

Modernization Solutions

ThyssenKrupp Elevator's Geared to Gearless Systems

ThyssenKrupp Elevator Americas



ThyssenKrupp

A Transition of Excellence.

ThyssenKrupp Elevator's journey toward sustainability has shown that we can address today's needs without compromising the needs of future generations.

As America's largest producer of elevators, we have made tangible commitments to demonstrate leadership in corporate responsibility, including the development of sustainable products and practices. The largest impact we can have on energy reduction is through the modernization of outdated and energy inefficient technology one building at a time.

Through our gearless modernization process, we have reduced the environmental impact of existing elevators by eliminating waste, increasing energy efficiency and improving indoor environmental air quality. ThyssenKrupp Elevator innovated a safe and superior gearless system that benefits the passenger, building owner and manager.



Scan for additional resources, or visit our website at www.thyssenkruppelevator.com.



A Time of Progression.

Over 15-20 years of an elevator's life, it transports scores of passengers thousands of miles. Like any key feature within a building, elevator systems need to be safe, reliable, energy efficient and aesthetically up-to-date, no matter how many years they have been in operation. ThyssenKrupp Elevator offers you a gearless modernization solution that will exceed your expectations.

Our gearless modernization technology has many advantages, including:

SUSTAINABILITY

Lower energy cost through reduced power consumption

Energy captured and reused

Improved indoor environmental air quality

EFFICIENCY

Quicker floor to floor travel time

Increased reliability and longevity of your elevator system

INCREASED PROPERTY VALUE

Superior ride quality

Quiet environment—inside the machine room and cab

Cleanliness—machine room oil and dust elimination

THE EVOLUTION OF ELEVATOR TECHNOLOGY.

It is important to first understand where we have been in order to appreciate the advances we have made.

In the past, in order to obtain the required speed and precision control needed to move an elevator in mid- and high-rise buildings, a geared machine utilized a motor that rotated a worm gear, which in turn rotated a ring gear, connected to the drive sheave wrapped with ropes that moved the elevator. This system had a large number of moving mechanical parts that created friction. The heat from this friction resulted in lost energy—until now.

GEARED MACHINE

Controller

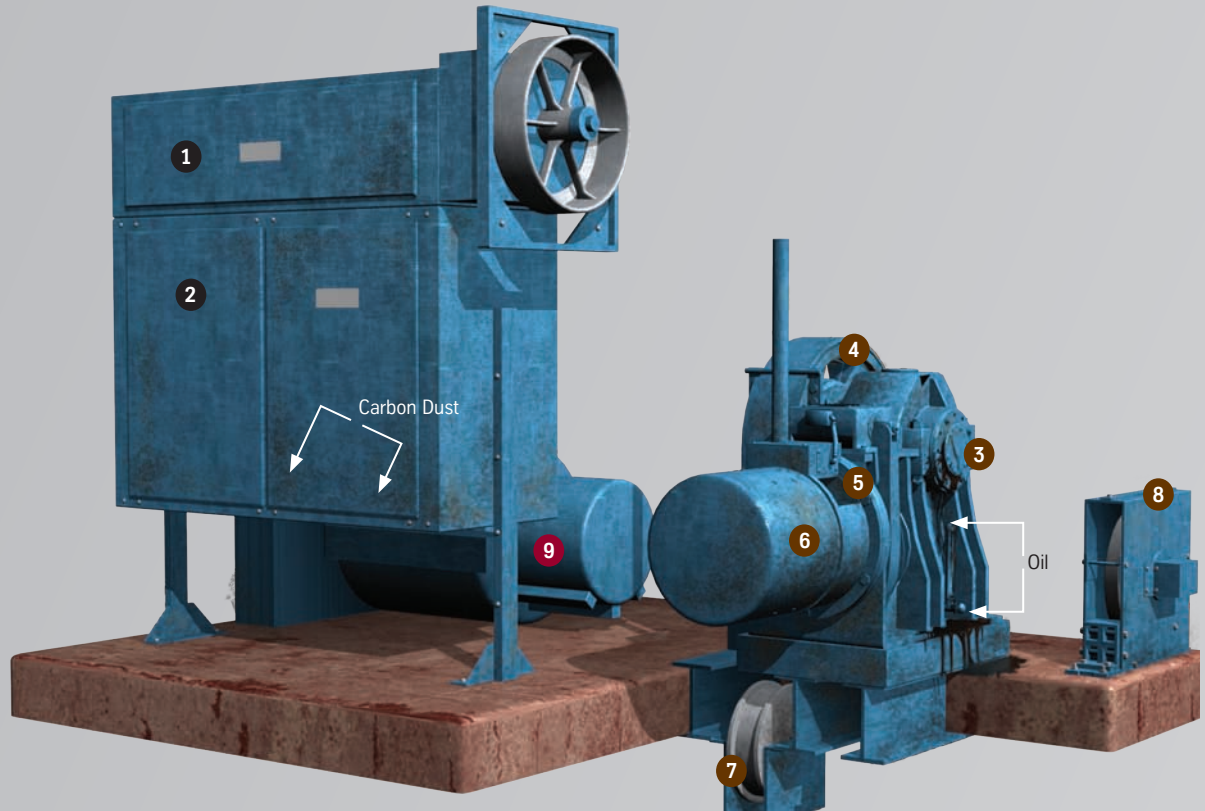
1. Selector—mechanical position and leveling system
2. Relay logic controller

Machine—Geared Technology

3. Worm and ring gear housing
4. Drive sheave
5. Drum brake
6. Direct current (DC) motor with carbon brushes
7. Deflector sheave
8. Governor

Generator

9. Motor generator set with carbon brushes



GEARED MACHINE—THE CHALLENGES

Relay Logic Controller

- Obsolete technology
- Hundreds of moving parts often need replacement
- Electromechanical relays produce heat
- Unreliable elevators aggravate passengers/building owners
- Large environmental footprint
- Leveling and positioning controlled by mechanical means
- Can lead to frequent shut downs; may require increased service calls

Machine—Geared Technology

- Worm and ring gear housing leaks oil and elevates energy costs; degrades ride performance with vibration
- Only 65%-70% of energy supplied is harnessed; the lost in energy creates heat, which increases air condition needs
- Carbon brushes create dust that contains pollutants; requires frequent replacement
- Requires petroleum-based lubricant
- Can lead to frequent shut downs; may require increased service calls

Motor Generator

- Carbon brushes create dust that contains pollutants; requires frequent replacement
- High heat and BTU output increase air conditioning needs
- Energy is wasted even when the elevator is idle
- Can lead to frequent shut downs; may require increased service calls

The gearless systems of today use a high efficiency motor directly integrated with the drive sheave—eliminating the geared drive assembly—which allows for 95% of the power to be harnessed. Our regenerative drives feed the energy produced back into the building's power grid. This system is both efficient and sustainable.

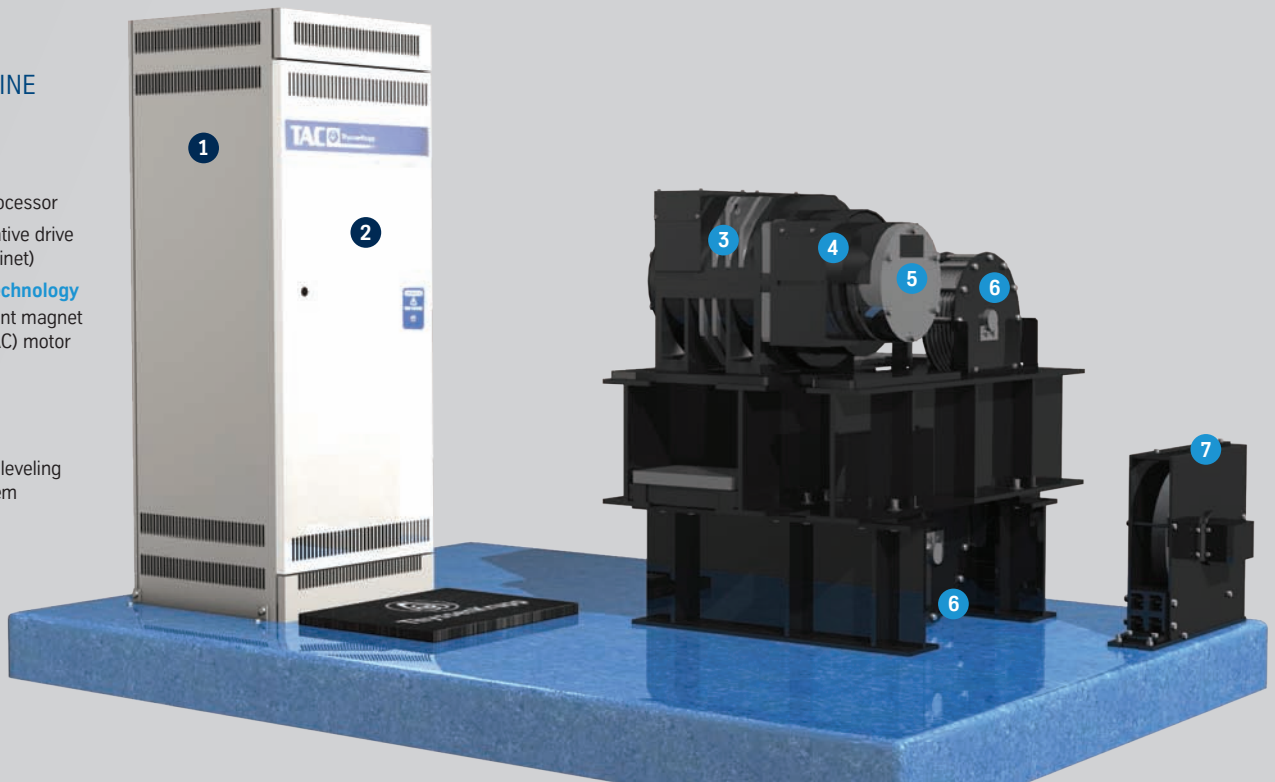
GEARLESS MACHINE

Controller

1. Controller—TAC Series, Micro-processor
2. Sustainable regenerative drive (Inside controller cabinet)

Machine—Gearless Technology

3. Direct-drive permanent magnet alternating current (AC) motor
4. Drive sheave
5. Dual brake system
6. Deflector sheaves
7. Governor with digital leveling and positioning system



GEARLESS MACHINE—THE BENEFITS

Controller—TAC Series

- Advanced technology, including micro-processor controllers, increases reliability
- Adjusts to high traffic buildings via technology that comprehends changes in patterns
- Self-diagnostics reduce downtime
- Requires less space
- Quicker floor-to-floor times
- Loadweigher technology eliminates stops when elevator is fully loaded

Machine—Gearless Technology

- Permanent magnet AC motor only runs when elevator is in use; significantly less energy is used
- Cleaner system; eliminates carbon dust
- Oil-free machine room
- Reduces heat; less air conditioning needed
- Direct drive technology maximizes energy efficiency
- Smooth ride with minimal vertical vibrations
- Better control and floor leveling
- Dual brake system provides additional safety features

Sustainable Regenerative Drives

- Replaces motor generator
- Harnesses unused energy captured for reuse in the building
- Reduces heat; less air conditioning needed
- Consistent performance
- Less space required
- Smaller environmental footprint

TRANSITION TO SUSTAINABILITY.

It is our vision to use our resources more efficiently, waste nothing and become better global stewards.

It is important for ThyssenKrupp Elevator to provide more sustainable customer solutions while educating our customers and partners on why sustainability is important. In general, our sustainable products and modernization processes increase the longevity of equipment, consume less energy, help lower energy bills and provide better air quality control.

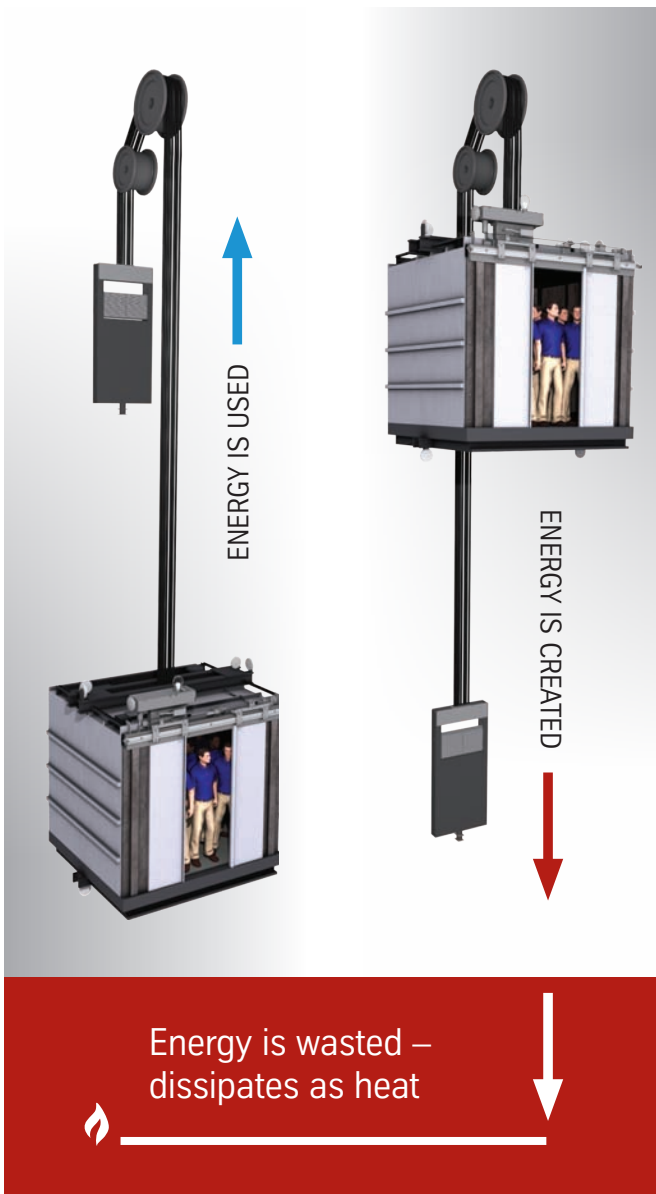
CREATING ENERGY THROUGH REGENERATIVE DRIVE TECHNOLOGY

Creating energy through regenerative technology increases your energy savings by transferring unused power back into the building's electrical grid to be reused throughout the location (Figure 2). Instead of requiring additional power, the building consumes the energy generated by the elevators—power that would have traditionally been dissipated via heat into the machine room (Figure 1). These regenerative drives help reduce the energy that was once used to cool the over-heated machine room.

SYSTEM WITHOUT REGENERATIVE DRIVES

When a loaded elevator rises, energy is needed. Naturally, when the machine lowers the loaded cab, the force of gravity generates energy. Without regenerative drives, this energy is wasted—it dissipates in the form of heat into the machine room.

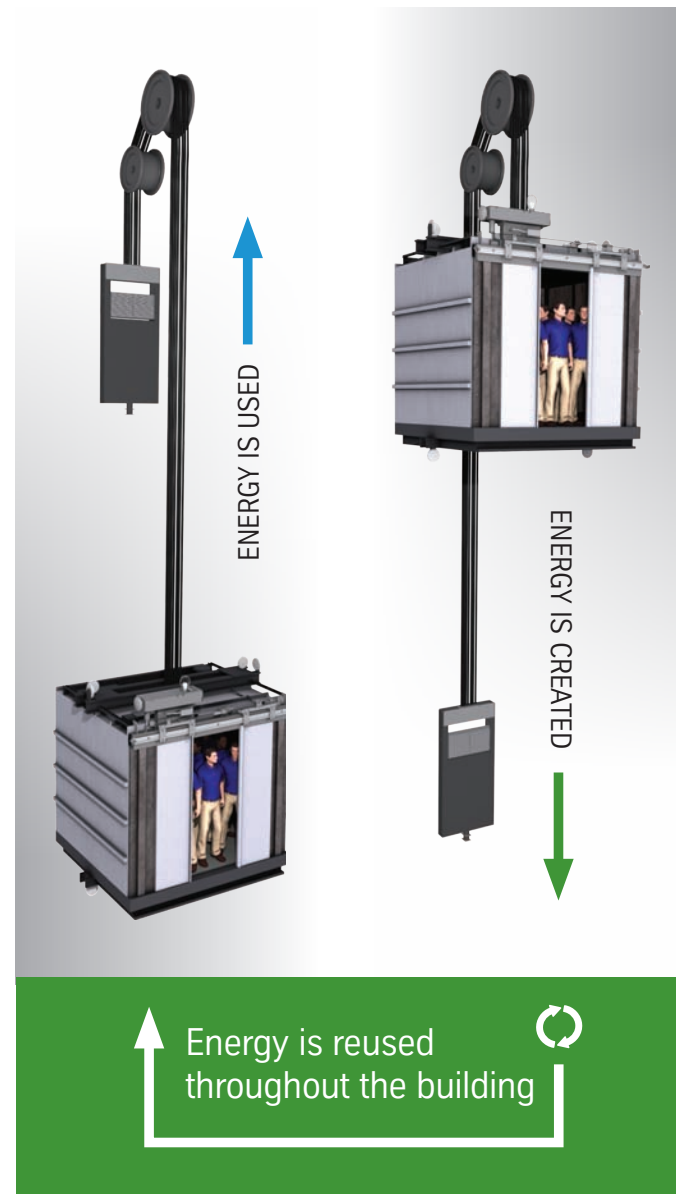
Figure 1



SYSTEM WITH REGENERATIVE DRIVES

With regenerative drives, the energy generated by lowering the loaded cab is captured and reused throughout the building—saving energy costs and helping ThyssenKrupp Elevator fulfill its sustainability mission and vision.

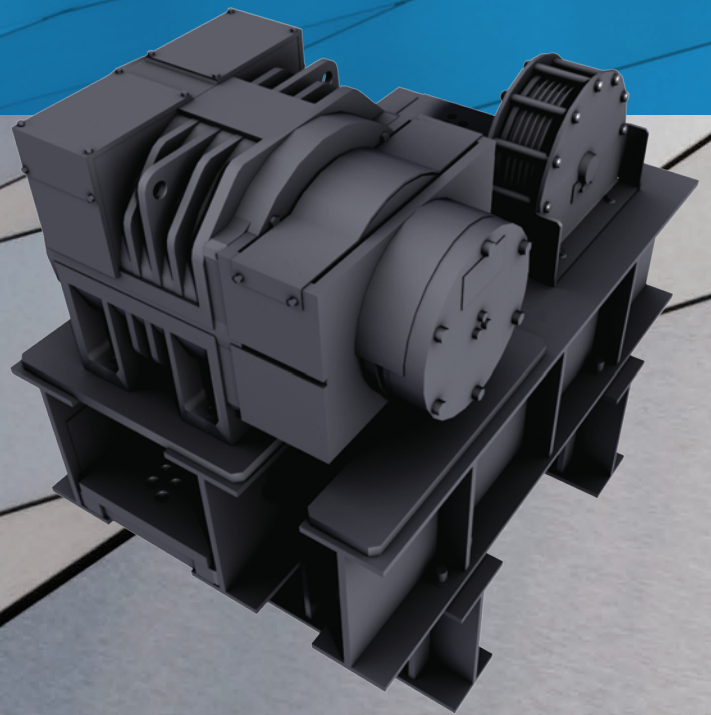
Figure 2



Advance to Gearless.

ThyssenKrupp Elevator's gearless modernizations are so advanced that we save you 25% over the industry average for every kilowatt used.

Our modernization experts will customize a plan that works best for you. We will remove your existing geared machine, controller and motor generator, one elevator at a time with minimal disruption to your building's traffic flow. Your facility will be modernized with the latest technology in micro-processor controls with advanced dispatching, an efficient AC drive system and today's compact gearless machines. The result is a seamless modernization with impeccable ride quality.



PERMANENT MAGNET MOTOR

At the heart of our gearless system is ThyssenKrupp Elevator's permanent magnet motor. This motor provides our customers with ultimate elevator performance in electrical efficiency, reduced vibration and improved ride quality and comfort.

A geared machine has to work much harder (900-1,800 revolutions per minute) to achieve the same speed as a gearless machine (80-240 revolutions per minute). The permanent magnet motor increases energy efficiency through the use of high-intensity earth alloy magnets. This design allows the elevator to draw power from its own energy fields and no time is wasted to achieve speed. Efficient acceleration and deceleration rates please passengers, who are reaching their destinations in a more timely manner.

INTELLIGENT EFFICIENCY

The intelligent TAC Series is a 32-bit micro-processor control system that processes data at record speeds. The TAC Series uses statistical information and advanced algorithms to provide the highest degree of flexibility in matching elevator performance to the changing characteristics of your passenger's demands.

BRAKING SYSTEM

A unique application of ThyssenKrupp Elevator's gearless machines are its dual brake system, which eliminates the need for additional components, such as a rope gripper. This system provides fail safe, smooth emergency stops.

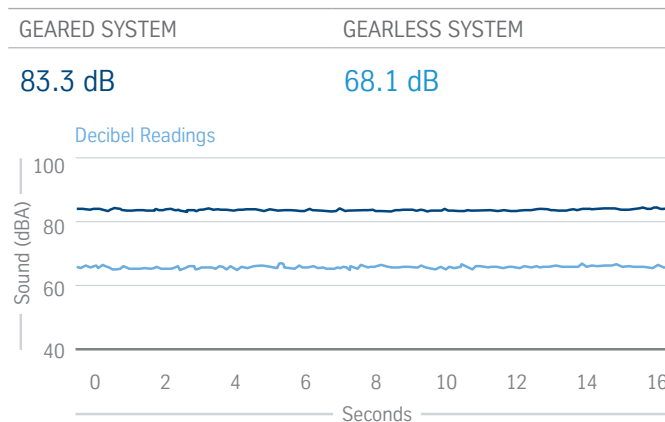
ROPING

ThyssenKrupp Elevator utilizes high quality, time tested steel ropes. Unlike belts made of rubber or other combustible materials, steel ropes will not catch on fire or require expensive monitoring to ensure fatigue failure does not occur. ThyssenKrupp Elevator's proven best practices provide your building with safe and reliable transportation.

MACHINE ROOM NOISE REDUCTION

According to American Speech-Language-Hearing Association, noise levels are measured in decibels (dB), with the lowest audible sound measured at 0 and the loudest sound possible reaching 194 dB.

DECIBELS (dB)	NOISE EXAMPLE
80-90 dB	city traffic, blow-dryer, kitchen blender
70 dB	busy traffic, vacuum cleaner, alarm clock
60 dB	typical conversation, dishwasher, clothes dryer
50 dB	moderate rainfall



IMPROVED RIDE QUALITY

Ride performance improved after the modernization process because vibration in the elevator was significantly decreased. Vibration is generated by an elevator moving through the shaft and changes in intensity during the acceleration, full speed and deceleration elements of each elevator ride. Elevator passenger are also generally subjected to a high frequency vibration generated by a primary source vibration through the rotating drive machinery which is transmitted into the elevator car by the suspension ropes. The ThyssenKrupp Elevator exclusive geared to gearless conversion allows an approximate **50% reduction in vertical vibration** through the elimination of the worm and ring gear.

RIDE PERFORMANCE COMPARISON

milli-g (mg) is 1 thousandth of gravity (g)

Type of Elevator	Vertical Vibration
Intermed./High Performance*	20-25
ThyssenKrupp Geared**	19-22
ThyssenKrupp Gearless**	10-12

* Standard traction elevator performance based on data from National Elevator Industry Inc.

** Performance achieved by ThyssenKrupp Elevator represents an approximate 50% improvement in vertical vibration through geared to gearless conversion.

BOTTOM LINE IMPACT.

ThyssenKrupp Elevator's gearless modernization solution is good for business. The new equipment is a sound investment and an environmentally responsible option for your building. Our gearless system generates value and efficiency while improving the overall experience for your passengers. This case study demonstrates how one project made the transition to excellence.

Case Study

Located on the Diamond Head end of Waikiki and just a short walk to the golden sands of Waikiki Beach, HYATT Place Waikiki Beach is a spring board to many activities and attractions for visitors on the go. In 2011, the 33-year-old, 20 story ocean resort underwent an extensive renovation, including an overhaul of their elevator system. The hotel remained open during its renovation and it rebranded itself as HYATT Place. Catering toward business travelers and families, the HYATT Place required a reliable and efficient elevator system.

Comfort, sophistication and technology came together in perfect balance for the newly modernized elevators at HYATT Place.



This photo is not an actual photo from the Hyatt.



THE CHALLENGE

- Modernize control system, hoist motor, generators, drive, signal fixtures and cab interior of two, 33-year-old elevators
- Deliver smooth, efficient ride quality for hotel guests and employees
- Provide a cost-effective, energy-efficient system
- Complete the modernization with minimal interference to hotel guests

THE SOLUTION

To obtain the latest in today’s technology, our modernization specialist suggested:

- Converting from geared to gearless operation
- Utilizing an alternating current (AC) motor in place of the existing direct current (DC) motor
- Adding regenerative drive technology
- Upgrading to a highly intelligent TAC Series micro-processor controller
- Incorporating LED cab lighting

THE RESULTS

56% reduction in elevator electrical consumption

86% energy improvement with use of LEDs in lieu of traditional lighting

39% improvement in power factor

42% ride quality improvement

Overview of Improvement:

	EXISTING EQUIPMENT	EQUIPMENT AFTER MODERNIZATION
Machines	Geared	Gearless
Motors	20 HP DC	Permanent magnet AC motor
Generators	15 HP DC	Removed (no longer necessary)
Controllers	Relay Logic	ThyssenKrupp Elevator TAC50 with destination-based software and regenerative drive technology
	Group Controllers	Removed (no longer necessary with the TAC50 advanced communication algorithms)
Lighting	Incandescent	LED
Cab Interior Hall Fixtures	Outdated & worn	Modern cab and hall fixtures, low VOC-emitting material
Elevator Code	Not up to code	Up to code according to equipment design safety compliance and life safety compliance standards

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