



ENDemic
— process engineering —



ENDIET[®]

CO₂ DRY ICE EXPANDED TOBACCO TECHNOLOGY



Higher filling power
Lower blend density

Efficient CO₂ recovery
Industrial Tobacco Expansion Plants

ENDIET[®]

Increase Tobacco Filling Power Through Controlled CO₂ Expansion

ENDIET® is an **industrial Dry Ice Expanded Tobacco—DIET**—technology developed for increasing the filling power of conditioned cut tobacco.

The process impregnates the cellular structure of tobacco with liquid carbon dioxide under controlled pressure and temperature. During staged depressurization, the retained CO₂ forms dry ice within the tobacco structure. The impregnated material is subsequently exposed to a controlled hot-gas stream, causing rapid sublimation and expansion.

The result is expanded tobacco with increased volume per unit mass and reduced bulk density.

Designed to Deliver

- Increased filling power and specific volume
- Reduced blend density
- More efficient utilization of tobacco raw material
- Controlled process conditions for repeatable production
- High-rate CO₂ recovery and recirculation
- Integration into new or existing tobacco-processing lines
- Automated process control and production reporting
- Plant configurations tailored to the customer's tobacco characteristics



An Engineering Platform for Modern Tobacco Processing

ENDIET® combines high-pressure process engineering, thermodynamic control, tobacco handling, CO₂ management, automation and process safety within one integrated plant.

More usable tobacco volume per kilogram—achieved through controlled physical expansion.



ENDIET® Industrial Tobacco Expansion Plants

From Conditioned Cut Filler to Expanded Tobacco

• Feed Preparation

Conditioned cut tobacco is weighed, transferred and prepared for impregnation. Feed moisture, cut geometry, tobacco variety and operating recipe are defined according to the required expansion performance.

• Liquid-CO₂ Impregnation

The tobacco is loaded into the high-pressure impregnation vessel. After air removal and CO₂ purging, the vessel is brought to the required pressure and temperature. Liquid CO₂ penetrates the cellular structure of the tobacco.

• CO₂ Recovery and Dry-Ice Formation

Unabsorbed liquid CO₂ is returned to the process circuit. Controlled staged depressurization converts the CO₂ retained within the tobacco structure into solid CO₂—dry ice—while recoverable gaseous CO₂ is routed to the recovery system.

• Discharge and Declumping

The impregnated tobacco is discharged through the purpose-designed vessel outlet. Controlled mechanical handling separates agglomerates and provides consistent material flow to the expansion section.

• Sublimation and Expansion

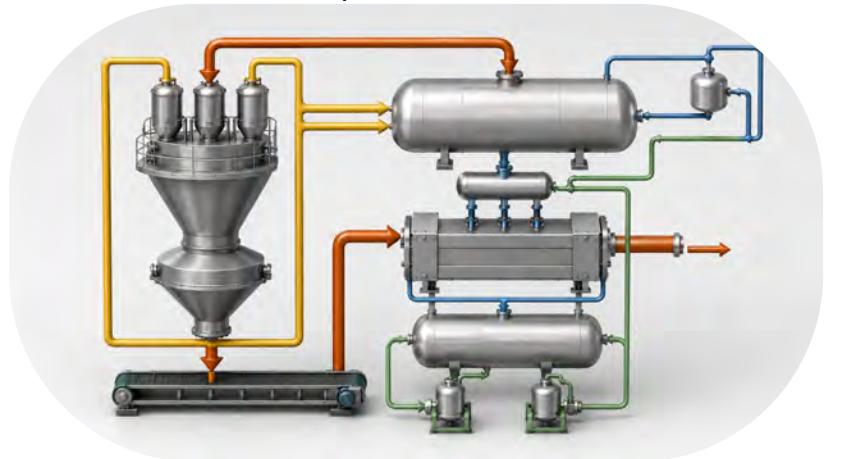
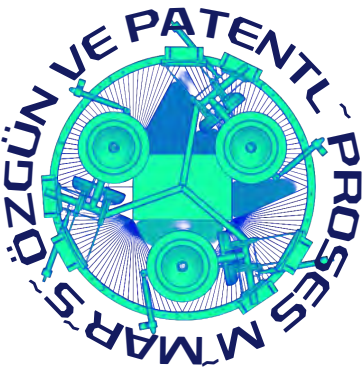
The dry-ice-containing tobacco enters the expansion chamber. A controlled hot-gas stream causes rapid CO₂ sublimation, expanding the tobacco's cellular structure and increasing its filling power.

• Cooling, Conditioning and Transfer

Expanded tobacco is cooled and, where required, conditioned to the target process moisture before downstream blending, storage or cigarette-making operations.

Process line

Conditioned Cut Filler → CO₂ impregnation → Staged Depressurization → Dry-ice Formation → Declumping → Controlled Sublimation → Expanded Tobacco



Engineered for Controlled, Repeatable Operation

The impregnation section is the thermodynamic core of the ENDIET® process. It is designed to provide consistent contact between conditioned tobacco and liquid CO₂ while enabling efficient recovery of excess liquid and gaseous carbon dioxide.

E/NPREGNATORE®



**Industrial Tobacco
Impregnation Unit**

Principal System Components

- High-pressure impregnation vessels
- Automated vessel closures and interlocks
- Tobacco loading and distribution system
- CO₂ purging and pressurization circuits
- Liquid-CO₂ dosing and transfer system
- Staged depressurization system
- Liquid and gaseous CO₂ recovery lines
- Discharge and declumping mechanisms
- Intermediate storage or buffer bin
- Pressure, temperature and level instrumentation
- PLC/SCADA control architecture

Staggered Production Architecture

Multiple impregnators can be operated in a staggered sequence. While one vessel is being loaded, another may be undergoing impregnation and a third may be discharging.

This coordinated arrangement supports:

- Stable downstream material flow
- Reduced process waiting time
- Higher effective plant availability
- Flexible production scheduling
- Continuity between batch impregnation and downstream expansion



The number and working volume of impregnators are selected according to target throughput, cycle time, tobacco characteristics and required operating redundancy.

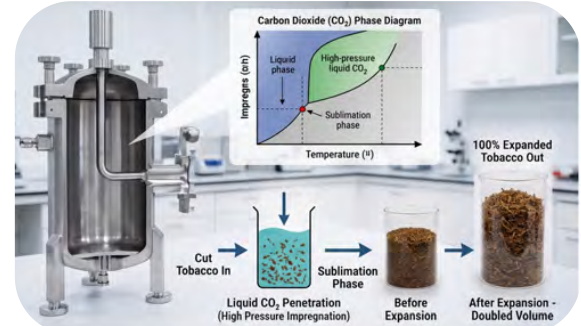
Closing the CO₂ Cycle

Excess liquid and gaseous CO₂ are recovered at defined stages of the process, conditioned and returned to the operating circuit.

ENDIET®

The recovery system can include:

- Liquid-CO₂ collection and transfer
- Gas recovery and buffering
- Compression
- Condensation or reliquefaction
- Refrigeration
- Storage and process-vessel management
- CO₂ make-up control
- Pressure-relief and safe-venting systems



**ENDEMIC ENDIET
E/NPREGNATORE
INDUSTRIAL BIOMASS IMPREGNATOR**

Controlled Expansion

Expansion performance depends on the interaction of several variables:

- Tobacco variety and blend composition
- Cut width and particle-size distribution
- Initial moisture content
- Impregnation pressure and temperature
- Liquid-CO₂ contact time
- Depressurization profile
- Dry-ice retention
- Expansion-gas temperature and flow
- Residence time
- Final cooling and moisture conditioning



ENDIET® plants are therefore configured as process-adaptive systems.

Operating recipes are developed and optimized for the customer's tobacco and required product characteristics.

Target Performance*

- Nominal capacity: from 300 kg/h
- Volumetric expansion: approximately 100% or project-specific
- CO₂ recovery efficiency: up to 96–98%
- Automated or semi-automated operation
- Continuous downstream material flow
- Tailor-made plant capacities and production scale-up strategies

*Final performance values are determined by feedstock trials, process design, tobacco characteristics and agreed acceptance-test conditions.

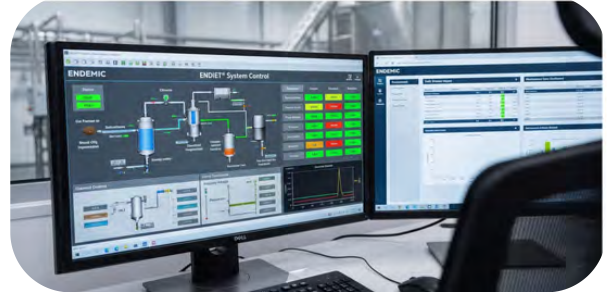
Intelligent Process Control

The ENDIET® control system coordinates tobacco handling, vessel sequencing, CO₂ transfer, pressure control, temperature control, recovery and downstream expansion.

PLC/SCADA Functions

- Recipe-based process operation
- Automated impregnation sequences
- Pressure and temperature trending
- Vessel status and cycle visualization
- CO₂ inventory and recovery monitoring
- Alarm and interlock management
- Batch and production reporting
- Energy and utility monitoring
- Maintenance notifications
- Historical operating-data storage
- Remote diagnostic capability, where permitted

ENDEMIC X WARE V4.1®



All ENDIET processes are equipped with the state-of-the-art **Endemic X Ware Process Control & Automation Software**

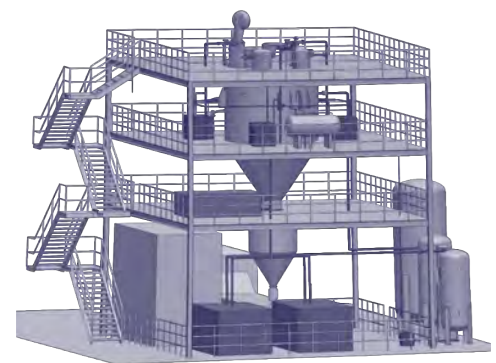
Safety by Design

ENDIET® is designed as an industrial high-pressure CO₂ installation. The engineering scope addresses the hazards associated with pressure equipment, cryogenic liquid CO₂, oxygen displacement, mechanical handling and high-temperature expansion gas.

Typical safeguards include:

- Safety-instrumented interlocks
- Pressure-relief protection
- Controlled depressurization
- CO₂ detection and ventilation interfaces
- Access control and guarded moving parts
- Emergency-stop architecture
- Safe-state operating logic
- Inspection and maintenance access
- Hazard and operability review
- Operator training and operating procedures

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Industrial Tobacco Expansion Plants



Pressure equipment is designed and documented according to the applicable project jurisdiction. Where applicable, the engineering basis may include

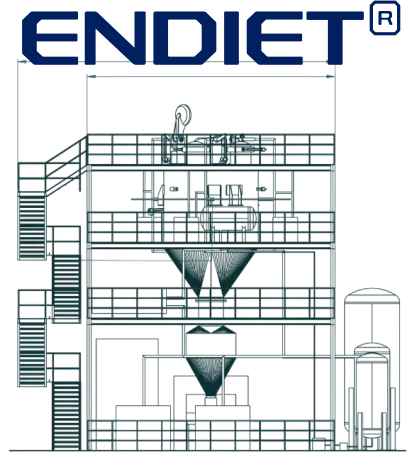
PED 2014/68/EU, EN 13445 and relevant machinery, electrical and functional-safety requirements.

Designed Around Your Tobacco, Factory and Production Objectives

No two tobacco-processing facilities have identical feedstock, product recipes, utility conditions or integration requirements. ENDIET® plants are developed through a project-specific engineering process.

Engineering Scope

- Feedstock and product-requirement assessment
- Laboratory or pilot expansion trials where required
- Process design basis
- Mass and energy balances
- Process flow diagrams
- Piping and instrumentation diagrams
- Equipment sizing and specification
- Three-dimensional plant layout
- Structural and access-platform design
- Electrical and automation engineering
- Hazard assessment
- Manufacturing and factory testing
- Installation supervision
- Commissioning and performance testing
- Operator and maintenance training
- Lifecycle technical support



Suitable Project Applications

- New tobacco-processing facilities
- Expansion of existing primary-processing lines
- Replacement of ageing expansion systems
- Capacity increases
- Energy and CO₂-recovery modernization
- Automation and process-control upgrades
- Project-specific research and development plants

Compact, Integrable Architecture

The ENDIET® plant can be arranged according to the available building height, floor area, material-flow direction and utility infrastructure.

Final footprint and building requirements are established during basic engineering.

Core Benefits

- Increased tobacco filling power
- Reduced blend density
- Controlled CO₂ impregnation
- High-rate CO₂ recovery
- Recipe-driven automation
- Compact plant architecture
- Project-specific engineering
- Integrated process-safety philosophy

CO₂ DRY ICE EXPANDED TOBACCO TECHNOLOGY



300 kg/h

NOMINAL CAPACITY
Scalable design basis

UP TO 96-98%

CO₂ RECOVERY EFFICIENCY
Closed-loop recirculation

AISI 304/316L

STAINLESS STEEL
Project-specific construction

AUTOMATIC & SMART

OPERATION SYSTEM
Low staffing requirement



ENDIET[®]

Engineering Greater Filling Power



Endemic is an R&D, process-engineering and industrial-technology company developing high-pressure processing, separation and advanced manufacturing systems.

Our capabilities extend from process development and mechanical design to automation, manufacturing, commissioning and lifecycle support.

[Request a technical consultation](#)



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