ASIA PACIFIC TRADE FACILITATION CONFERENCE 2025

Use of Generative AI in Customs Processes

India's experience

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सत्यमेव जयते

Presentation Outline

- IndiaAI mission for Safe & Trusted Responsible AI
- India's Experience in Use of Generative AI in
  - Customs Classification
  - Text based Product Clustering
  - Risk Management
  - Capacity Building

Challenges in Customs Classification

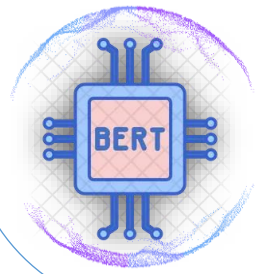
Problem before Customs Officers

- Text goods descriptions are Complex and Unstructured data
- Unclear , Cryptic and Technical product description – Need for product data augmentation
- Need for Logical reasoning for predicted HSN Classification Code
- Comparison with relevant supporting Binding Tariff Information (BTI)/Advance Rulings
- Need to refer catalogues/Web links for Technical products in web
- Historic offence cases and LPCO Compliance requirement of given goods description

India ‘s approach for Modern Customs Classification Model

Use of Generative AI and LLMs

- **Limitations of traditional models** (Random Forest, Decision Trees, Rule-Based Systems) – use of large language models
- Importance of **context-awareness** in product classification
- Need for **Transfer learning models** for easy fine tuning with less data
- Explainable AI ,not black box AI – for more Responsive and Reliable AI
- Use and customisation of Open source models
- In house Research and development



ADVAIT BERT – (ADVanced Analytics in Indirect Taxation BERT)-Advanced AI and BigData HSN Classification Prediction Risk Engine of Indian Customs

ADVAIT BERT – Advanced AI and Big Data HSN Classification Prediction Risk Engine of Indian Customs

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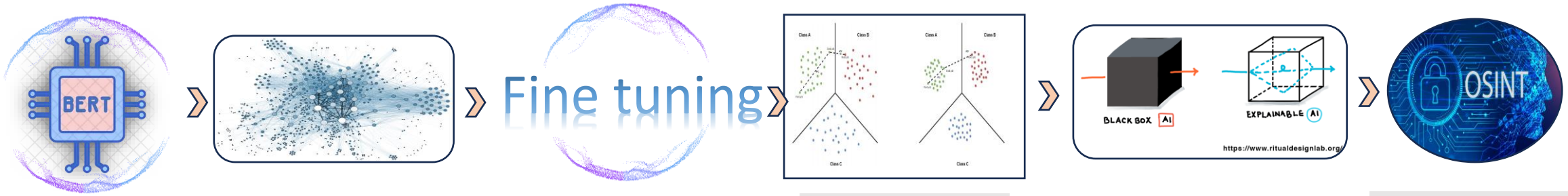
BERT – Bidirectional Encoder Representation from Transformers

– State of the Art , Open source LLM from Google

-- Able to understand the Product description better than other ML models

– Power of Context understanding



State of the Art BERT model

Training with Indian Customs Corpus

Finetuning to Predict HSN codes

Explainable AI with logical reasoning - LLMs

Data Augmentation from OSINT

Capabilities : Better Contextual understanding of Product descriptions

No need for any text cleaning or preprocessing

Better predictive accuracy

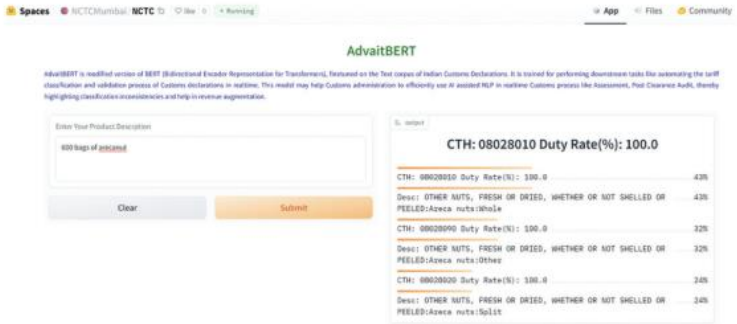
Meaningful Insights ,Clear reasoning pathways ,User-friendly explanations

Features of ADVAIT BERT

1. • Harnessing LLMs for Contextual understanding
2. • Customisation and contextualisation with Indian Big Data Analytics
3. • Explainable AI (XAI) for Transparency and elimination of bias
3. • Product Information Augmentation from LLM
4. • Automatic Web Crawling for Product Catalogs though OSINT
5. • Real-Time Advance Rulings integration
6. • NLP based Product Clustering analysis

Indian Customs develops Large Language Models – Based Model for Real-time Harmonised System Classification Inconsistency Identification

In today's rapidly evolving technological landscape LLMs have found their way into various domains, and Customs is no exception. Customs worldwide are exploring data models to extract valuable insights



Written by Ms Kopal Tandon, Deputy Director, NCTC and Mr Ramesh M Additional Director, NCTC Central Board of Indirect Taxes and Customs (CBIC)

/ Edited by Elliot Binder Senior Policy Officer ABF

Image: LLM Bi-directional Encoder Representation from Transformers (BERT)

In today's rapidly evolving technological landscape, Large Language Models (LLMs) have found their way into various domains, and the customs domain is no exception. Customs officers worldwide are exploring data models to extract valuable insights from import and export declarations. To support this endeavour, National Customs Targeting Centre (NCTC) officers under the Directorate General of Analytics and Risk management (DGARM), has embarked on a technological revolution by leveraging the power of Artificial Intelligence (AI) engines to identify inconsistencies on Customs Declarations in real-time.

The Requirement for the Classification Inconsistency Identification Model:

The need for bulk and real-time natural language processing has grown, especially for deriving insights from free text item descriptions in customs declarations. Additionally, risk management engines need to identify HS classification inconsistencies in real-time to process declarations efficiently. To address this gap, the NCTC team have developed cutting-edge AI-based model that can identify the top probable Harmonized System Nomenclature (HSN) codes for declared product descriptions, along with their confidence levels and associated taxation rates. This will significantly assist the risk engine in targeting HS classification anomalies with high revenue potential for Customs.

Application of LLM-Based BERT Model:

The team utilizes LLMs, such as the BERT (Bi-directional Encoder Representation from Transformers) model developed by Google, which is programmed to filter vast amounts of text data, enabling it to contextualize word representations and capture the meaning of statements. BERT's contextualized word embedding deciphers the context of product descriptions in customs declarations, even running on uncleaned descriptions in real-time. Given the vast number of classes in the Indian Customs CTH structure, BERT's suitability for classification tasks and bidirectional learning make it a powerful tool for accurate HS predictions.

Product Clustering using LLM based NLP tool kits

Unsupervised Text Clustering of Products descriptions

Going Beyond the HSN digits

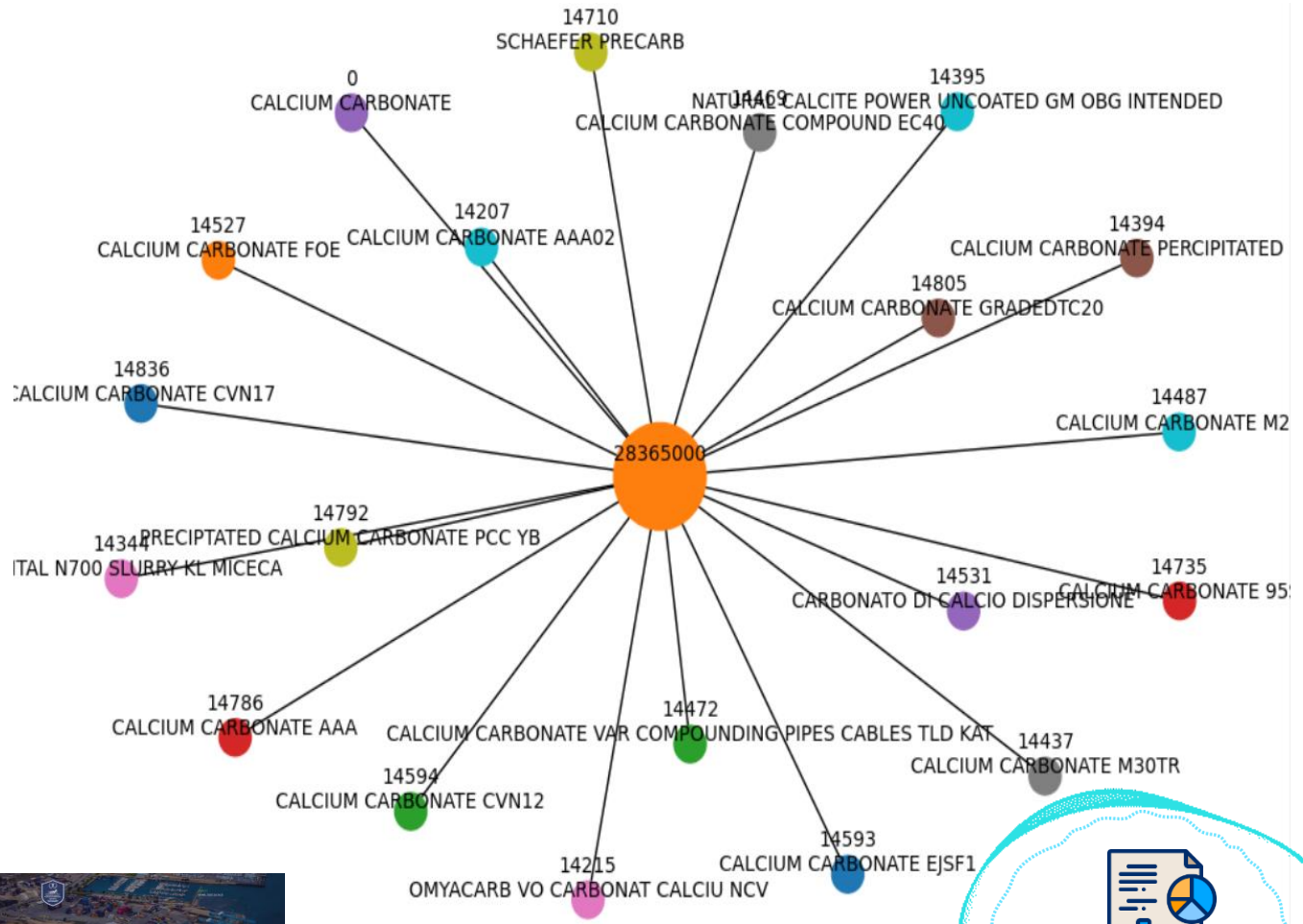
Product description clusters provide more granularity of analytics than HSN digit level

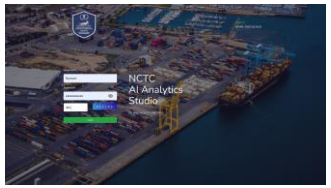
Technology used:

- BERT based embeddings for semantic clustering
- Generative AI based tool kits like Word llama, GLINER etc

Uses:

- Helps in identifying anomalies in customs classification , better Tax policy making and Tax simulations at product level





Demo

AdvaitBERT Report

Potential Applications of ADVAIT BERT

Comprehensive Decision support to Customs officers in swift clearance

Integration of AI based Post Clearance Audit

AI Assisted Customs Declaration filing assistance to Trade

Risk Management – Realtime integration with Risk engine for finding inconsistencies and misclassifications

Big Data Analytics and Tax policy making using Products clusters

Digital Vetting of Customs declarations for Compliance Verification

Using Generative AI Agents in Risk management

Data in Customs Declaration is minimum

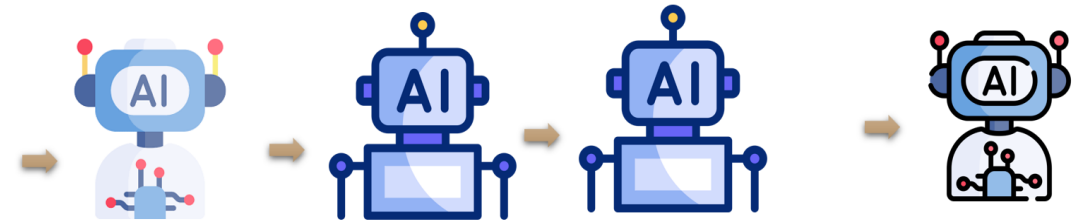
Customs declaration and manifest data has to be vetted with more data for compliance and risk verification

Autonomous AI agents for data augmentation And compliance checking

AI agents can fetch OSINT data about entities involved, declared products and find anamolies/risk

NCTC experiment - Multi AI agent app for Digital Vetting for compliance verification

AI Agent Workflow



Entity extractor agent

Importer web search agent

Supplier web search agent

Customs officer agent

(Validates and identifies risk insights , prepares report and send as email)

Demo

[redacted]

Generative AI Virtual Assistant for WCO HSN Explanatory Notes

Using Generative AI Agents

Exploring the power of Generative AI agents

Capable of thinking and deciding to use right tools to answer the question of user

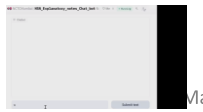
Autonomous and handle variety of tasks

AI agents can decide to search inhouse databases, open web, web scraping ,write and execute codes to analyse data etc

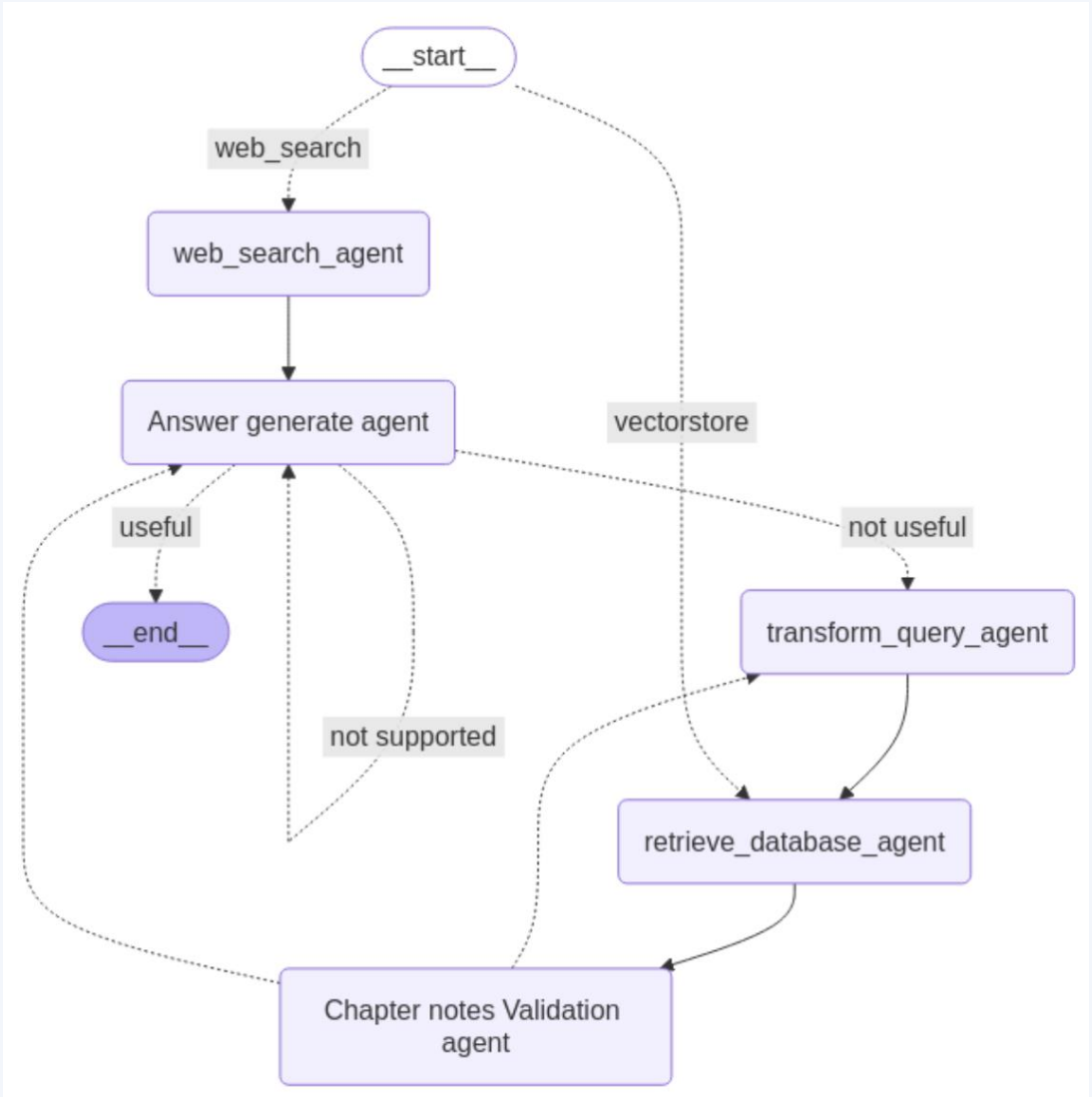
Better accuracy and reliability

AI agents intelligently validates and ensures the reliability of answer before puts to the user

Demo



AI Agent Workflow using Langgraph



Generative AI in Capacity building of Customs Officers

Virtual Assistant on Customs Procedures and laws (LegalTech)

Chatbot with capabilities to chat in 21 Indian languages (Bhashini Translation pipeline of Government of India)

ADWITIYA-

Custom Manual Chatbot

Using GenAI for CBIC Capacity Building - A free chat bot developed by National Customs Targeting Center using Open source LLMs for CBIC Officers

Developed by NCTC,Mumbai. Suggestions may be sent to *nctc-admin@gov.in*.

Image

Chatbot

What are benefits of the AEO Scheme and eligibility criteria?

The AEO (Authorized Economic Operator) Scheme offers several benefits to businesses involved in international trade, including:

1. **Enhanced Customs Facilitation**: AEOs receive a lower-risk score in Customs' Risk Management System, leading to fewer physical and documentary checks, and thus faster clearance of consignments.
2. **Simplified Procedures**: AEO status holders can enjoy simplified customs procedures and declarations.
3. **Relaxation in Bank Guarantees**: MSME AEO T1 entities need to furnish only 25% of the bank guarantee required for non-AEO importers/exporters, while MSME AEO T2 entities require 10%.
4. **Priority Treatment**: AEO-T3 entities get the highest level of facilitation with even quicker cargo release.
5. **Waivers and Exemptions**: Including waiver or reduction in bank guarantees, exemption from certain procedures like drawal of samples for drawback, and priority in assessment and examination.
6. **24x7 Clearance**: Availability of customs clearance around the clock at sea ports and airports.
7. **Self-Sealing**: Permission for self-sealing of consignments for exports in some cases.

What are benefits of the AEO Scheme and eligibility criteria?

Submit text

Embeddings

Generative AI in Capacity building of Customs Officers

Gen AI Quizbot for Hyper-personalized learning

Interactive and Fun based Classroom learning

Capable of instantly generating Quiz from Presentation slides of the faculties

Integration with Learning Management System (LMS) for Hyper-personalized Learning and mentoring

Quiz based Evaluation linked to Officer profiles (Under process)

Thank You

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ADVAIT BERT REPORT
HSN CLASSIFICATION THROUGH GEN-AI AND BIG DATA
Powered by NATIONAL CUSTOMS TARGETING CENTER

NCTC DGRM

Generated time (GMT): Sun Feb 23 23:31:32 2025

DECLARED PRODUCT DESCRIPTION

STATIC VAR GENERATOR

TOP HSN CLASSIFICATION BY NCTC AI BERT MODEL

CTH	Duty rate	CTH Description	Prediction %
85022090	7.5	Belongs to electric portable generators of an output not exceeding 3.5 kva, belongs to generating sets with spark-ignition internal combustion piston engines:, belongs to chapter electric generating sets and rotary converters	35.43
85023990	7.5	Not from powered by water turbine, not from powered by steam engine, not from wind-powered, belongs to other generating sets:, belongs to chapter electric generating sets and rotary converters	33.14
85432090	7.5	Not from tacho generators, not from impulse generators, not from sweep generators, belongs to signal generators:, belongs to chapter electrical machines and apparatus having individual functions, not specified or included elsewhere in this chapter	31.42

** The predictions are from NCTC's AI model called AdvaitBERT which is trained on Customs Big data corpus of Indian Customs**

AI EXPLAINABILITY OF PRODUCT

A Static Var Generator (SVG) is an electrical device used to dynamically provide or absorb reactive power in an electrical power system. It is designed to improve and stabilize the power factor, voltage regulation, and overall power quality. Unlike traditional reactive power compensation methods like capacitor banks, an SVG operates more dynamically and can respond almost instantaneously to changes in the power network.

SVGs are particularly useful in industrial and utility applications where loads can cause significant fluctuations in the power factor, such as with variable frequency drives, electric arc furnaces, or large motor starts. By generating or absorbing reactive power as needed, they help to:

1. Reduce energy losses in the system.
2. Prevent overloading of transformers and transmission lines.
3. Maintain a stable and high-quality voltage level, which is crucial for sensitive electronic equipment.
4. Increase the efficiency of the power grid, allowing it to operate closer to its rated capacity.

5. Minimize harmonic distortion, another common issue in modern power systems.

SVG technology typically uses power electronics, such as thyristors or IGBTs (Insulated Gate Bipolar Transistors), to control the flow of reactive power, making it a versatile and efficient solution for power quality issues in modern electrical networks.

EXPLAINABILITY AI CLASSIFICATION

A Static Var Generator (SVG) is an electrical device used primarily to control and regulate reactive power in electrical systems. It does not generate real power like a conventional generator but instead provides or absorbs reactive power to maintain voltage stability and improve power factor. SVGs are particularly useful in industrial applications and power grids where fluctuating loads can affect system performance.

Now, let's analyze the given Harmonized System (HS) codes to determine which one is the most appropriate for a Static Var Generator:

1. **CTH: 85022090** - This classification refers to electric portable generators with an output not exceeding 3.5 kVA, or generating sets with specific types of engines. An SVG is not a portable generator nor does it have an internal combustion engine. Therefore, this classification does not fit.

2. **CTH: 85023990** - This category covers other generating sets not specified earlier, such as those not powered by water turbines, steam engines, or wind. While this seems broader and could potentially include non-conventional generating equipment, it's important to note that SVGs do not generate power in the traditional sense; they manage reactive power. However, if interpreted broadly within the context of electrical generating systems, one might initially consider this as a potential fit due to its generality. But it's still not precise because SVGs are not "generating sets" in the common understanding of producing active power.

3. **CTH: 85432090** - This code is for electrical machines and apparatus with individual functions not specified elsewhere, excluding certain types of specialized generators. An SVG, being a specialized electrical apparatus that manages reactive power rather than generates electricity in the conventional sense, might be more appropriately classified here if none of the previous categories specifically cover SVG technology.

Given the descriptions, none of the classifications perfectly fits an SVG due to their focus on power generation or specific types of generators. However, if forced to choose based on the information provided and without a more specific code for SVGs, **CTH: 85432090** could be considered the least inappropriate, acknowledging that it still may not accurately reflect the nature of an SVG since it's a catch-all for unspecified electrical machinery.

Additional Information Needed:

To classify an SVG more accurately, we would need a classification code specifically designed for static VAR compensators or a detailed description within the HS codes that accounts for power factor correction devices or reactive power management systems. This highlights the importance of having clear categorization for advanced electrical equipment in tariff schedules.

Product Information Augmentation from Open Web

Static Var Generator (SVG) is a sophisticated power electronics device designed to improve power quality by dynamically compensating for reactive power in electrical distribution systems. Unlike traditional reactive power compensation methods, SVGs offer faster response times, higher efficiency, and better versatility, making them ideal for applications requiring precise voltage control and power factor correction.

Technical Specifications and Features:

• **Working Principle:** SVGs operate based on Voltage Source Converter (VSC) technology, which allows them to generate or absorb reactive power almost instantaneously. They detect the phase angle difference between voltage and current, and through advanced control algorithms, inject leading or lagging currents to correct power factor and stabilize voltage.

• **Components:** An SVG system typically comprises power electronics converters, capacitors, and reactors. The VSC, often based on Insulated Gate Bipolar Transistors (IGBTs), forms the core, enabling fast switching to control the reactive power flow.

• **Response Time:** SVGs have a response time in the range of milliseconds, making them highly effective in correcting transient power quality issues.

• **Application Areas:**

• **Industrial Plants:** SVGs are used to stabilize voltage and improve power factor in heavy machinery operations.

• **Renewable Energy:** They help wind farms and solar plants manage fluctuating reactive power demands, improving grid compatibility.

• **Electric Utilities:** SVGs assist in maintaining grid stability and preventing voltage sags and swells.

• **Data Centers:** Ensuring stable power quality is crucial for uninterrupted operation and efficiency.

• **Efficiency and Environmental Impact:** SVGs contribute to energy savings by reducing transmission losses and can operate over a wide range of operating points, making them environmentally friendly.

• **Indian Customs and Regulations:** While specific customs notifications vary and require checking the latest regulations, importing SVGs or any power electronics equipment into India may involve adhering to BIS (Bureau of Indian Standards) certifications for safety and performance, as well as applicable import duties and tariffs. It's advisable to consult the latest customs notifications and guidelines from the Indian government.

Practical Uses and Benefits:

• **Power Factor Correction:** SVGs correct power factor close to unity, reducing penalties often levied by utilities for low power factor.

• **Voltage Regulation:** They help maintain a stable voltage profile, enhancing the reliability of the electrical network.

• **Harmonic Mitigation:** SVGs can also be designed to filter harmonics, further improving power quality.

• **Reduced Equipment Stress:** By providing a stable power environment, SVGs extend the life of electrical equipment by reducing stress due to voltage fluctuations.

In summary, SVGs are a critical technology in modern power systems, offering precise and dynamic control over reactive power, thereby enhancing power quality, efficiency, and grid stability. Their application spans across industries, reflecting their importance in meeting today's stringent power quality requirements.

Links

https://www.deltaww.com/en-US/products/Static-Var-Generator/SVG2000

https://kaichpower.com/static-var-generator-working-principle-unraveling-the-intricacies-of-power-quality-enhancement/

https://www.deltapowersolutions.com/en/mcis/pqc-static-var-generator.php

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