

Braden Systems For Gas Turbines



**BRADEN
MANUFACTURING, LLC**
A GLOBAL POWER EQUIPMENT GROUP COMPANY
®



Challenge Us To

Design & Engineer

Braden...The GT OEMs' First Choice

For the last 30 years, Braden Manufacturing has occupied a unique spot halfway between the gas turbine OEMs and the power producers. No other company has spent more time listening, learning, and working with both groups.



As a result, Braden has established itself as the most experienced and trusted name in the design of auxiliary systems for GT power plants. Turbine manufacturers acknowledge that no other company is better equipped to handle the challenges of GT plants:

- Air Filtration
- Inlet Cooling
- Silencing
- Exhaust & Inlet Ductwork
- Diverter Dampers
- Expansion Joints
- Bypass Stacks
- Diffusers & Plenums

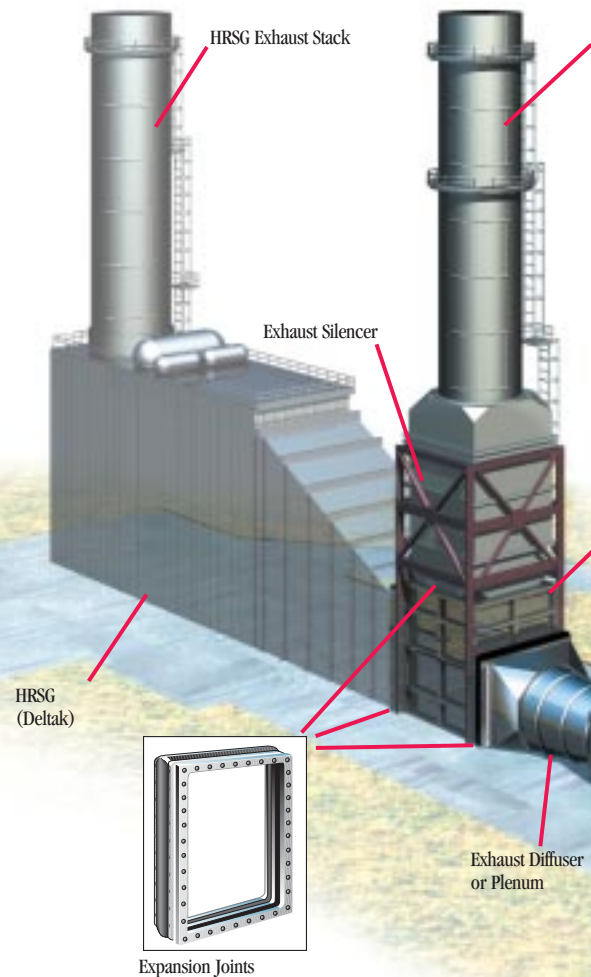
Site-Specific Design Goals



Every project begins with careful...listening. Listening to determine actual needs, so as not to over or under-design.

Overall design considerations (simple or combined cycle; turbine selection; site layout, etc.) are only the beginning. An analysis of plant site's weather data determines the inlet air treatment designs. It also influences material selection for various fabrications (e.g. stainless vs. mild steel).

Construction parameters are carefully developed. Transportation routes of pre-fabricated modules are fully-mapped out. Manufacturing sites, from Braden's extensive international network of fabricators, are selected based on technical expertise, proximity to the installation and any "local content" regulations.



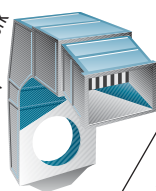
1923

Braden incorporates

1964

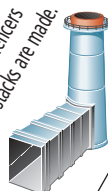
Braden becomes a fabricator of GT acoustical enclosures. Eventually Braden designs and fabricates enclosures for all major GT and generator OEMs.

1967



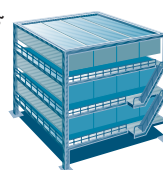
Braden begins engineering and manufacturing inlet ductwork and silencers.

1967



Braden's first exhaust silencers and stacks are made.

1967



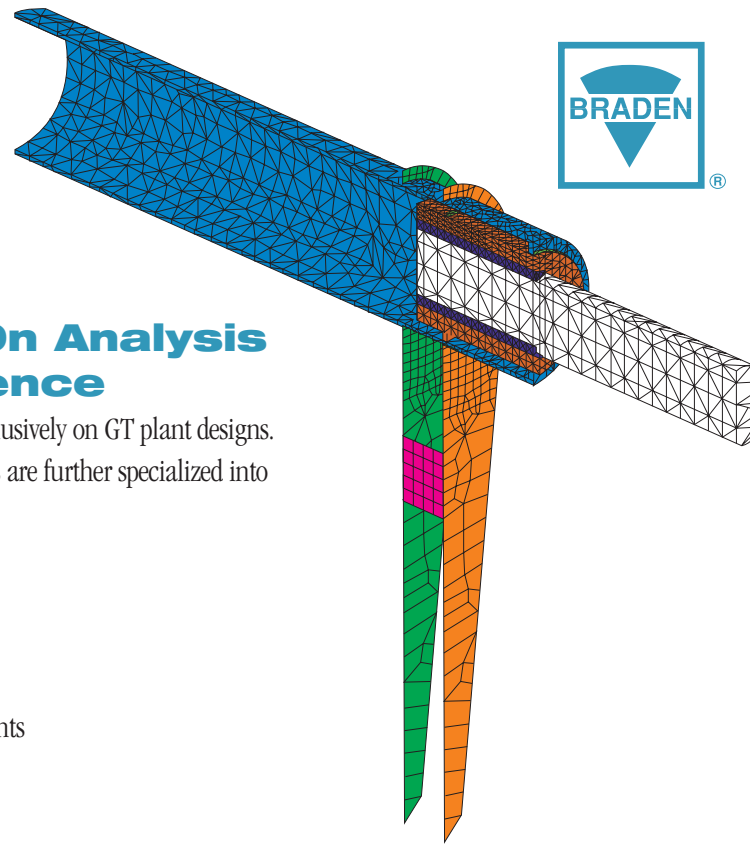
Braden manufactures its first filter house.

1967

Braden offers expansion joints.

1991

Braden opens its Fort Smith, Arkansas manufacturing facility, specializing in GT plant ductwork.



Engineering Based On Analysis & Real-World Experience



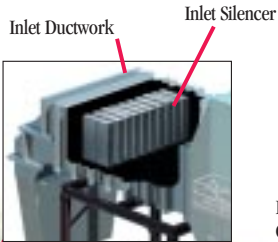
Braden engineers work exclusively on GT plant designs. The engineering disciplines are further specialized into system groups:

- Filter Houses
- Inlet Cooling Systems
- Anti-Icing Systems
- Ductwork/Expansion Joints
- Diverter Dampers
- Silencers
- Exhaust Stacks
- HRSGs (through our sister company, Deltak).

Exhaust Bypass Stack

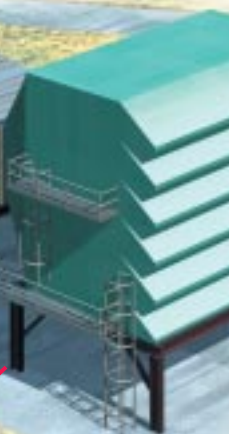


B.E. Diverter Damper



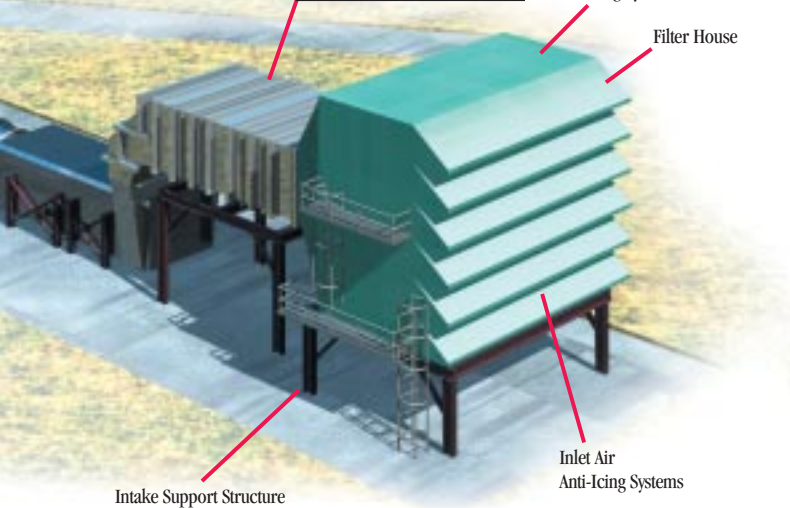
Inlet Ductwork

Inlet Silencer



Inlet Air Cooling Systems

Filter House



Intake Support Structure

Inlet Air Anti-Icing Systems

Braden's Toolbox:

- 3-D Solid Modeling of Complex Shapes
- Computational Fluid Dynamics (CFD)
- Structural Design Analysis
- Thermal, Buckling and Vibration Frequency Analysis
- Finite Elemental Analysis (FEA)
- Acoustical Testing and Analysis.

1992

Braden buys Metro Technologies, a major producer of diverter dampers based in Heerlen, Netherlands, and renames it Braden-Europe B.V.

1992

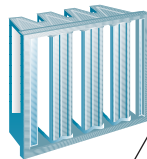
Braden develops internally insulated exhaust gas diffuser. Braden offers proprietary designed expansion joints.

1993



Braden introduces its GT static air filters product line and self-cleaning filter houses.

1995



Braden develops exhaust silencer panel designed to withstand thermal cycling of gas turbines.

1995

Braden receives patents for exhaust silencer panel design and exhaust gas diffuser interface.

1997

Braden expands its manufacturing capacity into Mexico.

1998

Braden's Fog Cooling introduced.

1999





Challenge Us To

Install or Retrofit

A La Carte Or Turnkey

Braden will install a single retrofit system, or build you an entire GT plant from scratch...it's your choice. Braden supplies the necessary financial and logistical data to help you decide on our level of involvement.



Assembly of rectangular exhaust stack.

On-Time, On-Budget, On-Target



Installation of Braden B-Flex expansion joint.

Braden's supervision of materials, procedures, and personnel means single-source responsibility for each construction event under contract. Our specialized construction knowledge base minimizes erection time and costs, and puts your plant on target to achieve peak power performance as quick as possible.

MANUFACTURING LOCATIONS

Argentina
Australia
Bahrain
Brazil
Canada



China
Egypt
Germany
Hungary
India
Indonesia



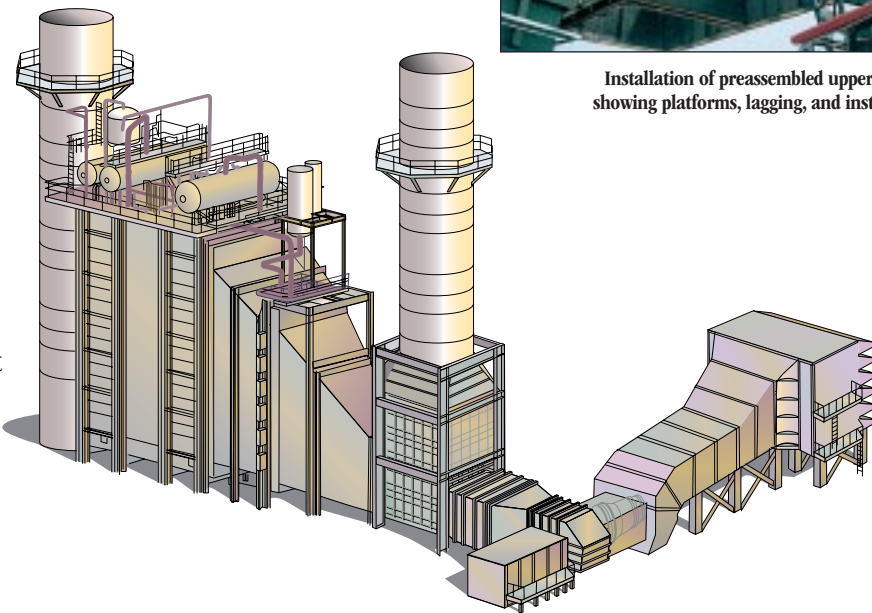
Korea
Malaysia
Mexico

Comprehensive Retrofit Solutions

Braden's full array of engineers (structural, mechanical, civil, electrical, control, and acoustical) scrutinize every aspect of your retrofit design.

A Partial List of Braden Retrofits

- **Filter Houses:** Projects range from reconditioning to redesigning. Supplemental air treatments, including: fog cooling, cooling coils, evaporative cooling, and anti-icing.
- **Ductwork:** Projects range from replacement with more appropriate alloys (e.g. stainless steel) to redesign for better airflow/performance.
- **Silencers:** Inlet and exhaust. Engineered using Braden's 30 years of silencing knowledge for quieter performance, reduced pressure drops, and reduced maintenance.
- **Duct Isolation Systems:** Design of modular components and installation of these isolation systems, including diverters, louvres, flap, and guillotine dampers.
- **Expansion Joints:** Oftentimes the "weak link" in ductwork transitions, expansion joints must be fully-engineered to withstand the stress of sudden thermal growth created by GT start-ups.



Exhaust plenum installation.



Installation of preassembled upper stack section showing platforms, lagging, and instrumentation.

MANUFACTURING LOCATIONS

Netherlands
Pakistan
Poland



Saudi Arabia
Spain
Taiwan
Thailand
Turkey
UAE
UK



USA (2)
Venezuela
Vietnam



Braden Air Inlet Treatments

- Filter Houses:
 - New & Retrofit
- Prefilters & Coalescers
- TriCel™ Barrier Filters
- ExCel™ Pulse Filters
- Fog Cooling
- Cooling Coils
- Evaporative Coolers
- Anti-Icing Systems



Braden's complete line of GT air filters includes prefilters with all-paper frames, prefilters with reusable all-plastic frames, and coalescing filters.



Braden has designed and fabricated hundreds of filter houses since 1970.

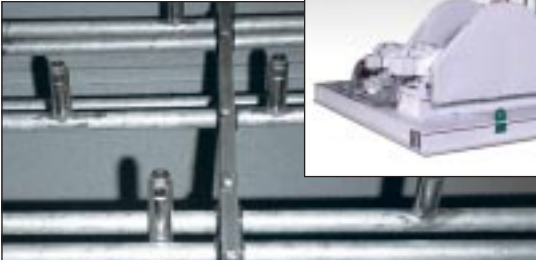
Braden's TriCel™ barrier final filter was especially designed for the rigors of GT operation. It's available in various efficiency ranges to offer the most economical match for your operating atmosphere.



Braden's ExCel™ Self-Cleaning Pulse Filter Systems offer fast, powerful cleaning with high filtering performance. Systems can include: filter modules with ExCel cartridges; clean air plenum; pneumatic systems; controls, electrical & instrumentation; weatherhoods with birdscreens; service platforms and ladders; and complete support structures.



Braden fog cooling systems are a series of stainless steel tubing arrays precisely distributing demineralized water under high pressure to specialized nozzles. The resulting tiny water droplets cool the inlet air, making it more dense, maximizing gas turbine power output. Braden uses extra heavy-duty stainless steel pipe manifolds with high integrity orbital welding.



This new project had already been designed when the customer requested additional bids for a fog cooling system. Braden stepped in (at the request of a GT OEM) to design, engineer and fabricate the system.



Braden offers all three types of cooling systems, including cooling coils, evaporative coolers, and fog cooling, so your application will receive an unbiased technical recommendation. Shown here is a Braden Filter House with barrier filters, cooling coils, louvres and anti-icing system.



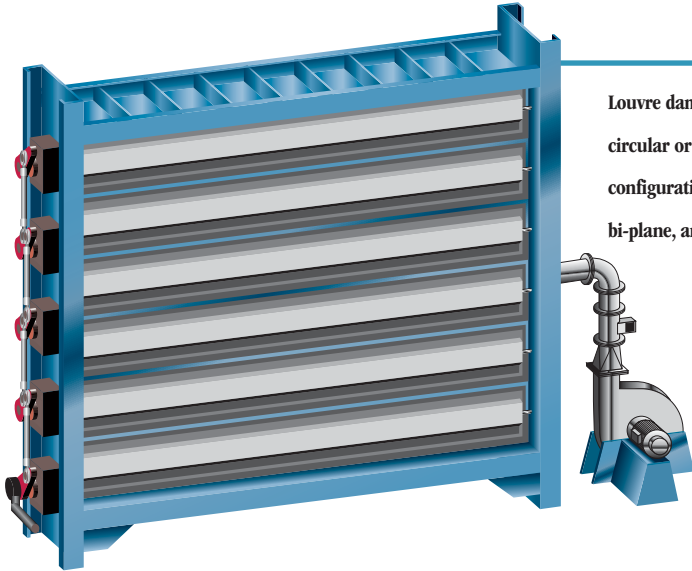
Braden-Europe's Duct Isolation Systems

- Diverter Dampers: Single & Triple Blade
- Louvre Dampers
- Flap Isolators
- Guillotine Isolators

A single blade diverter, featuring toggle linkage drive mechanism. Available for large frame gas turbines (unit shown here is 20.9' x 20.9' or 6.4m x 6.4m). Pivot drives are also available for diverters with inlet dimensions up to 16.4' x 27.8' (5m x 8.5m).

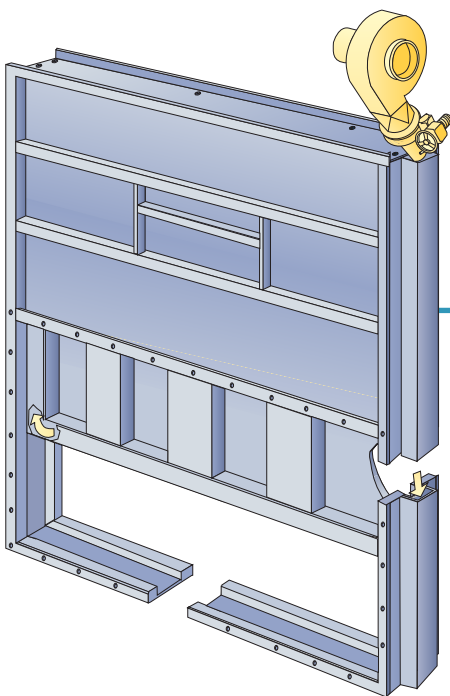
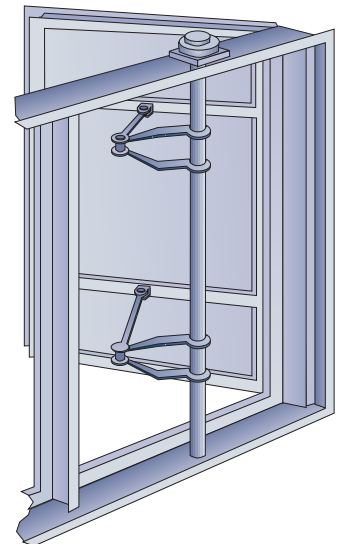
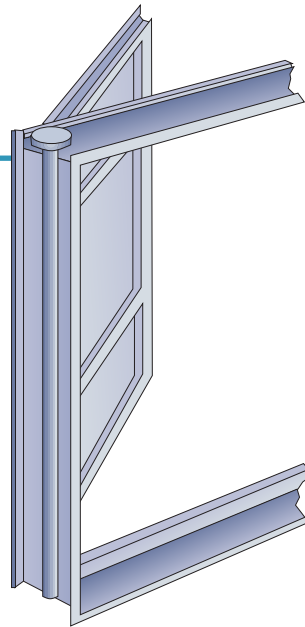


A triple blade diverter damper.



Louvre dampers can be designed to fit into circular or rectangular ductwork. Louvre configurations include single, parallel, opposed, bi-plane, and double-louvre with seal air.

Flap isolators are compact, lightweight and versatile, able to be configured for virtually all duct shapes and sizes, including round. Pivot drives (as shown on left side) are typically for small flaps, while toggle lever drives (as shown on right side) are for big flaps.



Guillotine designs vary from simple chainfall plate designs to fully-automated 100% gas-tight isolators. Typically specified for heavy-duty, gas-tight shut-off of ducts. Shown here is a special stiffened blade design for high differential pressures, ensuring blade flatness even with high temperature differential across the blade.



Braden Exhaust & Silencing Systems

- Rectangular Stack
- Round Stack, with Structural Support
- Round Stack, Free-Standing
- Silencers, in Vertical Stack
- Silencers, in Horizontal Ductwork

FS-9E inlet exhaust and silencing system.



50' tall LM6000 exhaust system,
Guyaquil, Ecuador.



125' tall round stack for a W501-D5 turbine.
Silencer panels are built into the horizontal
ductwork leading into the stack.



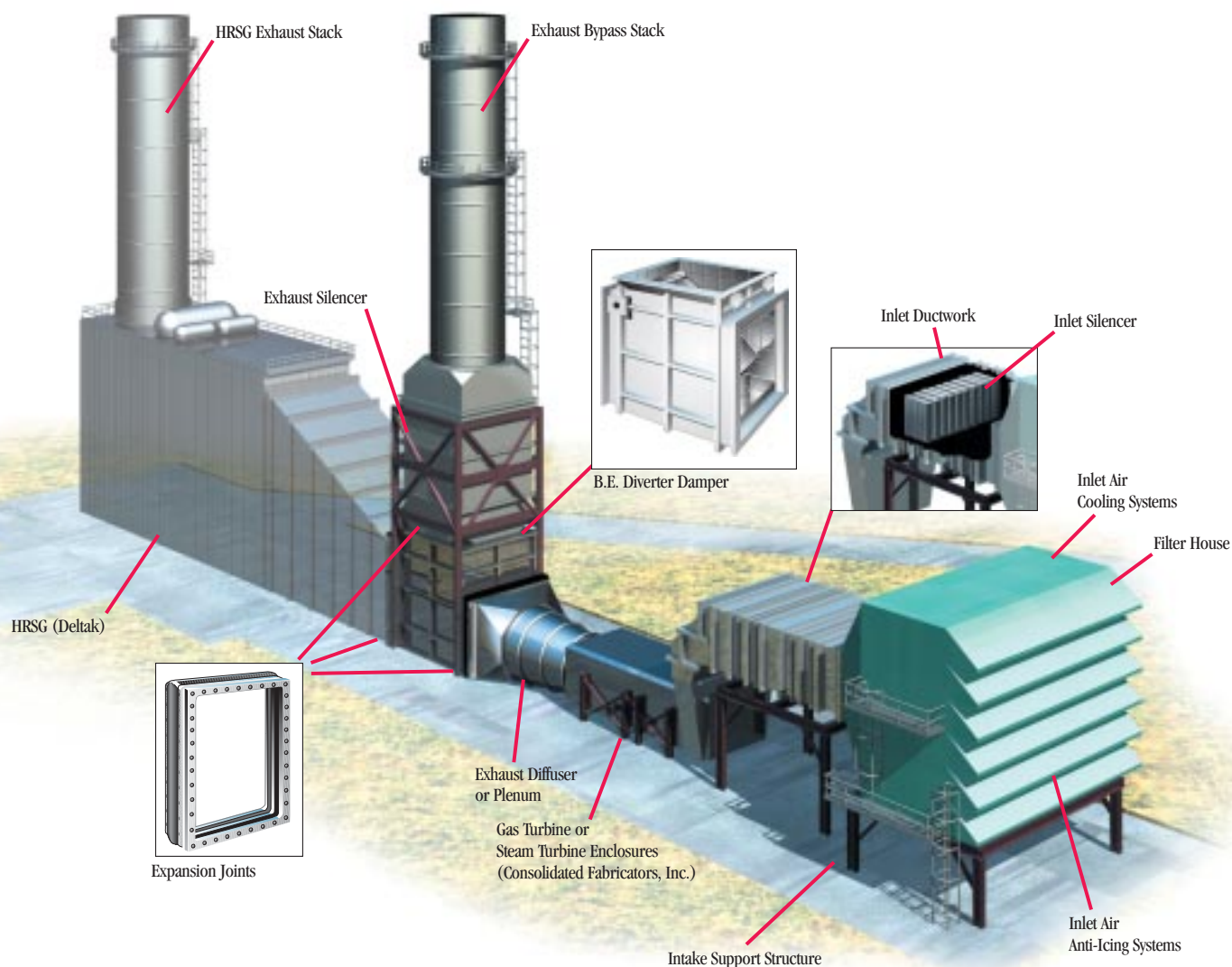
75' tall system for a V84.2,
designed for a low-noise site.



30' tall rectangular exhaust
for two W251 units in
Bali, Indonesia.



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