oil in A3 was given as a volume and the input for the used NIBE EPD online application needs to be a mass, a density of 888 kilogram per cubic meter [Ravenol, 2020] was used for the conversion. The same was the case for nitrogen, where a density of 807 kilogram per cubic meter [Wikipedia, 2020] was used.

The transport distance of 100 kilometers for the packaging in A3 is based on an educated guess, since no data was available.

For the transport A4, the distances and types as well as the product quantity for the different countries were provided by the Silikal GmbH. Since it is only possible to insert one distance value and select one transport type in the used NIBE EPD online application, a transport scenario for Europe was created, because here all distances are covered with trucks. Therefore, the transport type “Lorry (Truck), unspecified (default)” is selected in the NIBE EPD online application.

All the distances for the different countries were weighted with the help of the product quantities per country. In the end, the weighted transport distances were summed up. The used values are shown in the Life Cycle Inventoy Analysis.

The amounts of electricity for the assembly A5 and the demolition C1 are based on assumptions made by the Silkal GmbH.

The selection of the waste scenarios for the different materials is based on the information given by the Silikal GmbH. The waste scenarios are based on the “Nationale Milieudatabase” (NMD), the National Environmental Database of the Netherlands. This is due the fact that the used NIBE EPD online application is developed in the Netherlands.

3.4 Cut-off criteria

The material flows were assigned potential environmental impacts based on the Ecoinvent database version 3.5. All material flows that contribute to more than 1% of the total mass, energy or environmental impact of the system have been considered in the LCA. It can be as-sumed that the neglected processes in total contributed less than 5% to the considered impact categories. The production of the machines, plants and other infrastructure required for the production of the products was not taken into account in the LCA.

3.5 Period under review

All process-specific data was collected for the operating year 2019. The quantities of raw and auxiliary materials as well as energy consumption have been recorded and averaged over the entire operating year 2019.

3.6 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are considered.

In this case, 1 m² flooring system was selected as the declared unit. To be able to compare the EPD data, the declared products need the same declared units, or the declared unit has to be converted with the proper conversion factors to make it comparable.

3.7 Background data

All the background data is taken from the Ecoinvent database version 3.5 (2018). The life cy-cle was modelled with the help of the NIBE EPD online application. Geographical reference space of the background data is Germany. Almost all consistent datasets contained in the Ecoinvent database version 3.5 (2018) are documented and can be viewed in the online doc-umentation.

3.8 Data quality

Overall, the quality of the data can be considered as good. In the operating data survey, all relevant process-specific data could be collected. The data relating to the manufacturing, transports and construction phase of the flooring systems were determined by the Silikal GmbH.

Secondary data were taken from the Ecoinvent database version 3.5 (2018). The database is regularly checked and thus complies with the requirements of DIN EN ISO 14044 (background data not older than 10 years). The background data meets the requirements of EN 15804. The quantities of raw materials, consumables and supplies used as well as the energy consumption have been recorded and averaged over the entire year of operation.

The general rule has been complied that specific data from specific production processes or average data derived from specific processes must be given priority when calculating an EPD or Life Cycle Assessment. Data for processes that the manufacturer cannot influence or choose, were backed up with generic data.

The selection of the best fitting data sets is based on research and the help of experts. The transport distances for the waste treatments as well as the used environmental profiles for loads and benefits are based on the data from the NIBE EPD online application.

If data was missing, like the transport distance of the packaging supplier, an educated guess was made with the help of expert’s knowledge.

No secondary materials or secondary fuels are used.

3.9 Allocation

Specific information about allocations within the background data is included in the documentation of the Ecoinvent datasets. There are no co-products in the raw material supply phase, so no allocation methods were used at this stage. There are no allocations during the manufacturing phase at the plant.

3.10 Calculation methods

For life cycle assessment, the calculation methods described in ISO 14044: 2006, section 4.3.2 have been applied. The evaluation is based on the phases in the system boundaries.

3.11 Electricity mix and CO_2 certificates

The electricity mix was chosen according to the geographic reference space (Germany) and time reference. Since only the conventional electricity mix is used, no further energy sources were considered. The German power mix composition is based on the Ecoinvent database version 3.5 (2018). No CO_2 certificates were counted.

4. LCA: Scenarios and additional technical information

No scenarios were analysed in this EPD.

5. LCA: Results

The following tables show the results of the indicators of the impact assessment, the resource input as well as the waste materials and other output-flows. The here shown results refer to the declared unit of 1 m^2 flooring system.

Description of the system boundary (X = Included in LCA; MND = Module not declared)																
Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
Raw material supply	Transport	Manufacturing	Transport from manu-facturer to place of use	Construction-instal-lation process	Use	Maintenance	Repair	Replacement	Refurbishmen	Operational energy use	Operational water use	De-construction / demolition	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	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Results of the LCA – Environmental impact: Silikal System B Quartz TA											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
ADP-e	kg Sb	2,17E-05	1,80E-06	1,83E-06	4,48E-06	9,96E-07	3,92E-08	4,07E-07	0,00E+00	1,52E-07	-2,09E-08
ADP-f	MJ	3,40E+02	9,86E+00	1,01E+01	2,45E+01	1,25E+01	4,02E-01	2,23E+00	0,00E+00	2,95E+00	-7,05E-01
AP	kg SO_2-eq.	1,08E-01	2,74E-03	2,32E-03	6,82E-03	3,91E-03	1,25E-04	6,19E-04	0,00E+00	7,84E-04	-2,91E-04
ODP	kg CFC-11-eq.	7,88E-08	1,18E-07	2,73E-07	2,94E-07	2,80E-08	1,34E-09	2,67E-08	0,00E+00	3,14E-08	-3,70E-09
GWP	kg CO_2-eq.	2,14E+01	6,33E-01	6,50E-01	1,57E+00	8,35E-01	2,74E-02	1,43E-01	0,00E+00	1,12E+00	-4,80E-02
EP	kg PO_4^{3-}-eq.	1,01E-02	5,53E-04	5,42E-04	1,37E-03	4,61E-04	3,41E-05	1,25E-04	0,00E+00	1,83E-04	-5,68E-05
POCP	kg Ethene-eq.	2,23E-02	3,76E-04	3,41E-04	9,33E-04	7,43E-04	3,98E-06	8,48E-05	0,00E+00	2,75E-04	-9,63E-05
ADP-e = Abiotic depletion potential for nonfossil resources; ADP-f = Abiotic depletion potential for fossil resources; AP = Acidification potential of land and water; ODP = Depletion potential of the stratospheric ozone layer; GWP = Global warming potential; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants											

Results of the LCA – Resource use: Silikal System B Quartz TA											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	0,00E+00	0,00E+00	5,27E+03	0,00E+00	1,58E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,90E+00	1,04E-01	5,27E+03	2,57E-01	1,58E+02	5,72E-02	2,34E-02	0,00E+00	4,81E-02	-1,46E+00
PENRE	MJ	0,00E+00	0,00E+00	5,27E+03	0,00E+00	1,58E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	3,68E+02	1,05E+01	5,28E+03	2,61E+01	1,72E+02	4,09E-01	2,37E+00	0,00E+00	3,14E+00	-5,41E-01
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	1,01E-01	1,68E-03	6,94E-02	4,17E-03	5,69E-03	1,18E-04	3,79E-04	0,00E+00	2,97E-03	-1,12E-05

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of nonrenewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Results of the LCA – Output flows & waste categories: Silikal System B Quartz TA											
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	kg	6,36E-06	6,29E-06	1,65E-02	1,56E-05	5,00E-04	1,49E-06	1,42E-06	0,00E+00	2,30E-06	-7,48E-06
NHWD	kg	2,53E-01	6,02E-01	6,96E-02	1,50E+00	4,58E-01	1,42E-03	1,36E-01	0,00E+00	1,10E+01	-3,16E-03
RWD	kg	1,37E-05	6,66E-05	2,64E-05	1,65E-04	1,29E-05	1,77E-06	1,50E-05	0,00E+00	1,80E-05	-8,74E-07
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,36E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	2,62E-08	0,00E+00	4,94E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	2,21E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,45E-01

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical/thermal energy

6. LCA: Interpretation

6.1 Environmental impact categories

Figure 2 shows the percentage of the product phases in the environmental impact categories.

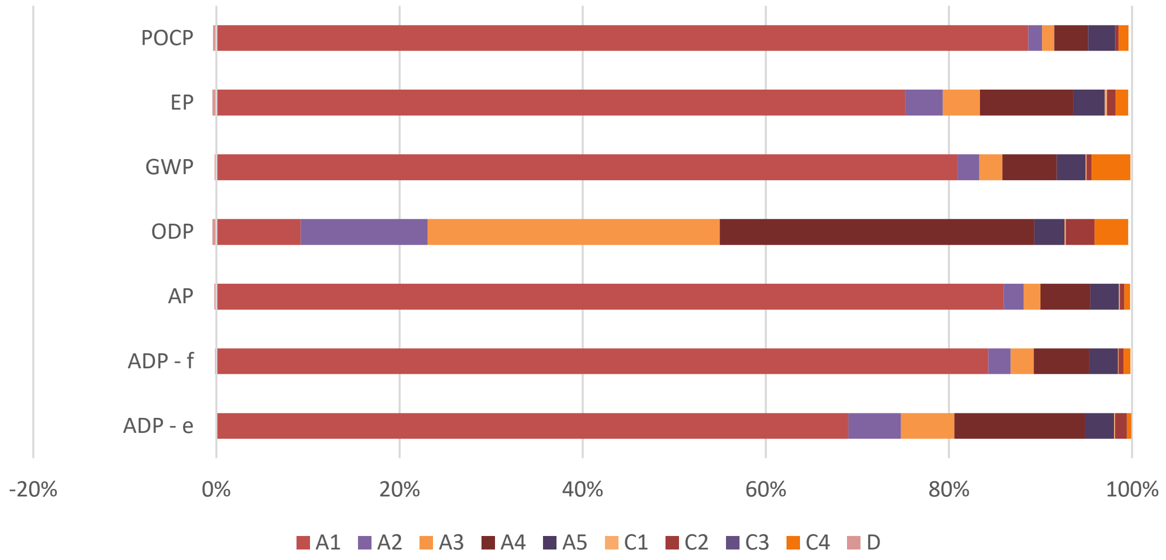

Figure 2: Percentage of the product phases in the environmental impact categories

As one can see, in all environmental impact categories the raw material supply A1 has by far the highest percentage. Only with the depletion potential of stratospheric ozone coat (ODP) the transport phases A2 and A4 as well as the manufacturing A3 have also high percentages. Since for the raw material supply A1 the exact amounts were provided by the manufacturer Silikal GmbH and in all cases relatively well matching data sets from the Ecoinvent database were found, the uncertainty about the results should be small. The data can be assumed to be well representative for the average product declared.

The main raw materials are Methyl methacrylate and Polymethyl methacrylate, which are used in every layer of the flooring systems. They have the main influence on the environmental impact of the flooring systems. For those main raw materials the exact matching data sets were available in the Ecoinvent database. The results should consequently be reliable. A clearly higher mass share of the used raw materials have the fillers (see Table 2). But since they consist of sand, they do not have a big environmental impact.

6.2 Limitations

The limitations regarding the interpretation of the results are due to the assumptions made for the LCA, because it assesses the real world in a simplified model. It can be assumed that the results for the declared products are well representative, because the quality of the data used can classified as good overall. All relevant process-specific data could be collected in the operational data collection. Consistent data sets from the Ecoinvent database were available for almost all inputs and outputs.

In principle, a comparison of EPD data is only possible if all data sets to be compared were created according to same standard (EN 15804+A1) and all relevant data sets are from the same database. For an evaluation, the same flooring systems in the building context or the product-specific performance characteristics have to be considered.

7. References

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EN 15804: EN 15804:2012-04+A1 2013; Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 16810: EN 16810:2017; Resilient, textile and laminate floor coverings – Environmental product declarations – Product category rules

ISO 14025: DIN EN ISO 14025:2011-10; Environmental labels and declarations – Type III environmental declarations – Principles and procedures

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