



# Starvert iS7

## High Performance AC Drive

3Φ 200V: 0.75kW~75kW  
3Φ 400V: 0.75kW~375kW



### Powerful Performance

- Ride Through for the sudden power failure(Kinetic Energy Buffering)
- PM Sensorless Vector control for PMSM



### Various Options

- Profibus-DP, DeviceNet, Lonworks, Ethernet-IP, CC-Link, CANopen, Modbus-TCP, Rnet communication option
- Extended I/O , PLC card option, Encoder card option, etc..



### User & Environment-friendly

- Wider LCD Keypad and User & Macro Group
- Built-in EMC Filter for reducing electronic distortion
- Built-in DC Reactor for harmonic reduction and PF improvement

## Specification

Item		Description
Control	Control Mode	V/F, V/F PG, Slip Compensation, Sensorless Vector-1, Sensorless Vector-2, Vector Control
	Frequency Setting Resolution	Digital Command : 0.01Hz Analog Command : 0.05Hz (Max. Frequency : 60Hz)
	Frequency Tolerance	Digital Command : 0.01% of the Max. Frequency Analog Command : 0.1% of the Max. Frequency
	Run/Stop Type	Keypad / Terminal / Communication
Operation	Frequency Setting	Digital Command : Keypad Analog Command : 0 ~ 10[V] / -10 ~ 10[V] / 0 ~ 20[mA]
	Functions	PID, Auto-tuning, Auto-restart, Kinetic Energy Buffering, Flying Start, Low leakage Operation, etc.
Input	Digital Inputs (8)	Selectable between NPN (Sink) / PNP (Source) Definition : Run/Stop, Reset, External Trip, DC Brake, 3-Wire, Up-Down, etc.
Output	Run/Stop Type	State of Drive
	Frequency Setting	Below DC 24V 50mA (N.O., N.C.) Below AC250V 1A, Below DC30V 1A
	Functions	0 ~ 10 Vdo (Below 10mA) : Selectable between Frequency, Current, Voltage and DC Voltage

## Application

### Theater System



### Overall

- Drive controls flying batten which carry Lights, Flags, Stage boards move vertically

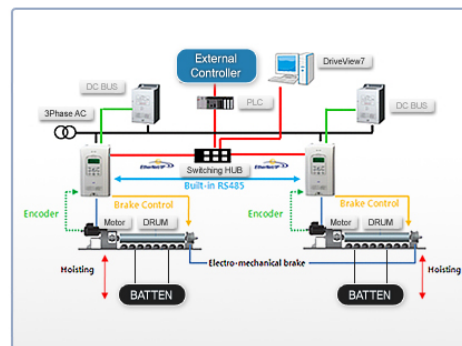
### Features

- Regenerative energy from the heavy loads has to be controlled
- Depending on the situation, single position control or proportional position control are required

### Requirements & Solution

- Electro-mechanical brake control
  - iS7 Brake Control Function
- Zero-speed Control
  - iS7 Vector Control Mode
- High-speed Communication
  - iS7 Ethernet-IP Option
- Position Control
  - iS7 Position Control Option

## Configuration



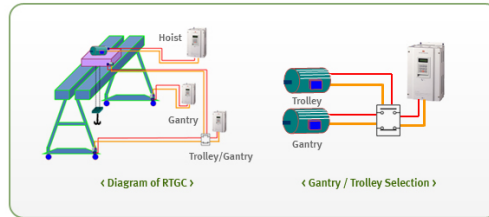
# Crane Applications

RTGC/Overhead Crane

- Among the various types of cranes, the representative Cranes that are applicable with Inverters are Overhead Cranes, Gantry Cranes, Tower Cranes and others
- Overhead Crane and RTGC(Rubber Tired Gantry Crane) Applications

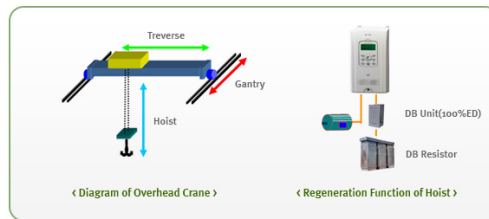
## RTGC(Rubber Tired Gantry Crane)

- The RTGC is a representative Harbor crane which has rubber tires that enable the crane to move freely at the yard. The RTGC has to be resistant to noise problems as it has no ground connection
- **Power optimization function to improve system efficiency**
- **Selection of Gantry or Trolley motor by communication**
- **Improvement of Power quality and Noise characteristics with PWM converter**
- **Torque enhancing and monitoring functions to improve start-up performance**



## Overhead Crane

- Generally used to move materials or products from one place to another in factories. The shape and size of the hook tends to vary according to the material to be relocated.
- **Hoisting, Traversing, Travelling Drive**
- **Travelling Drive: Multi motor control by one inverter**
- **Hoisting Drive: Powerful torque requirement and Mechanical brake control**
- **Powerful Regeneration capability: 100%ED Dynamic Brake Unit**



## Application case

### RTGC(Rubber Tired Gantry Crane)

#### Facility

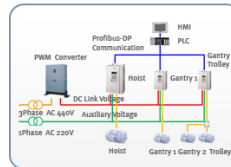
AMobile type Crane used to load trucks with containers or move containers from one place to another in port facilities

#### Applied Products

- HMI(InfoU) 1Set, PLC(XGR) 1Set
- PWM Converter 1EA, Inverter 3EA, Motor 4EA

#### Key Functions

- Crane Optimized functions: Power optimization, Torque enhancing, Multi motor Control functions
- Adoption of PWM Converter for Noise characteristics
- Profibus-DP Communication for Credibility
- IVS Sensorless Vector Control



### Overhead Crane

#### Facility

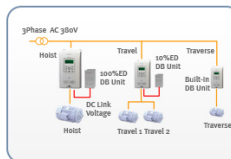
Rail Fixed type Crane are installed in factories to Load and Unload trucks or move goods from one place to another

#### Applied Products

- Inverter 3EA, Motor 4EA

#### Key Functions

- Mechanical Brake Control
- 100%ED Dynamic Brake Unit
- Multi motor control for Travelling
- IS7 Sensorless Vector Control

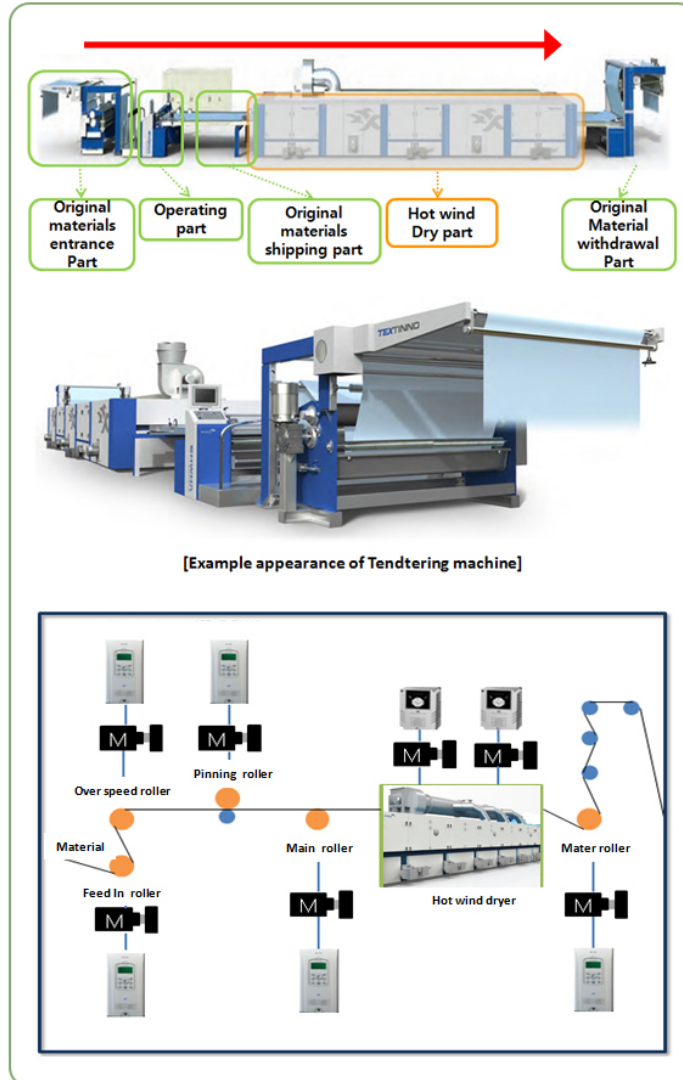


# TENDTERING APPLICATIONS

## • What is the Tendtering?

- Tendtering is to do various resin processing (PP processing, anti-fouling processing, water repellent, flame retardant processing) to enhance the product value, increase the perfection of processing materials and improve the shrinking, wrinkling that occur during the machine processing of a workpiece. During textile processing if the fabrics pass through the wet process such as scouring, bleaching, dyeing, processing lots of shrinkage for the width direction is happened due to the tension for the direction of slope. Tendtering is the process that giving some kind of power to correct the fabrics with returning to original width.

## • System composition of Tendtering machine



## • Facility Outline

- Progress for process the materials: Material Entrance part, Operating part, Material shipping part, Hot wind dry part, Material withdrawal part

## • Principle of working

- Feed In roller : Transfer the entered material to the overfeed roller
- Overfeed roller : Transfer the material to the main roller  
Extend the material using the speed difference
- Pinning roller : Press the material
- Main roller : Transfer the material to the Hot wind dryer
- Master roller : Withdraw the material from the hot wind dryer

## • Applied products

- Inverter: IS7: EA, IG5A: 2EA, Induction Motor: 7EA  
※ The number of the applied products depend on the progressing machine

## • Mainly applied functions

- Auto Retry after releasing Trip
- Frequency Detection (FDT)

# Press Applications

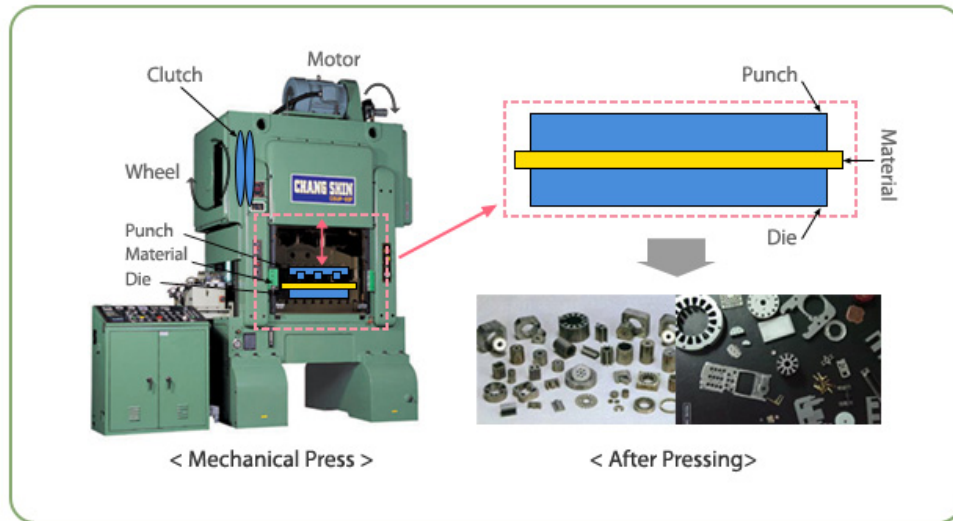
## • Press applition

The machine that press raw material and made up some small components

## • System feature

- When the punch impacts against the die, almost 200% of drive rated current could occur
- When the punch goes up after impact, motor generates power (Over-voltage)
- Due to the reason above, press need Dynamic Braking Unit and Dynamic Braking Resistor
- Too much frequent operation will affect the life time of DBU, DBR

## • Main Functions



# Bolt Former

## • Summary

The machine that press raw materials and made up bolts.

## • Applied product

IS7-55kW 1ea

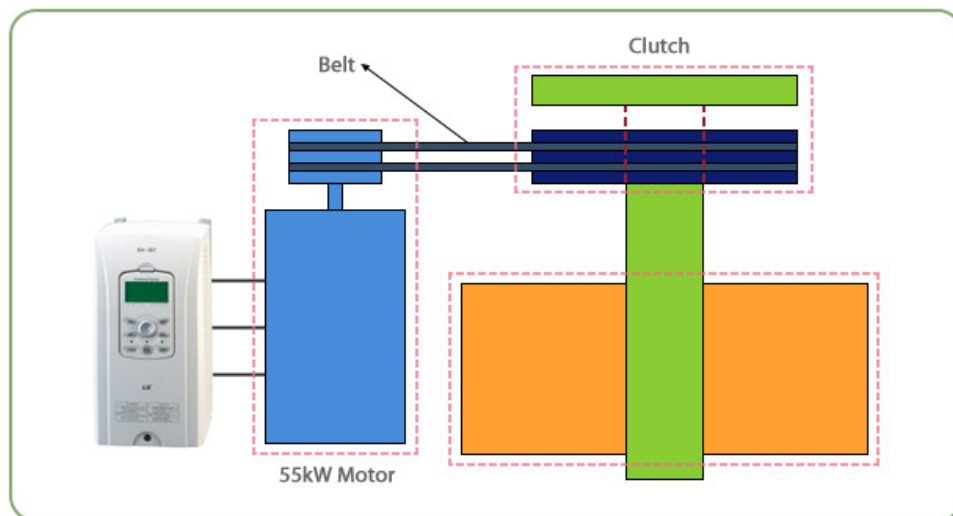
## • Key function

### 1) Sensorless Vector Control

- Sensorless mode make out current stable

### 2) Regeneration avoiding

- IS7 have function to control regenerative voltage
- When motor generates energy, IS7 accelerates motor to consume the energy from the motor
- Effective DC voltage control decrease DBU operation time
- Life time of DBU, DBR could be long than existing system



# Rod Pump Solution Using LS Drive

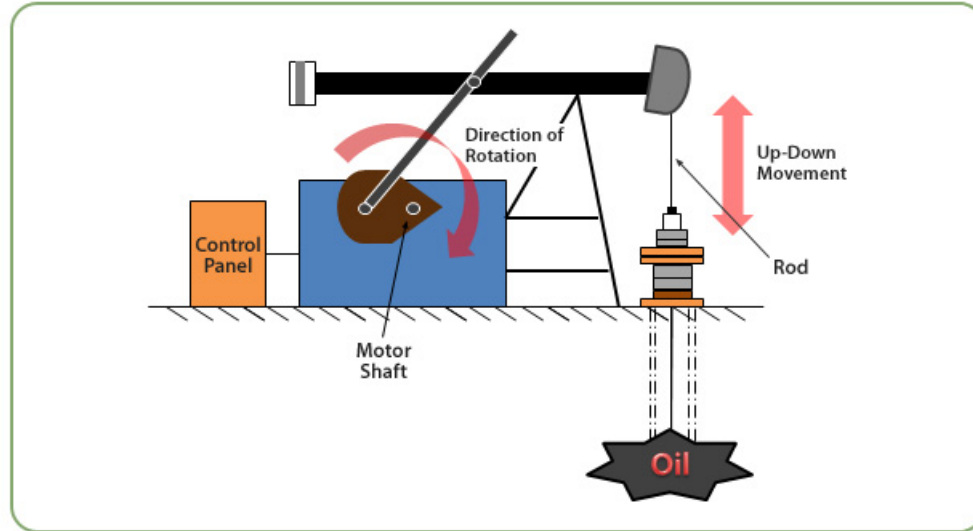
## • Rod Pump System

A transferring system of motor to make up and down movement of rod.

## • System Characteristics

- 1) A bar is connected on the end of the rotary plate, and when the motor starts running, the rod starts moving up and down.
- 2) When the rod moves to downward direction, regenerative energy occurs. Methods of preventing overvoltage should be used.
- 3) On the initial run, high torque is needed due to high viscosity.
- 4) High energy saving can be possible due to variation in viscosity.

## • System Diagram



## • Adapted Application

Oil Pump

## • Requirements

Issue & Requirements	LS Solution
High Torque on Low Speed Area	Sensorless Vector Control INV
Noise & THD Reduction	DC Reactor, EMC Filter embedded Drive INV Embedded Option
Cyclical Regenerative Energy Control	Regeneration Evasion Function INV
OC&OV Prevention while Acc/Dec	Stall Preventing Movement INV
Protection when Mechanical Damage	Light Load Alarm Selection INV

## • Applied Product

IS7 45kW (60HP) – NOFD Type

## • Adapted Function

- 1) **Sensorless Vector Control**
  - Requirement of torque were matched in high viscosity and low speed area.
- 2) **Regeneration avoiding**
  - Speed were raised in regenerative period to avoid overvoltage trip.
  - By controlling DC-Link effectively, additional DB Unit and Resistor would not be used.
- 3) **Stall Prevention Function**
  - Output current are controlled under given value while accelerating and on steady speed.
  - Voltage can be controlled under overvoltage level when decelerating.
- 4) **Light Load Alarm Function**
  - When the rod is damaged, drive would notice by the difference in load rate.
  - By setting the minimum load level, drive can stop running to prevent more damage.

## Application

# Paper mill Application

### Paper machine

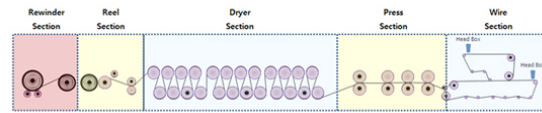
- Paper machine is a machine to produce a paper using mixed materials and continuous process system to control of tension with each section.

#### •Paper machine

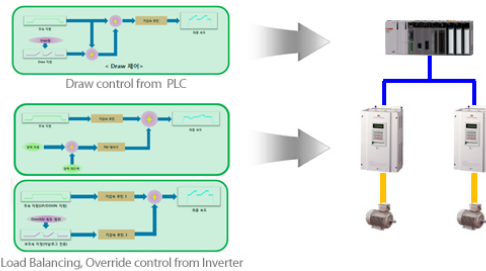
- A machine to produce a paper and is composed of Wire section, Press section, Dryer section and Reel section. Line speed is faster and faster with following stage and PLC controls it. Inverter controls tension with Load Balancing Algorithm.

#### •Way to control of Paper machine

- Draw control: Tension control with section
- Load Balancing control: Torque control of processing Loads
- Override control: Pressure control of Fan-pump



< Diagram of Paper machine >



## Example of Paper machine

### •Facility

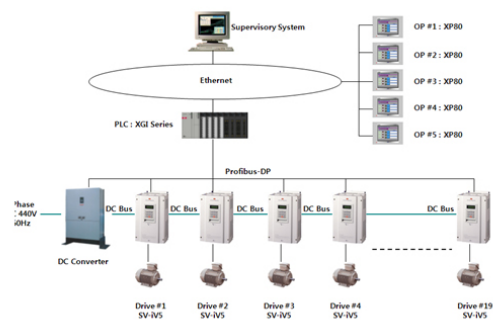
- Paper machine to produce a paper

### •Applied Products

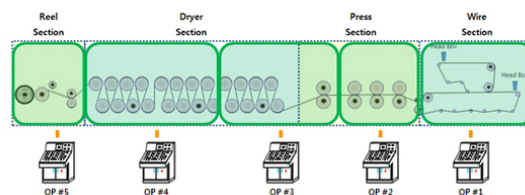
- DC Converter 1set, PLC(XG) 1set, HMI(XP80) 5set, Inverter(IVS) 19ea, Motor 19ea

### •Key Functions

- Draw control: Tension control with section
- Load Balancing control: Torque control with processing Loads
- Override control: Pressure control of Fan-pump



< Diagram of Control system >



< Diagram of Paper machine >



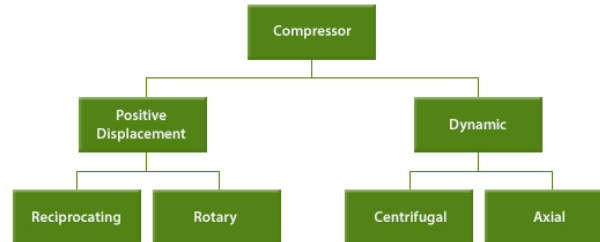
## Application

# COMPRESSOR Solution Using LS Drive

## 1. COMPRESSOR

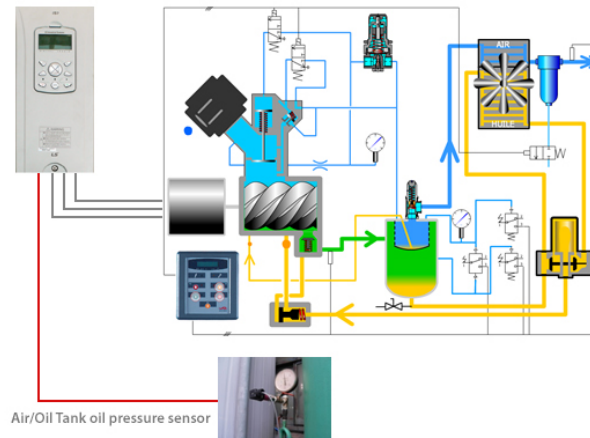
Compressor is a device that makes the pressure of gas more high level than current condition. Firstly, converting the electrical energy into mechanical energy by a motor then, compresses the gas by mechanical power. Finally, it makes work with the compressed air.

## 2. System



- Reciprocating** A reciprocating compressor or piston compressor is a Positive-displacement compressor that uses pistons driven by a crankshaft to deliver gases at high pressure
- Rotary** They are commonly used to replace piston compressor where large volumes of high pressure air are needed, either for large industrial applications or to operate high-power air tools such as jackhammers
- Centrifugal** Centrifugal compressors, sometimes termed radial compressors, are a sub-class of dynamic axisymmetric work-absorbing turbomachinery.
- Axial** Axial compressors are rotating, airfoil-based compressor in which the working fluid principally flows parallel to the axis of rotation. This is in contrast with other rotating compressors such as centrifugal, axi-centrifugal and mixed-flow compressors where the air may enter axially but will have a significant radial component on exit.

## 3. System Diagram



- Machine** Air/Oil compressor
- Key Function** Screw rotor should be filled with oil and then compressor will be started. Although motor rotate, it cannot compress air because oil is not filled in the screw rotor when compressor start up
- Solution** By using Pre-PID function, it can use PID function after proper pressure should be fed back.

## 4. Applied Product

INVERTER IS7

## 5. Key Function

- Pre-PID** Pre-PID is useful at screw compressor. In such application should need an oil filled before start  
In order to fill the oil into screw compressor after starting drive, Pre-PID will react in the form of open loop
- Sleep and Wake-up function** Sleep and Wake-up function can stop drive's operation in low weighted load situation. And if the load is restored to a normal situation, drive will restart. This mechanism ultimately brings energy saving result of entire system.

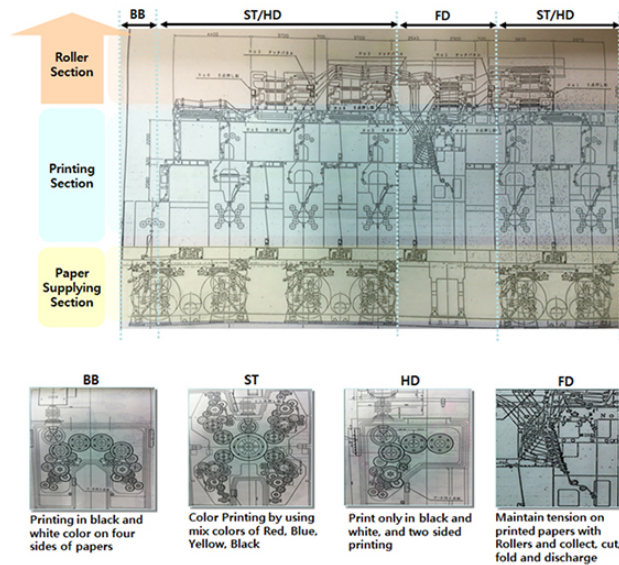
## Application

# ROTARY PRESS MACHINE

## 1. Rotary Press Outline

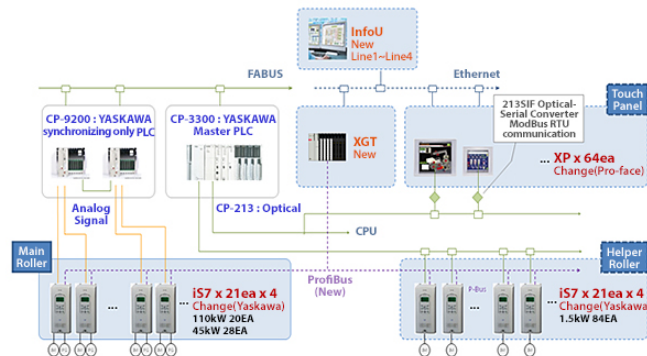
- Machine which is printing on the papers among the fast turning cylinders. Its printing plates are installed in shape of cylinders and these cylinders turns so fast that can print.
- Rotary Press Machine can be classified into two categories. They are the shaft system machine whose shaft is connected to a long shaft and shaftless system machine which is needed high resolution pulse's Input/Output and specific synchronized speed control (Vector Control) without shaft.

## 2. Rotary Press Composition



- Feeding paper on the first time, along to the moving path, System is composed of Paper supplying, Printing, Roller sections.
- Make a Master of the FD, BB, ST and HD are operated in synchronized speed.
- Motor which is in the Roller part can be controlled by FieldBus communication.

## 3. Control System Composition



- IS7(High pulse Line Drive Input/Output type vector control): Precise synchronized speed control
- (110kWx5ea, 45kWx7ea, 1.5kWx21ea)x 4 sets
- InfoU-XGT-XP Panel : Ethernet communication

## 4. Inverter's Main Function

- Sensored Vector Control
  - High responsive, precise speed control is possible with Encoder(PG)-attached motor
  - Sensored vector mode's control features are way better than those of V/F control or the others and control features of servo machine can be realized.
- ASR Gain Control Function
  - By adjusting P-Gain and I-Gain of ASR, Synchronize response speed among each controller.
- Run Enable Function
  - If order is entered, inverter output is blocked, motor Free-runs and if order is cleared, it restart.
- ZSD(Zero Speed Detection) Function
  - This is a function that hold the motor stopped at any place



## KEB Applications



### Instant Power Failure

Power disturbances due to instant power loss, temporary voltage drop, power disconnection

Inverter DC-Link Voltage reduced due to shutdown of power input

Within hundred msec. Low Voltage Trip will occur and the inverter's output will be cut off

After disconnection, motor continues to rotate due to inertia

If continuous operation is required, process loss occurred

Solution

**What is a LS Solution?**

### KEB : Kinetic Energy Buffering

In case of power failure, until power is restored KEB function is operated by using the regenerative energy produced from the inertia of the load. Therefore, it is allowed to keep the DC-Link voltage up to a point to maintain the inverter to operate.

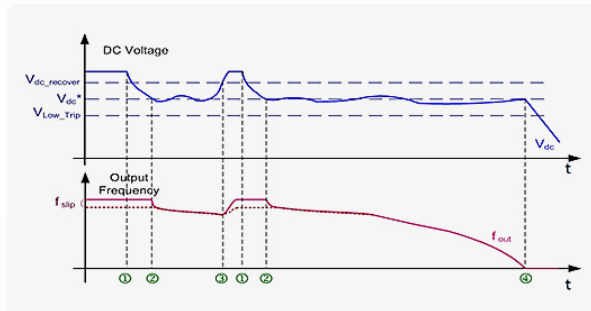


### Ride-Through Process

- DC Link Voltage can be maintained by using the regenerative energy, due to the load inertia.
- When the power is back, the Inverter operates at the state right before the power loss.

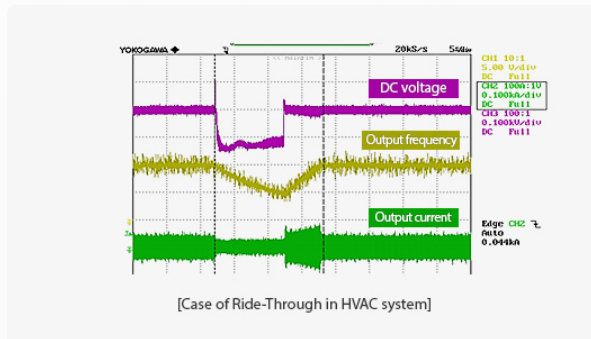
### Safety-Stop Process

- DC-link voltage is maintained by the regenerative energy produced by the inertia of the load.
- Slows down the operating frequency of the inverter to perform a stable stop.



### Ride-Through Applications and Equipment

- Load system with large inertia such as fans in HVAC
- Production lines that require continuous operation such as semiconductor HVAC and LCD lines.
- Equipment that require continuous process in an unstable power supply

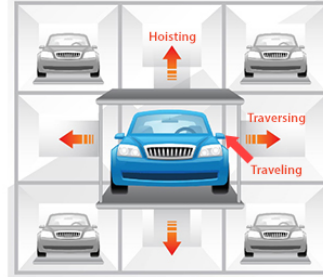


## Application

### Car Parking Systems

#### 1) Overview

- Secure car parking systems by traveling, traversing, hoisting.
- Parking systems are variable like elevator type, cart type and so on.
- Cart type parking system.



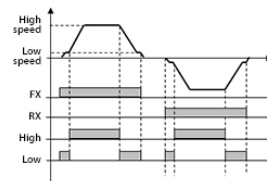
#### 2) Requirements & Solutions

Issues & Requirements	LS Solutions
High torque at low speed	V/F Control : Torque Boost (IS7)
	Sensorless & Sensored Vector Control (IS7, IV5)
Low Speed & High Speed Control	Multi Step Frequency & JOG
Stable stop with minimum vibration	S-Curve Function
Brake control for fall protection	Brake Release Control Function

#### 3) Key Functions

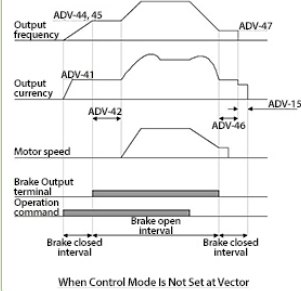
##### [Multi-step Frequency & S-curve]

- Stable speed control by low & High speed
- Low speed area for stable stop
- Minimum vibration using S-curve function



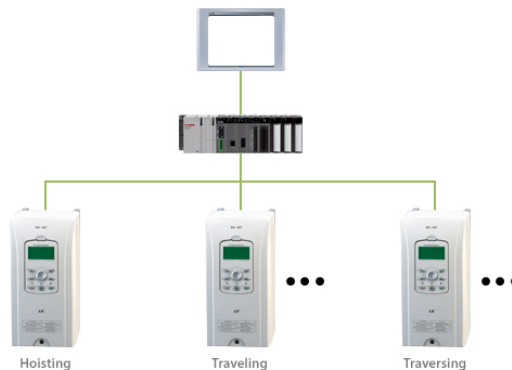
##### [Brake Release Control]

- Brake open & close using digital output signal
- Digital Output : 'BR Control'



#### 4) Cart Type Parking System Application

- HMI : XP50
- PLC : XGB-M04A, XGP-ACF2, XGK-CPUE, XGL-CH2A, XGI-D22A, XGQ-TR4A
- Drive : IS7



## Application

# Drop Lift Application

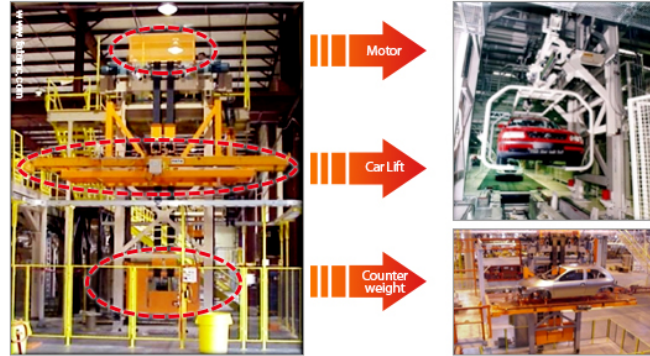
### 1. Drop Lift System

One type of a lift application where in a manufacturing process a drop lift is used to lift the object up or down. (example: automobile manufacturing line)

### 2. System Characteristics

- 1) The process where automobile parts such as car frame, engine, doors, etc are moved from floor 1 → 2 / floor 2 → 1
- 2) Regenerative energy either exists or do not exist at all  
(Down operation with load and empty load up – Regenerative energy exists  
Up operation with load and empty load down – No regenerative energy)
- 3) DBU and DBR is recommended process regenerative energy

### 3. System Structure



# XX Motor Company D/L Application

### 1. Summary

One type of application in an automobile production plant where it is used to deliver the frame of the car, modules, or engines etc. up or down in the manufacturing process.

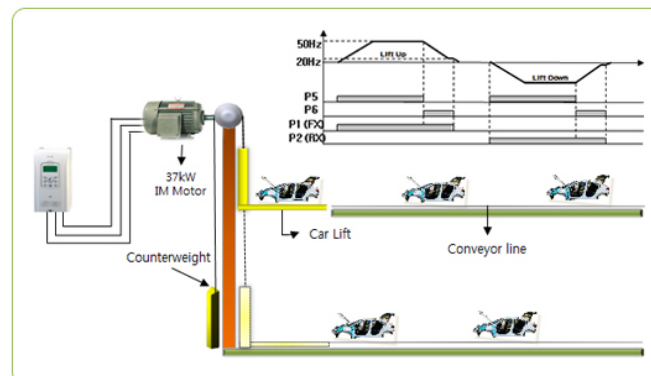
### 2. Applied Product

SV0370IS7-4NO 1ea

### 3. Applied Functions

	DRV group	Setting	DRV group	Setting	DRV group	Setting	DRV group	Setting
Parameters	09: Ctrl Mode	V/F	50: Step Freq-1	8.0Hz	01: ACC. Pattern	S-curve	32: Relay 2	BR control
	14: Motor Cap.	15.0kW	50: Step Freq-2	33.0Hz	02: DEC. Pattern	S-curve		
			50: Step Freq-3	10.0Hz	41: BR Rls Curr	1.2%		
					42: BR Rls Dly	0.5s		
					44: BR Rls Fwd Fr.	0.9Hz		
					45: BR Rls Rev Fr.	0.9Hz		
					46: BR Eng Dly	0.6s		
					47: BR Eng Fr.	1.0Hz		

- 1) Step Frequency control  
- Low, middle, high step frequency is used through digital input signal
- 2) BR Control: IS7 function to control the mechanical brake of the lift
- 3) V/F pattern: S-curve pattern used to apply smooth operation during accel and decel.



## Application

# Elevator Solution Using LS Drive

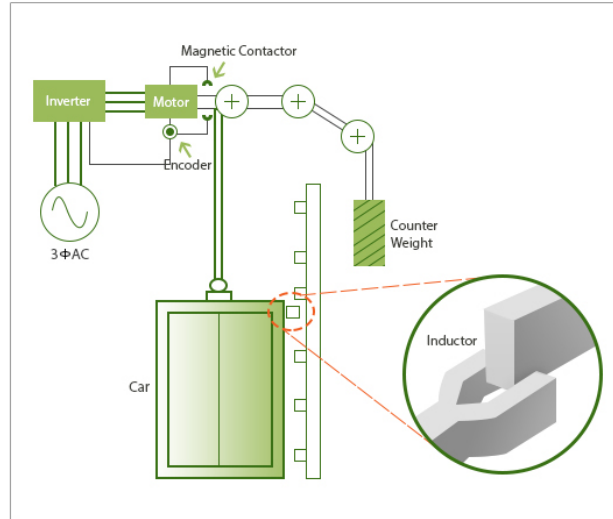
## 1. Elevator

A subsidiary vertically moving lift load to carry objects or people up and down.

## 2. System Characteristics

- 1) Requires 150~200% rated torque at startup.
- 2) Safety sequence needs to be a first priority factor in designing an elevator and mechanical braking system is mandatory
- 3) High regenerative energy occurs due to its vertical loads characteristics.
- 4) Elevator system is more complicated compared to a normal lift as it differs depending on which type of motor(IM or PM) it is designed with.
- 5) If it is a passenger elevator, comfort operation is a crucial factor.

## 3. System Diagram



## Application

## 1. Application

Elevator

## 2. Required Function

Issue & Requirements	LS Solution
PM motor vector control	→ Applying iV5 MRL <b>INV</b>
High Torque at Low Speed	→ Sensored Vector control <b>INV</b>
Low/ high speed drive	→ Multi step speed drive or Jog drive <b>INV</b>
Roll back improvement without load cell	→ Anti-Roll back function <b>INV</b>
Soft start & stability	→ S-Curve & Brake Control function <b>INV</b>
Feed-back by Endat Encoder	→ Available with Endat Encoder option board <b>INV</b>

## 3. Applied Product

iV5 11kW(MRL) Inverter

## 4. Function Explanation

### 1) SIN/COS EnDat encoder

- Confirms the absolute position information by using the EnDat. communication → Repetitive magnetic flux detection not necessary after initial magnet detection.

### 2) Multi-step speed drive & S-curve

- Stable speed control by low and high speed driving
- Minimizes vibration by applying S-curve Function

### 3) Anti-Rollback Function

- Roll Back : A condition in which the motor moves to a certain direction when brake is opens. It occurs due to imbalance in load weight.
- Anti-Roll Back : Prevents Roll Back by securing initial starting torque without using load cell

### 4) Brake Control Function

- Controls the Brake operation (Open/Close) by output contact relays

## Application

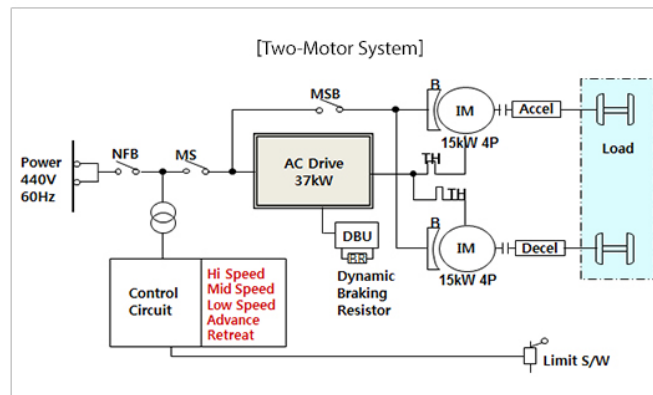
# Pallet Truck Application

## 1. Pallet Truck

- Pallet truck is used to palletize load for stacking or moving to a new position.
- Increase of speed and carrying capacity are needed to increase productivity.
- The motor that has constant output-characteristics in the high-speed region is used.
- Carrying capacity can be upgraded without changing of motor-capacity.

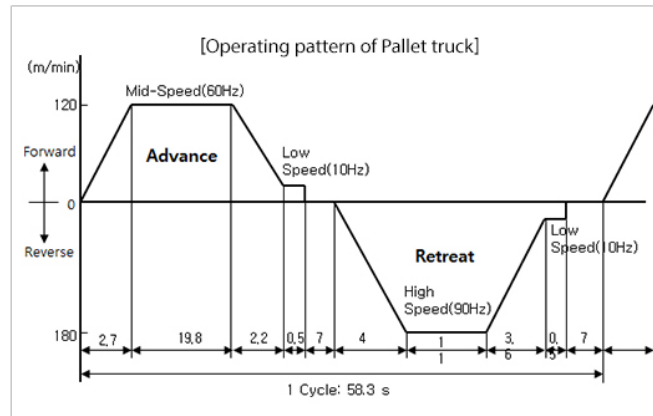
## 2. System Composition

- The capacity of AC drive must be greater than that of two motors.
- Two motors are always running at an equal speed.
- There is not a big load unbalance problem and load torque is optimally distributed between two motors.
- While the motor is decelerating, Regenerative energy are consumed by DBR.
- In case of emergency, the motor stops immediately by the electronic brakes.
- Cage type induction motor is suitable for dusty and vibration circumstances.



## 3. Advantages

- A motor speed can be increased by changing hertz through AC drive.
- High-speed operation can be possible without changing the size of driving part.
- If the load carrying and moving at high speed, collapsing can be prevented.
- If there is no load on the truck, operating speed can be increased.
- Cycle-time can be reduced by optimizing motor speed.



## 4. Applied Product

- iS7 37kW AC Drive

## 5. Caution

- While there are loads on the pallet truck, The motor should be driven under the middle-speed (under 60Hz). In the case of opposition, It should be driven above 60Hz.
- Only optimization of accelerate and decelerate time can prevent slips of wheel and collapsing of loads.
- Smooth start and stop can be realized by applying S-curve function.
- Vibration isolation measures are required to protect motors from vibration.
- Totally enclosed outdoor motors are recommended: Easy maintenance and installation without restrictions in place.
- Use cage type induction motor to avoid trouble from dust or vibration.