Airwallex

Transaction Handbook

There are 5 safety factors, some of which have multiple sub-checks. They are not necessarily in the easiest to hardest order of implementation. Feel free to implement them in any order.

Note that as soon as a safety check passes, it means the transaction is safe to approve, regardless of if it meets the criteria for any other safety check. For instance a transaction that is safe due to the merchant validity check, but is not considered safe due to the card validity check is still overall safe to approve.

Transaction Checks

Check 1: Merchant Validity (35% of transactions pass)

The merchant is encoded as a string. Unfortunately network interference has meant the merchant field is somewhat garbled and needs to be decoded.

The merchant field is encoded as follows:

Field Name	Length (the number of non-junk characters after the length field)	Category Code	Name	Country	Junk
Field Length	3	4	Variable	2	Variable
Example	043	0314	Cool Merchant	AU	sh to the cat now look at

1. As part of risk management, specific countries may have sanctions placed against them, or an issuer may choose not to do business with regions due to increased risk of transacting with merchants in that country.

   Due to our limited number of supported merchants in South America, we have high trust for this region. Therefore any transaction that comes from a merchant in South America is considered a safe transaction.

2. Any transaction where the card's issued country and the merchant country match is considered a safe transaction.

3. The merchant category code (MCC) determines what type of business a merchant performs. We consider any transaction with an airline or air carrier a safe transaction. More information about MCCs and their values can be found here.

4. The merchant's name can be a descriptive indicator of what business they carry out, indicating whether they can be trusted or they are likely engaging in fraudulent activity.

   After back testing previous transactions, one of our risk engineers made a remarkable discovery: if the merchant's name does not contain the letter E, it is guaranteed to be a safe transaction. Although probably correlation and not causation, you can assume this will be true for all future transactions.

Check 2: Card Validity (42% of transactions pass)

1. We can assume any card from an enterprise customer is a safe transaction (hint: look at appendix 1.)

2. We can assume any transaction coming from a legacy card is a safe transaction. A legacy card is a card with an expiry date within the next 12 months, from the current date inclusive.

   So if today is March 2025, any transaction from a card with expiry between March 2025 to March 2026 is safe.

3. Each transaction contains a checksum, calculated by concatenating the card number, expiry month (two digits), expiry year (last two digits), and CVV and then applying the SHA-256 algorithm. The final hashed value is a string of hexadecimal digits.

   The format for the checksum is: cardNumberexpiryMonthexpiryYearcvv.

   For example, if the card number is 1234, the expiry month is 12, the expiry year is 23, and the CVV is 678, the checksum string prehashing would be "12341223678".

   A transaction with a valid checksum is always safe to approve (hint: look at the hashlib python module).

4. Another remarkable discovery: if the Primary Account Number (PAN) contains a strictly increasing subsequence of length 7 or more, it is actually safe to approve! The data engineer was in disbelief.

   For instance, "123488567" passes the check because it contains the increasing subsequence "1234567". However, "123488765" fails the check as it does not have such a sequence.

Check 3: Transaction Limit (21% of transactions pass)

Accounts can place restrictions on the use of their cards. One such restriction is setting a transaction limit. For simplicity we consider a transaction limit to be applied per transaction, although in reality these are measured per card over a period of time and potentially over multiple transactions.

A transaction limit will always be set in USD. Note that a transaction could be in any currency listed in the currency table. Also know that not all currencies can be directly converted to USD, they may need to be converted through intermediate ones first.

You will see in the python code there is a function called *perform_conversion*. You can use this function to get the conversion rate between any two currencies. For example, if you pass in *perform_conversion("AUD", "USD")*, the function will return 0.66 - as there are 66 US cents to one Australian dollar. If a conversion doesn't exist, the function returns *None*. Finally, all currency conversions are two ways, so if *perform_conversion("USD", "HKD")* returns a value, that means *perform_conversion("HKD", "USD")* will too.

After doing some backtesting on the transactions Airwallex receives, we have the following data of the distribution of transactions:

Transaction Currency	**Percentage of Transactions**
USD	20%
One that can be directly converted to USD	50%
One that cannot be directly converted to USD	30%

If a transaction's amount is lower than the transaction limit, it is *always* safe to approve. Otherwise it may still be safe to approve, depending on the other checks.

Check 4: Repeat Customers (14% of transactions pass)

If an account has submitted a safe transaction from a given card, all future transactions from that account and card will always be safe.

That is if a transaction has an accountId and cardId that were present **together** in a previous transaction that was a safe transaction, this new transaction will also be safe.

To demonstrate consider the following sequence of transactions:

Transaction Number	Card ID	Account ID	Was Safe	Passes this check
1	card1	account1	No	-
2	card2	account1	-	-
3	card1	account1	No	No, as every previous transaction from this card/account was not safe
4	card1	account1	Yes	Again no for the same reason

5	card1	account1	-	Yes, as a previous transaction from this card/account was safe

Check 5: Dynamic Rules (21% of transactions pass)

Customers can configure their own risk related rules as a way to further protect themselves against fraudulent transactions, catering to their specific needs.

These rules can be found in the dynamicRules field on the card. Only if ALL dynamic rules pass, does it mean a transaction is definitely safe.

If a card has no dynamic rules, we consider it the case where all dynamic rules have passed, so the transaction is definitely safe to approve.

A dynamic rule is a string encoded as three or four words, separated by spaces, always in the same order:

"*propertyName NOT* (optional) *operator value*"

Information about each word is below:

propertyName	NOT (optional)	operator	value
A property of the transaction or card, for instance *transactionAmount*.	If it is present, it negates the following operator.	One of <, >, = or IN.	A value (or many if the operator is IN) to test against the property in the transaction. Will always be of the same data type as the property.

For instance:

"transactionId NOT = f10b3b0a-e681-4494-8611-d98b7536c37b": means this specific dynamic rule passes if the cardId in the transaction does not equal f10b3b0a-e681-4494-8611-d98b7536c37b.

"*cvv < 134*" means this specific dynamic rule passes if the card in the transaction's cvv is less than 134.

“cardNumber IN [1234567890123456, 3285792835789242]” means this specific dynamic rule passes if the card’s number is one of the two numbers listed in the rule.

Note again that if there are more than one dynamic rule, BOTH rules must pass for this check to pass, only then guaranteeing the transaction safe to approve.

Appendix

1. Airwallex Bins

A card bin is the 6 digit prefix of a card's PAN. Airwallex has purchased a number of card bins which are used when issued to customers.

New bins are added very frequently, so treat any bins outside of the ones listed here as an undocumented SME customer.

Bin	**Customer Type**
402633	Enterprise
552187	Enterprise
370002	Enterprise
601105	Enterprise
455938	Enterprise
520091	Enterprise
340788	Enterprise
644003	Enterprise
752981	SME
183562	SME
328495	SME
610834	SME
297516	SME
864203	SME
509178	SME
146329	SME
485730	SME

2. Currencies

All of the currencies a transaction can have are listed in the table below. You can assume you will not encounter any currency not listed here.

Currency	Currency Code	Can be directly converted to USD?
United States Dollar	USD	Yes
Euro	EUR	Yes
Japanese Yen	JPY	Yes
Pound Sterling	GBP	Yes
Australian Dollar	AUD	Yes
Canadian Dollar	CAD	Yes
Swiss Franc	CHF	Yes
Chinese Yuan	CNY	Yes
Swedish Krona	SEK	Yes
New Zealand Dollar	NZD	Yes
Mexican Peso	MXN	Yes
Singapore Dollar	SGD	Yes
Hong Kong Dollar	HKD	Yes
Norwegian Krone	NOK	No
South Korean Won	KRW	No
Turkish Lira	TRY	No
Indian Rupee	INR	No
Brazilian Real	BRL	No
South African Rand	ZAR	No

Russian Ruble	RUB	No
Danish Krone	DKK	No
Polish Złoty	PLN	No
Thai Baht	THB	No
Indonesian Rupiah	IDR	No
Hungarian Forint	HUF	No
Czech Koruna	CZK	No
Israeli New Shekel	ILS	No
Chilean Peso	CLP	No
Philippine Peso	PHP	No
UAE Dirham	AED	No
Colombian Peso	COP	No
Saudi Riyal	SAR	No
Malaysian Ringgit	MYR	No
Romanian Leu	RON	No
Peruvian Sol	PEN	No
Argentine Peso	ARS	No
Egyptian Pound	EGP	No
Nigerian Naira	NGN	No
Bangladeshi Taka	BDT	No
Vietnamese Dong	VND	No

3. Country Codes

All countries and their country code are listed below. You can assume you will not encounter any country not listed here.

Country	Country Code
United States	US
European Union	EU
Japan	JP
United Kingdom	GB
Australia	AU
Canada	CA
Switzerland	CH
China	CN
Sweden	SE
New Zealand	NZ
Mexico	MX
Singapore	SG
Hong Kong	HK
Norway	NO
South Korea	KR
Turkey	TR
India	IN
Brazil	BR
South Africa	ZA
Russia	RU

Denmark	DK
Poland	PL
Thailand	TH
Indonesia	ID
Hungary	HU
Czech Republic	CZ
Israel	IL
Chile	CL
Philippines	PH
United Arab Emirates	AE
Colombia	CO
Saudi Arabia	SA
Malaysia	MY
Romania	RO
Peru	PE
Argentina	AR
Egypt	EG
Nigeria	NG
Bangladesh	BD
Vietnam	VN